

COTTON QUALITY PRICE DIFFERENTIALS PAID BY U.S. TEXTILE MILLS

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Abstract

This paper investigates the price premiums and discounts paid by U.S. textile mills for different cotton quality attributes. The study examines the pricing of cotton from four different growing regions: South, Southwest, San Joaquin Valley, and other Western cotton for the 1994-1996 period. Data were collected from eleven textile mills and marketing cooperatives. Hedonic price analysis was used to examine the price-quality relationships. Results showed that fiber attributes affected cotton price in the four regions differently.

Introduction

Cotton production in the U.S. averaged around 18.8 million bales during the crop years 1994 to 1996. This represented, on average, 21% of the world cotton production (U.S. department of Agriculture, 1997). The Cotton Belt spans the southern half of the United States, stretching from the Carolinas to California. Because of the inherent climatic and soil variation across this part of the United States, production practices, yields, and fiber characteristics differ from one region to the other. Such variation, as well as market structure differences may create different pricing structures for cotton from different regions of the Cotton Belt.

Quantitative, as well as qualitative, parameters affect the demand and supply of cotton and thus determine the price (Chen and Ethridge, 1996). Because cotton is of heterogeneous quality (over 800,000 potential quality combinations recognized by the USDA grading system), it may have different prices for different combinations of quality attributes. Past studies (e.g., Ethridge and Neeper, 1987) have documented that prices of cotton are, to some extent, determined by quality attributes. Furthermore, Bowman and Ethridge (1992) found that fiber premiums and discounts in the producer market varied across regions.

Chen and Ethridge (1996) examined the pricing determination of cotton in the textile market and identified the patterns of premiums and discounts across different production regions. In their study, no differentiation was made between the San Joaquin Valley and the remaining Western cotton. The differentiation is made here to capture further price structure variation with updated information. The objectives of this study were to (1) estimate the effects of fiber characteristics on textile firm's pricing of cotton and (2) identify the patterns of premiums and discounts paid by the textile mills across four major regions of origin in the United States: South, Southwest, San Joaquin Valley, and other West.

Data and Model

Data used in this study were collected from eleven textile mills and marketing cooperatives in the United States. The data consist of sale or purchase contracts, representing about 8 million bales of cotton from the 1994 to 1996 crop years. These contracts of actual market transactions included the price paid by textile mills for a specific quantity and quality of cotton. The contracts specified many of the recognized fiber attributes: micronaire, color grade, strength, staple length, etc. In addition, the type of sale (fixed or call) was identified. Call contracts were converted to an equivalent fixed price on the date of the transaction by adjusting that day's New York futures price for the month nearest delivery month contract 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 cotton quality pricing (Chen and Ethridge, 1995). The price quality relationship was explained by the following hedonic model:

$$P = B_0(DC1)^{B_1}(DC2)^{B_2}(DLF)^{B_3}(L)^{B_4}(STR)^{B_5}e^{B_8(M)+B_9(M^2)}(DSCQ)^{B_{10}}e^{B_{11}(CLS)+B_{12}(MERCHANT)+B_{13}(EXPORTS)+B_{14}(LM)+B_{15}(Y94)+B_{16}(Y95)}\epsilon$$

where:

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

DC1 = 8-C1, indicating whiteness (absence of grayness) of fiber, C1 is the first digit of the color grade (1-7) (since C1 has a maximum value of 7, subtracting from 8 converts C1 from an indicator of grayness to an indicator of whiteness);

DC2 = 5-C2, indicating the whiteness (absence of yellow) of fiber, C2 is the second digit of the color grade (1-4);

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

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

STR = minimum strength (gram/tex).

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

DSCQ = Daily Spot Cotton Quotation (cents/lb.), which was used to represent the level at base quality in each regional market on the date of transaction (USDA) (this variable controls for the general market fluctuations through time);

CLS = indicator variable for type of sale (if CLS = 1, it is a "call" sale and the price is estimated according to New York futures contracts; if CLS = 0, the sale is "fixed" and the price is specified by the contract);

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

EXPORTS = indicator variable for type of buyer (if EXPORTS = 1, the buyer is a foreign mill, 0 otherwise; if both exports and merchant = 0, then the buyer is a domestic mill);

LM = indicator variable for location (if LM = 1, the cotton is priced at mills' warehouse, if LM = 0, the cotton is priced at seller's warehouse);

Y94 = indicator variable for crop year (if Y94 = 1, the cotton is from 1994 crop; Y94 = 0 otherwise);

Y95 = indicator variable for crop year (if Y95 = 1, the cotton is from 1995 crop; Y95 = 0 otherwise; if Y94 = Y95 = 0, the crop year is 1996; and

ϵ = The random error for the model.

