COTTON QUALITY PRICE DIFFERENTIALS FROM TEXTILE MILLS' PERSPECTIVE: AN UPDATE

Kalyan Chakraborty and Don Ethridge
Post Doctoral Research Associate and Professor
Department of Agricultural and Applied Economics
Texas Tech University
Lubbock, TX

Abstract

This paper investigates price discounts and premiums paid for cotton quality attributes by textile manufacturers for three US cotton producing regions. Data collected from textile firms in the 1997/98 marketing year (1997 crop) was used in hedonic price models to estimate the quality premiums and discounts for cotton from the South, Southwest, and San Joaquin Valley regions. The analysis found significant differences in price differentials across the regions under study for that year.

Introduction

US textile mills use about 10.8 million bales of cotton each year utilizing about 64% of US cotton production. Textile firms typically purchase their cotton in anticipation of processing needs through contracts with shippers. They manufacture a wide array of textile products, using different types and configurations of processing equipment and technology, thus requiring cotton fiber with different combination of fiber attributes. The combinations of cotton attributes tend to be somewhat different depending on the growth region of origin of cotton. Due to this and other considerations, there is a body of evidence showing that the structure of cotton prices (base prices and quality premiums and discounts) differs by region of origin of the cotton (Karaky, Ethridge, and Floeck, 1998); Ethridge and Chen, 1997; and Chen and Ethridge, 1996). The purpose of this paper is to present the latest evidence on this matter using the most recent data obtained from US textile manufacturers.

The Data Set and Model

The data set used in this analysis include contracts for the 1997/98 marketing year for 1997 crop year. The data set consists of the cotton quality attributes and the price of cotton either from a sale or a purchase contract. They were collected from eleven textile firms and marketing cooperatives in the United States. The data set contained 1,938 sales accounting for 4.1 million bales of cotton. The contracts specified many of the recognized fiber attributes such as micronaire, color grade, strength, staple length, etc., in addition to the type of sale (fixed or call), region of origin, and other stipulations. Call contracts were converted to an equivalent fixed price on the date of the transaction; that day's New York futures price (for the month nearest the contract delivery month) was adjusted by the agreed upon basis stated in the contract.

The price-quality relationships were estimated by regressing the contract price on the fiber characteristics and other non-quality variables. Because of the declining marginal productivity of fiber attributes in the manufacturing process, a non-linear relationship best describes the pricing of cotton quality (Chen and Ethridge, 1996). The price-quality relationship was explained by the following hedonic model:

$$P = \beta_0 (DC_1)^{\beta_1} (DC_2)^{\beta_2} (DLF)^{\beta_3} (L)^{\beta_4} (STR)^{\beta_5} (BALES)^{\beta_8} (DSCQ)^{\beta_9}$$

$$\exp^{\beta_6 (M) + \beta_7 (M^2) + \beta_{10} (MER) + \beta_{11} (CLS)} \varepsilon ,$$

where:

P = price (cents/lb.) of the cotton specified (fixed) by or derived (call) from the contract;

DC_1 = 9-C_1, indicating whiteness (absence of grayness) of fiber, C_1 is the first digit of the color grade (1-8) (since C_1 has a maximum value of 8, subtracting from 9 converts C_1 from an indicator of grayness to an indicator of whiteness); DC_2 = 6-C_2, indicating the whiteness (absence of yellowness) of fiber, C_2 is the second digit of the color grade (1-5) (since C_2 has a maximum value of 5, subtracting from 6 converts C_2 from an indicator of yellowness to an indicator of whiteness);

DLF = 8-LF, LF is the leaf grade (1-7);

L = staple length (32^{nd}'s of an inch);

STR = minimum strength (grams/tex) in the contract;

M = micronaire reading, an average of high and low micronaire in the contract;

DSCQ = Daily Spot Cotton Quotation (cents/lb.) for base quality, which is used to adjust for the level of general market price over time in each regional market on the date of transaction (USDA);

CLS = indicator variable for type of sale (if CLS = 1, it is a 'call' if CLS = 0, the sale is 'fixed' and the price is specified in the contract);

