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Estimation of Implicit Market Prices of Quality Characteristics of Cotton in Davangere, Karnataka

The value of cotton like most agricultural commodities is influenced by many underlying quality characteristics. The price of cotton may be conceptualised as being simultaneously affected by its quantitative and qualitative dimensions. The quantitative dimension consists of supply and demand forces affecting the price of cotton. The qualitative dimension is the effect on price as quality characteristics change. These quality characteristics affect the price of cotton to a greater extent. Many of these quality characteristics are related to variety and environmental factors as well as production practices. Producers should know the value of these quality characteristics when making economic decisions regarding their control. The study on these quality characteristics will also be useful to the researchers to fine tune the research effort to cater to the market demand for quality. Thus it is necessary to analyse the values of the quality characteristics which affect the demand for cotton.

The relationships among quality-price and demand and supply of quality have been evaluated by many studies. Brorsen *et al.* (1984) found that grades are useful but inadequate in explaining observed quality differentials. Ethridge and Neeper (1987) observed that some quality characteristics have significant effects on the prices of cotton. Russel (1988) determined that quality aspects have major effects on the demand for cotton by mills. However, there are very few studies which have taken into consideration the important characteristics of cotton and its relationship with price. Hence, the present study was undertaken with the following objectives: (i) to assess the value of product characteristics and their impact on the prices of cotton and (ii) to determine the demand for quality in raw cotton by the cotton fabric manufacturers.

METHODOLOGY

The study is based on the primary data collected from the buyers of cotton kapas (unginned cotton) in Davangere cotton market in Chitradurga district of Karnataka (Umapathi, 1994). Cotton arrivals constitute a major part of the arrivals and the physical grading of cotton is in vogue.

In order to know the perception of the buyers on the quality attributes, a five-point scale was developed and the information on cotton quality attributes and prices from randomly selected lots of different grades were collected for a period of ten days during the month of May 1994. Five lots of cotton were selected for three genotypes, viz., DCH-32, LRA and Jayadhar on each day. In all, 150 lots were evaluated over 10 days through personal interviews with the buyers of cotton kapas in the market.

Further, the data on quality requirements of cotton were elicited for five samples from each of the five fabric manufacturers at Davangere by interviewing them to assign score to the quality of yarn available with them for the quality characteristics of cotton used in its production.

Hedonic price models were used for the evaluation of the objectives of the study. Hedonic pricing involves implicit prices of quality characteristics of a commodity rather than the price of a commodity itself. A hedonic price function is a regression of the observed price of a commodity against its quality attributes (Lucas, 1975; see also Bowman and Ethridge,

1992). The underlying hypothesis is that the goods are valued for their utility bearing characteristics and the prices of goods vary directly with the specific amount of each characteristic the goods contain.

The following three hedonic price models were used in the study.

1. Linear model

where $P = b_0 + (b_1 x_1 + b_2 x_2 + \dots + b_7 x_7) + e_1$
 P = observed price of a lot of cotton kapas (Rs. per quintal),
 x_1 = staple length,
 x_2 = staple strength,
 x_3 = staple length uniformity,
 x_4 = denier (fineness),
 x_5 = maturity level,
 x_6 = trash content and
 x_7 = colour.
 b_i = regression coefficients and e_1 = disturbance term.

Staple length was expressed in counts and all other quality characteristics were scored on a five-point scale. A brief description of the scores employed is provided in the Appendix.

2. Semilogarithmic model

$$\text{Log } P = \text{Log } a_0 + (a_1 x_1 + a_2 x_2 + \dots + a_7 x_7) + e_2$$

3. Logarithmic model

$$\text{Log } P = \text{Log } c_0 + (c_1 \log x_1 + c_2 \log x_2 + \dots + c_7 \log x_7) + e_3$$

The demand for quality in raw cotton by the cotton fabric manufacturers was also determined by regressing price on the qualitative attributes of cotton lint. The same models (log, semilog and linear) were used with quality characteristics, viz., staple length (mm), staple strength (gm/texture), staple length uniformity (per cent), micronaire value (numerical value), trash content (per cent) and colour (scores 1 to 5).