The growth areas in each contract were categorized into one of the four regional specifications: Southwest region (SW) consisted of cotton grown in Texas and Oklahoma; South (SO) included all the cotton grown in the Southeast and Midsouth; San Joaquin Valley (SJV) specified cotton grown in the San Joaquin Valley of California; and other West (OW) refers to cotton originating from Arizona and New Mexico. The data specific to each region were used separately in estimation of the four individual regional models. The regional data were pooled in the national model.

The equations were converted to linear form for parameter estimation using logarithmic transformation, and estimated using ordinary least squares. Variance inflation factors were calculated to check for multicollinearity. The first digit of the color grade was dropped out of the model whenever it was highly correlated with the leaf grade. Positive signs were expected for all quality variable parameter estimates except M^2 ; price should increase as the values of attributes increase for all attributes except M (M should cause price to increase, then decrease). Variables with estimate signs inconsistent with theoretical expectations were dropped out of the models. Based on the parameter estimates and the variable means, a base price was calculated for each region and premiums and discounts for each individual fiber attribute were estimated for interpretation and comparison purposes.

Results and Discussion

The regional models explained 67.91%, 42.61%, 58.83% and 63.35% of price variation for the SJV, SO, SW, OW regions, respectively. The regional models showed differences between price structures across the four regions. Across all the models, price-quality differentiation was significantly lower in 1994 and 1995 compared to the 1996 crop year. The first digit of the color grade was not significant (even at the 10% significance level) in any of the models; therefore, it was dropped from the models. The models showed that leaf grade was not significant in the SJV and OW regions. Staple length was significant in all the regions. The models for the SJV and the SW regions showed strength and micronaire to be significant in explaining price variations.

Base Prices

Prices for base quality (color grade 41, leaf 4, length 34, strength 24.5, and micronaire 4.2) were calculated for the different regions using the regression estimates of each regional model. Non-quality variables were held at their mean values. The base prices differed across all regions, with a range of more than 10 cents/lb. (Table 1). The differentiation suggests that the textile mills considered factors other than measured quality characteristics when purchasing cotton. These factors may include 1) growth areas with a history of growing certain quality characteristics with some consistency and/or 2) different intended end uses.

Color Grade Discounts

The first digit of the color grade, which indicates cleanness, was not significant in any of the four regions. The second digit of the color grade, which indicates yellowness, was discounted in the SJV, SO, and SW regions; it was not significant in the OW region. The heaviest discounts were found in the SJV region, while the SO had the lowest (Table 2, Figure 1). The large discounts in the SJV region may be explained by the intended end use for that cotton. SJV region cotton, e.g., may be sought for producing products such as men's dress shirts for which whiteness becomes particularly important.

Leaf Grade Premiums and Discounts

Leaf grade differentials were present in the SO and SW regions only. Premiums and discounts for leaf were higher in the SW than the SO region (Table 3, Figure 2); leaf traded within a narrower range in the SW. Leaf grade was not a significant variable in the SJV and the OW models.

Staple Length Premiums and Discounts

Premiums and discounts for staple length were present across all four regions. Variation in premiums and discounts were not pronounced among the four regions (Table 4, Figure 3). The SO exhibited the highest premiums and the largest discounts for staple across the range of staple lengths. The SJV had the lowest premiums and discounts. Low premiums and discounts in the SJV may be attributed to the relative abundance of fiber length in the region.

Strength Premiums

The SJV and SW regions showed price differentials for strength; strength was not significant in the SO and OW regions. Strength premiums were considerably larger in the SJV than in the SW regions (Table 5, Figure 4). The rates of increase in the premiums for higher strength were very similar between the SJV and SW regions.