MER = indicator variable for type of seller/buyer (if MER = 1, the buyer is a merchant/shipper, 0 otherwise); and

BALES = number of bales specified in the contract.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:256-259 (1999)
National Cotton Council, Memphis TN

The cotton growing areas in each contract were categorized into four regional specifications: Southwest region (SW) - Texas and Oklahoma; South (SO) - all cotton grown in the southeast and mid-south; San Joaquin Valley (SJV) of California; and Other West - Desert Southwest. Other West was planned to be estimated, but there were not enough observations for that region. The data specific to the above three regions were used to estimate three regional models (See Tables 1A, 1B, and 1C).

A log-linear specification of the model was estimated using ordinary least squares. In order to check for probable multicolinearity the variance inflation factors were calculated and found to be within the threshold limit. Leaf grade was dropped out of those regional models when found highly correlated with the first digit of color grade. Extensive error-term analysis was done (Brown and Ethridge, 1995) to insure that the hedonic models contained no systematic errors in the estimation. It is hypothesized that all quality variables are positively related to cotton price except M^2, because as M increases, price of cotton increases at first, then starts decreasing as M increases. In the preliminary regression analysis, variables with signs that were found inconsistent with economic theory were dropped out of the final model. A base price for each region was calculated based on the parameter estimates of those models using base attribute levels, holding all other non-quality variables at their mean values.

Results and Discussion

Parameter estimates from the three regional models are reported in Table 2. All coefficients are of expected sign and are significantly different from zero at the 5 percent or 10 percent level. A comparison of the coefficient estimates across regions reveals that length and micronaire had the largest impact on cotton price in the San Joaquin Valley. Leaf grade had an unexpected sign and was not significant in models for the South and Southwest; hence, it was dropped from those models. Variables for strength and the second digit of the color grade were dropped from the San Joaquin Valley model for the same reasons. The coefficients of variation in all three regional models suggest that the models performed well in explaining the variations in prices. Simplified comparisons of prices and quality premiums and discounts derived from the models are presented below.

Base Prices

Calculation of regional base prices uses color grade 41, leaf 4, micronaire 4.2, strength 24.5, and length 34. The base price differed across regions by about 10 cents/lb., suggesting that the influence of factors other than the quality attributes and other variables in the model have an effect on textile mills' purchase prices (Table 3). These factors may include; (i) regional history of growing certain quality characteristics with consistency, (ii) different intended end uses, (Karaky et al., 1998) (iii) perceived differences in quality and/or (iv) attributes not measured in the current grading system.

Color Grade Premiums and Discounts

Both attributes of color grade (i.e., first and the second digit, C_1 and C_2) are significantly different from zero in the regional models (Table 2). For Southwest cotton, in 1997/98 the textile industry on the average paid 1% more as cotton became 1% less gray and 0.63% more as cotton becomes less yellow. In 1997/98 the textile industry differentiated more for cotton in the South than in the other two regions (Table 4); both premiums and discounts for color grade were heavier for the South than for the other regions. The smallest premiums and discounts for color were in the Southwest.

Staple Length Premiums and Discounts

Cotton prices in the textile mill market were significantly affected by fiber length in all three regional models (Table 2). Length premiums and discounts were larger in 1997/98 for SJV cotton than for the SO and SW cottons (Table 5). The divergence of estimated premiums and discounts for length between SJV and the two other regions might have resulted from the types of products the cotton is used in and the predominant spinning technologies used. The South had the smallest premiums and discounts for fiber length.

Strength Premiums and Discounts

Fiber strength significantly affected cotton price for both SO and SW cotton (variables are significant at the 5% and 10% levels, Table 2). Larger premiums for increased strength for SW cotton suggests that textile manufacturers may use it for products that need strong fiber, and must pay the premiums to get the higher strength (Table 6). Absence of strength premiums for SJV cotton implies that textile manufacturers are probably getting sufficient strength from SJV cotton for present uses.