To know the contribution of each of the quality characteristics to the prices of cotton kapas/cotton lint, standardised regression coefficients were calculated using the formula (Harshbarger, 1977).

$$\text{Standardised regression coefficient } x_i = b_i \times \frac{\sigma_P}{\sigma X_i}$$

where b_i = regression coefficient of the i -th characteristic,
 P = price of cotton kapas/cotton lint (Rs./quintal),
 X_i = quality characteristics of cotton kapas/cotton lint and
 σ = standard deviation.

In view of the fact that the selected quality characteristics are strongly associated with each other, factor analysis was carried out to identify those groups of characteristics whose presence is simultaneously determined.

RESULTS AND DISCUSSION

Influence of Quality Characteristics of Cotton Kapas on Its Price

The value addition due to different quality characteristics on the prices of cotton kapas was estimated by regressing quality characteristics on prices of cotton kapas using three models, namely, logarithmic, semilogarithmic and linear, the results of which are presented in Table I. By and large, the results of these three models are similar.

TABLE I. IMPACT OF QUALITY CHARACTERISTICS ON WHOLESALE PRICES OF COTTON (KAPAS) IN DAVANGERE MARKET, MAY 1993

Model	Intercept	Quality characteristics							R ²
		Colour	Staple length	Staple strength	Staple length uniformity	Fineness	Maturity level	Trash content	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log	4.8620	0.1823* (2.4219)	0.2687** (5.6359)	0.2359** (3.1966)	0.1967** (2.7002)	0.1392** (2.7960)	0.0236 (0.3144)	0.0036 (0.0756)	0.85
Semilog	-841.6990	288.324** (4.3521)	307.671** (7.4319)	173.299** (2.7053)	84.351 (1.1337)	96.249* (2.2269)	-103.347 (-1.5835)	35.033 (0.8457)	0.83
Linear	-89.7054	48.1094** (2.6554)	8.3576** (9.1550)	52.6829* (2.5535)	37.1853 (1.6455)	35.3193* (2.0251)	9.8535 (0.5360)	7.7874 (0.5118)	0.88
Standardised		0.1443	0.4288	0.1734	0.1273	0.1178	0.0355	0.0285	

Notes: Figures in parentheses are 't' values.

* and ** significant at 5 and 1 per cent level respectively.

In the case of logarithmic model, five out of seven characteristics were found to be significant. Among these, staple length, staple strength, staple length uniformity and fineness are found to have affected the price at 1 per cent level of significance while colour affected the price at 5 per cent level of significance. Positive coefficients indicated that as the value of the variable increased, the price also increased. The R² value indicated that 85 per cent of the variation in the price was due to these quality characteristics.

The results of the semilogarithmic model revealed that the characteristics of colour, staple length, staple strength and fineness affected the price significantly and the R² value explained 83 per cent of the variation in price.

The coefficients obtained under the linear model showed that the characteristics of colour, staple length, staple strength and fineness affected the price significantly inasmuch as 88 per cent of the variation in price was explained by these quality characteristics.

Thus colour, staple length, staple strength and fineness have significant positive effects on the price of cotton kapas. The adequacy of the fitted models was indicated by high R² values ranging between 0.83 and 0.88.

The standardised regression coefficients revealed that staple length and staple strength of cotton kapas are the strongest determinants of the price with a coefficient of 0.43 and

0.17 respectively. The effects of maturity level and trash content on the price are smaller.

It is found that for each unit increase in counts, the price increased by Rs. 8.36 per quintal (linear model). Since cotton with higher staple length is used for making finer cloth, the demand for such type of cotton is relatively high. The longer the fibre, the finer is the texture. Also fibre length is highly correlated with the strength of carded yarn and has some influence on the combed yarn strength. As it is a varietal factor, the buyers assume that a variety with specific staple length will have the required strength and fineness. That could be the reason for the buyers to go for price discount/premium with a decrease/increase in staple length.