Micronaire Premiums and Discounts

The micronaire discount structure imposed by mills differed substantially across the regions. Micronaire did not affect the pricing structure for the SO and OW regions, and affected prices very differently in the SJV and SW regions (Table 6, Figure 5). The highest value cotton occurred below the 3.5-4.9 mike range (3.48) in the SW. This result is consistent with previous findings (Chen and Ethridge, 1995). Consequently, the base price and the premiums and discounts for the SW region were calculated on a base micronaire of 3.48. The SJV region was discounted for low micronaire grades heavily but discounted very little for high micronaire. The SW discounted very little for low micronaire but more heavily for high micronaire. The optimal micronaire for SJV cotton was 4.8. The differences between the valuation of micronaire in the SJV and SW regions are not clearly understood.

Summary and Conclusions

This study examined the price-quality relationships for U.S. cotton in the textile mill market. Fiber quality attributes explained the variation in pricing structures across the four regions considered, but the pricing structures of cotton were substantially different across the regions. Differences in price structure between the South and the Southwestern regions were more pronounced than during the 1992-1994 period (Chen and Ethridge, 1996), especially for strength. The separation of the Western region into the SJV and the OW revealed very different structures in these two markets. Length was found to be the only quality variable that significantly affected cotton pricing in the OW region over the study period. More research would be needed to confirm this finding.

Similarities, as well as differences, were observed between the current and previous results from earlier studies (Chen and Ethridge, 1995, 1996). The research is on-going. Cooperating textile mills continue to update the data set and new participants are being sought to enlarge the informational base. The main objective is to explain the cotton market thoroughly and convey the most timely and accurate information to all market participants in order to enhance efficient decision making.

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Table 1. Base Price by Region (cents/lb.).

Region	Base Price (cents/lb.)
SJV	88.97
SO	77.74
SW	78.87
OW	82.84

Table 2. Discounts for Color Grade from Base Quality (points/lb.).

Color	SJV	SO	SW
41	0	0	0
42	-699	-64	-208
43	-1591	-152	-491

Table 3. Premiums and Discounts for Leaf Grade from Base Quality (points/lb.).

Leaf Grade	SO	SW
1	--	--
2	+237	--
3	+129	+319
4	0	0
5	-164	-393
6	-388	-913
7	--	--

Table 4. Premiums and Discounts for Staple Length from Base Quality (points/lb.).

Staple	SJV	SO	SW	OW
28	--	--	--	--
29	--	--	--	--
30	--	--	--	--
31	--	--	-428	--
32	-247	-377	-284	-303

33	-122	-188	-141	-150
34	0	0	0	0
35	+120	+187	+139	+149
36	+239	+373	+277	+296
37	+356	+558	+413	--
38	+471	--	--	--

Table 5. Premiums and Discounts for Strength from Base Quality (points/lb.).

Strength	SJV	SW
18 & below	--	--
19	--	--
20	--	--
21	--	--
22	--	--
23	--	-89
24 & 25	0	0
26	+309	+85
27	+378	+139
28	+476	+191
29	+511	+242
30	+575	+292
31	+637	+340
32	+697	--

Table 6. Discounts for Micronaire from Base Quality (points/lb.).

Mike	SJV	SW
24 & below	--	--
25 - 26	--	-211
27 - 29	-1925	-114
30 - 32	-1383	-36
33 - 34	-1037	-4
34 - 35	-673	0
35 - 49	0	-127
50 - 52	-34	-622
53 & above	-105	-777

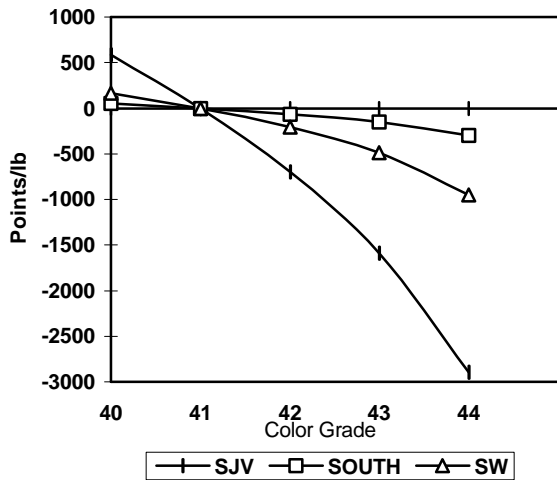


Figure 1. Premiums and Discounts for Color Grade.