Micronaire Discounts

It is evident from the coefficient estimates for micronaire (Table 2) that market value of cotton increased as micronaire increased, then decreased as micronaire increased beyond an optimal value. For both SO and SJV cotton, textile manufacturers discounted low micronaire (probably for immaturity) and high micronaire (probably for coarseness) of the cotton (Table 7) because immature and coarse fiber reduce the strength of yarn and fabric and the appearance of finished products. Micronaire had no significant impact on the prices of SW cotton for the 1997 crop year. Patterns of micronaire discounts for both SO and SJV are similar; average micronaire specifications for cotton grown in SO and SJV were about the same 4.1 and 4.0, respectively.

Other Variables

The Daily Spot Cotton Quotation (DSCQ) at base quality controls for the effect of general market price movement over time. It had a significant effect on mill price paid or

received in all three models (Table 2). On the average, for a 1% change in the base quality Daily Spot Cotton Quotation price, the price paid by the textile mills would change by about 0.5%. The reasons why these two prices do not move together are: (a) quotations represent only one (base) quality, (b) they represent a market not defined in terms of a pricing point, and/or (c) they are subjective quotations, not measures (Ethridge and Chen, 1995). The impact of the indicator variables imply that prices paid were higher for a call sale for SW cotton and for a purchase from a merchant for SO cotton. The quantity of bales specified in the contract (BALES) had a small but significant effect on price in all three regions.

Summary and Conclusions

This study examined the relationship between the prices paid by textile manufacturers for cotton and various quality attributes of the fiber, general market forces, and selected specification terms for contractual arrangements for cotton used in the 1997-98 marketing year. Comparison of estimated price flexibility for fiber attributes across regions in 1997-98 showed some important differences. For example, responsiveness in price paid by manufacturers for color was highest for cotton from the South while price responsiveness for fiber length was greatest for cotton from the SJV. Price was most responsive to variations in strength in SW and least responsive in SJV.

This study does not provide the definitive explanation for textile mill price differences across regions it does provides objective evidence of the patterns of the regional market values for cotton fiber attributes that were paid by the textile manufacturers in 1997/98. It is important for all market participants to know what values the market is placing on the fiber attributes in order to participate in the market and make rational decisions.

Acknowledgments

The authors acknowledge the help provided by Hope Floeck, graduate research assistant and Shauna Swink, with the data set used in this study and the assistance of the cooperating firms supplying the data. This research was supported by the Cotton Economics Special Item from the Texas Legislature and by Cotton Incorporated.

References

Chen, C. and Don E. Ethridge. "Premiums and Discounts Paid for Cotton Fiber Quality Attributes by U.S. Manufacturers." *1995 Beltwide Cotton Conferences, Proceedings (Addendum)*. Cotton Economics and Marketing Conference, National Cotton Council, Memphis, TN, pp. 92-96.

Chen, C. and Don E. Ethridge. "Valuation of Cotton Characteristics by U.S. Textile Manufacturers." *1996 Beltwide Cotton Conferences, Proceedings*. Cotton Economics and Marketing Conference, National Cotton Council, Memphis, TN, pp. 427-434.

Ethridge, D. E., and C. Chen. "Values Placed on US Cotton-fiber Attributes by Textile Manufacturers." *The Journal of Textile Institute*, 88 (No.1, 1997): 4-12.

Karaky, R.H., D. Ethridge., and H. Floeck. "Cotton Quality Price Differentials Paid by US Textile Mills." *1998 Beltwide Cotton Conferences, Proceedings*, Cotton Economics and Marketing Conference, National Cotton Council, Memphis, TN, pp. 370-373.

Table 1A: Summary of Data Used in the Analysis, South (SO) Region.

Variables	Mean	S.D	Range
Price	76.30	3.84	56.51 – 92.24
DC_1	4.67	0.50	3 – 7
DC_2	4.91	0.29	3 – 5
Leaf	4.43	0.65	2 – 6
Length	34.60	0.72	32 – 36
Strength	26.74	1.05	23.50 – 32.00
Micronaire	4.13	0.12	3.20 – 5.00
Bales	2,478	4,319	6 –34,200

Table 1B: Summary of Data Used in the Analysis, Southwest (SW) Region.