Staple strength had significant impact on the price of cotton kapas. This characteristic depends on the maturity level of the kapas and is also influenced by climatic factors. Strong staple strength would lead to an increase in staple length, fineness and uniformity of the fibre, thus enhancing the value of the lot. It is a determining factor for yarn strength. Cotton with good fibre strength usually causes less trouble in the manufacturing processes.

Colour is found to be another significant factor in determining the price of cotton kapas. Since good colour enhances the lustre of the fibre as well as price, the buyers mainly look for colour as an indicator of the amount of trash and pay a price premium or discount according to the degree of brightness.

Length uniformity and fineness are looked for their levels since these are of significant importance in the manufacture of both carded and combed yarn. Moreover, fineness contributes to yarn strength.

The other two characteristics, viz., maturity level and trash content have no significant effects. This could be attributed to the season in which the data were collected. Since the data pertained to the summer season wherein the arrival of cotton kapas to the market was low, the price discounts/premiums associated with these characteristics were also low. When the availability of cotton, in general, is relatively scarce, the buyers could not discount trash content as much as when cotton supply is relatively plentiful. Also the major arrivals of cotton during that period are of low quality since they are mostly from the last pickings (fourth and fifth pickings). Perhaps this could be the reason for the non-significant effect of maturity level on the price of cotton kapas.

Hedonic Price Estimates for Cotton Lint Characteristics

Estimates of implicit prices of quality characteristics of cotton lint are worked out using hedonic price function and the results are presented in Table II.

The results under all the three models revealed that staple length is the only characteristic that affected the price of cotton lint. The other characteristics are found to have non-significant effects on price. The standardised regression coefficients revealed that staple length alone has explained 79 per cent of price variation. Thus there is a greater demand for staple length from the fabric manufacturers.

Factor analysis was carried out to determine the association among the characteristics of cotton lint. This could perhaps throw light on why the quality attributes of lint are not reflected in the price of the produce. From the results presented in Table III it is found that factor I revealed a single association between staple length, staple strength, colour and

price. Thus higher staple length in combination with staple strength and superior colour is found to have increased the price of cotton lint. Factor 2 shows that length uniformity is a unique attribute. In factor 3, trash content is negatively correlated with staple strength. Thus

TABLE II. ESTIMATES OF IMPLICIT PRICES OF QUALITY
CHARACTERISTICS OF COTTON LINT PREFERRED BY
THE FABRIC MANUFACTURERS (MILL SECTOR)

Model	Intercept	Quality characteristics						R ²
		Staple length	Staple strength	Length uniformity	Micronaire value	Trash content	Colour	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log	5.33	0.93** (2.80)	0.11 (0.37)	-0.33 (-0.47)	0.04 (0.26)	-0.00 (-0.02)	0.35 (1.22)	0.77
Semilog	-5545.26	3234.46** (3.02)	417.16 (0.46)	-1509.78 (-0.67)	313.06 (0.64)	154.66 (0.37)	1326.05 (1.45)	0.79
Linear	-546.23	112.77** (3.46)	15.31 (0.50)	-26.05 (-0.60)	65.80 (0.63)	24.75 (0.21)	261.92 (1.36)	0.81
Standardised		0.79	0.11	-0.07	0.09	0.03	0.16	

Notes: Figures in parentheses are 't' values.

** Significant at 1 per cent level.

a higher trash content has a negative impact on the strength of the fibre as well as the price of cotton lint. From factor 4, it is found that colour and staple length have positive correlation. Factor 5 shows that micronaire value has negative correlation with staple length, staple strength and price. This implies that an increase in micronaire value is negatively associated with the price of cotton lint. However, staple length and staple strength revealed that the fibre with a high degree of fineness is of greater length and strength.