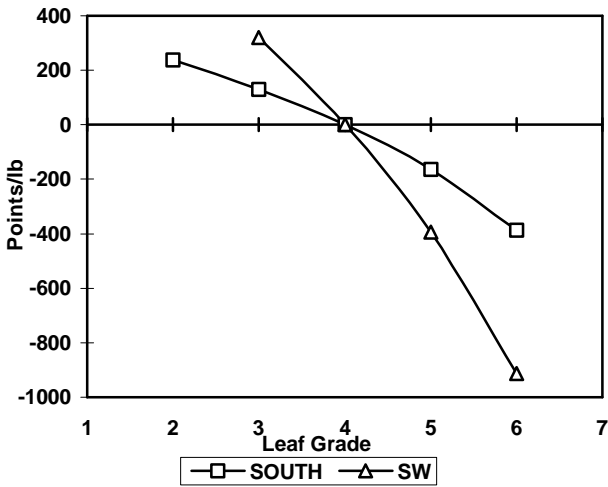


Figure 2. Premiums and Discounts for Leaf Grade.

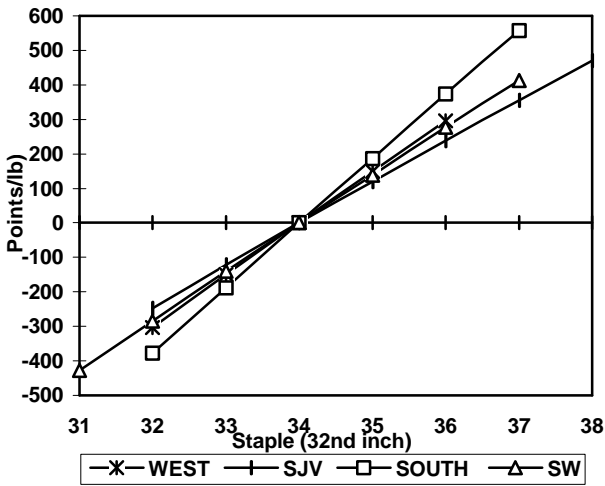


Figure 3. Premiums and Discounts for Staple Length.

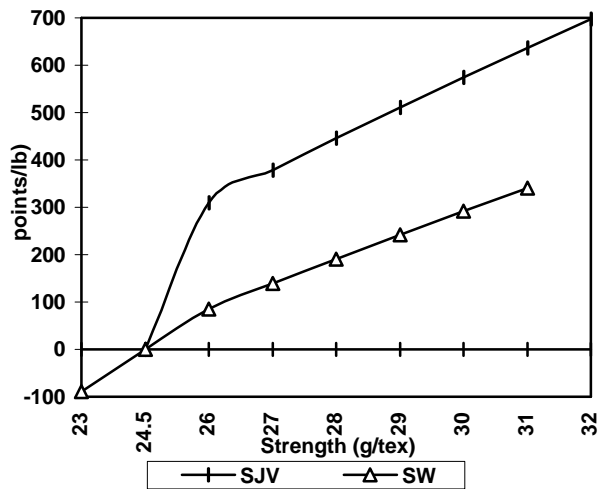


Figure 4. Premiums and Discounts for Strength.

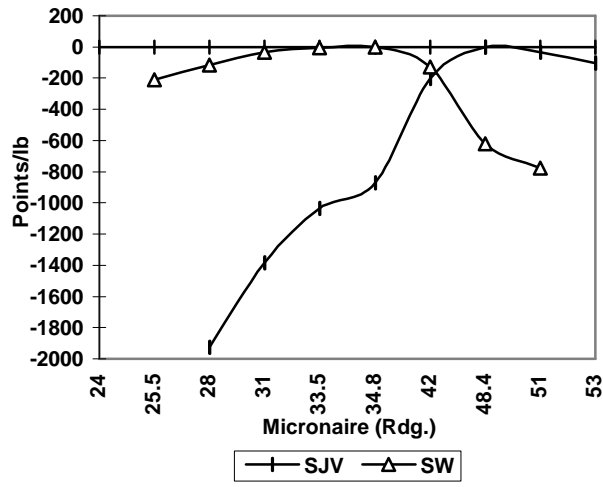


Figure 5. Premiums and Discounts for Micronaire.