Variables	Mean	S.D	Range
Price	74.77	6.37	49.10 – 81.68
DC_1	4.60	0.56	3 – 8
DC_2	4.58	0.52	3 – 5
Leaf	4.38	0.56	2 – 7
Length	33.96	1.50	32 – 37
Strength	26.77	1.23	24 – 30.30
Micronaire	3.93	0.33	2.75 – 5.14
Bales	1,526	2,300	2 – 18,990

Table 1C: Summary of Data Used in the Analysis, San Joaquin Valley (SJV), Region.

Variables	Mean	S.D	Range
Price	84.20	4.49	68.00 – 91.70
DC_1	5.14	0.76	3 – 6
DC_2	4.98	0.16	3 - 5
Leaf	3.80	0.87	3 – 6
Length	35.58	0.58	32 – 36
Micronaire	4.00	0.28	3.25 – 4.25
Bales	1,037	934	5 – 8,100

Table 2: Hedonic Price Model Parameter Estimates for the Three Production Regions.

Independent Variables	South β's	Southwest β's	San Joaquin Valley β's
Intercept	-1.479*	-2.232*	-3.865*
	(-4.235)	(-6.321)	(-4.644)
$Ln(DC_1)$	0.121*	0.996*	0.049**
	(9.769)	(4.149)	(1.347)
$Ln(DC_2)$	0.127*	0.631**	NA
	(7.191)	(1.849)	
Ln(DLF)	NA	NA	0.097*
			(4.056)
Ln(L)	0.372*	0.526*	1.197*
	(6.097)	(5.368)	6.244
Ln(STR)	0.044**	0.600*	NA
	(1.540)	(7.815)	
M	0.833*	0.018	0.945*
	(6.220)	(0.141)	(2.527)
M^2	-0.106*	-0.005	-0.122*
	(-6.284)	(-0.289)	(-2.435)
Ln(BALES)	0.002**	0.014*	0.016*
	(1.774)	(5.423)	(5.781)
Ln(DSCQ)	0.545*	0.549*	0.440*
	(23.433)	(16.799)	(7.877)
MER	0.013*	NA	NA
	(4.116)		
CLS	NA	0.054*	NA
		(2.680)	
R-squares	0.5373	0.6919	0.7548
Observations	1092	400	148

t-ratios are in parentheses,
'*'- Indicate coefficients are significant at 5% ;
'**' - Indicate coefficients are significant at 10% .

Table 3: Base Price for US Cotton (cents/lb), by Region.

Region	Base Price
South	76.32
Southwest	69.95
San Joaquin Valley	79.75

Table 4: Premiums and Discounts (Points/lb) for First and Second Digit of Color Grade (C_1 and C_2) From Base Quality for US Cotton, by Region.

Color	South	Southwest	San Joaquin Valley
11	----	+324	----
21	+318	+230	----
31	+170	+124	+71
41	0	0	0
51	-203	-149	-86
61	-458	-336	-196
41	0	0	----
42	-213	-97	----
43	-480	-222	----

Table 5: Premiums and Discounts (Points/lb) from Base Quality for Staple Length (L).

Staple Length	South	Southwest	San Joaquin Valley
32	-170	-219	-558
33	-84	-109	-279
34	0	0	0
35	+82	+107	+281
36	+164	+213	+564
37	----	+318	----

Table 6: Premiums and Discounts (Points/lb) from Base Quality for Strength (STR).

Strength	South	Southwest
23	-21	----
24.5	0	0
25	+6	+85
26	+20	+253
27	+33	+419
28	+45	+583
29	+57	+744
30	+68	+903
31	+80	+1060
32	+91	+1215

Table 7: Discounts (Points/lb) from Base Quality for Micronaire (M).

Micronaire	South	San Joaquin Valley
27-28	----	----
28-29	----	----
30-32	----	-463
33-34	-204	-160
34-35	-121	-70
35-49	0	0
50-52	-1053	----