TABLE III. FACTOR LOADINGS OF QUALITY CHARACTERISTICS OF COTTON LINT

Variable	Rotated factors						
	F ₁ (2)	F ₂ (3)	F ₃ (4)	F ₄ (5)	F ₅ (6)	F ₆ (7)	F ₇ (8)
(1)							
Staple length	0.879	0.060	-0.077	0.170	-0.365	0.047	-0.231
Staple strength	0.779	-0.038	-0.255	0.242	-0.274	0.440	-0.019
Length uniformity	0.017	0.977	0.181	0.107	-0.044	0.440	-0.019
Micronaire value	-0.046	-0.058	0.077	-0.146	0.876	-0.005	-0.003
Trash content	-0.140	0.195	0.958	-0.138	0.065	-0.049	0.000
Colour	0.305	0.130	-0.154	0.920	-0.134	-0.038	-0.003
Price	0.917	0.002	-0.090	0.261	-0.201	0.042	0.188
Eigen values	3.836	1.341	0.766	0.459	0.363	0.160	0.075
Total variance (per cent)	36.173	14.525	15.130	15.053	14.876	2.973	1.270
Cumulative variance (per cent)	36.173	50.698	65.828	80.881	95.757	98.730	100.000

Thus it could be inferred from the results of factor analysis that staple length is associated directly or indirectly with the other quality characteristics. Hence, staple length must have captured the values of the other characteristics. This along with other characteristics has explained a major share of the price variation. This could be the reason for the other characteristics having non-significant effects on price. Hence, the fabric manufacturers mainly look for staple length as the indicator of characteristics. They know that cotton with specific staple length will be associated with desirable levels of the other characteristics. Therefore, based on the levels of staple length alone, they quote the prices for cotton. Even though they look for other characteristics, they usually do not explicitly value all other characteristics individually.

Though the farmer's manoeuvrability with respect to quality is limited to the variety he grows, there is some scope for enhancing quality through the adoption of proper cultural practices such as proper irrigation, fertiliser application, adoption of appropriate plant protection measures and timely picking. Storage of the harvested crop plays a crucial role in preserving the quality. High moisture content during storage can affect the colour adversely. Further, improper storage can lead to higher trash content and mixing of grades of cotton can depress the value.

CONCLUSION

The study has revealed that price and quality characteristics are closely related. The model used in this study could be useful to the participants in the market to show how quality differentials are reflected in price. Producers should know the discounts associated with some of the quality characteristics in order to make profits. The results discussed here suggest that the major quality characteristics in determining price are staple length, staple strength, colour, length uniformity and fineness of the fibre. Staple length was found to be associated with other desirable quality characteristics in the case of cotton lint. Hence, mills exhibited a stronger preference for cotton with superior staple length.

Cotton is one of the important commodities in which Karnataka has comparative advantage in the context of free trade. Therefore, it is imperative that future research efforts in cotton, while aiming at improving the productivity levels should pay attention to the quality dimensions as well.

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APPENDIX

Colour: It is a varietal characteristic influenced by the environment. The ranges of colours are bright white, creamy, dull white, duller white and yellow/brown. These were assigned scores as 5, 4, 3, 2 and 1 in that order.

Staple length: It is the length of the fibre. Buyers perceive staple length based on counts, which is the number of hanks, each of 840 yards, which weigh one pound. There is a direct relationship between staple length and counts. Accordingly, five grades of staple length were identified. Extra long (60-120 counts) scored five, long (30-60 counts) scored four, superior-medium (25-30 counts) scored three, medium (20-25 counts) scored two and short (below 20 counts) scored one.

Staple strength: It is the property of the fibre by virtue of which it can resist strain induced by external forces. Traders evaluate this characteristic by a jerk on the sample strand. This parameter was measured by assigning scores of 5, 4, 3, 2 and 1 for strong, very good, good, average and weak respectively.

Staple length uniformity: It is the combination of staple strength and length. The lots were classified as highly uniform, moderately uniform, average, below average and poor by assigning scores 5, 4, 3, 2 and 1 respectively.

Denier (Fineness): It measures the fineness of the fibre which can be gauged by feel. The buyers were asked to indicate 5 for most superior denier and 1 for most inferior denier; in between these for intermediate fineness.

Maturity: It can be determined by visual observation. They were classified into full, high, medium, low and very low. The buyers were asked to score the lots as 5, 4, 3, 2 and 1 in the order of maturity.

Trash content: It is the extraneous matter present in the fibre. The lots were classified into very clean, clean, slightly leafy, moderately leafy or leafy for which scores 5, 4, 3, 2 and 1 were assigned respectively.

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