Accuracy of Cotton Market Price Information

Rene Aelvoet and Don Ethridge*

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Cotton Economics Research Institute
Department of Agricultural and Applied Economics
Texas Tech University

*Former Undergraduate Student and Professor, respectively, Dept. of Agricultural and Applied Economics, Texas Tech University. This research was part of Aelvoet's senior research project. The authors acknowledge the helpful comments and suggestions of Benaissa Chidmi, Jeff Johnson, and Jaime Malaga on earlier drafts of this report and the assistance of Emily Gray and Kimberly Redding with the manuscript.

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Introduction

Cotton quality is a fundamental element in price determination because quality heterogeneity is so prevalent in cotton and combinations of quality attributes have a known effect on its value in manufacturing textile products (Ethridge, Hudson, and Misra, 2005). The fiber is most often spun into thread and used to make a soft, breathable textile, which is the most widely used natural-fiber cloth in clothing today (Merriam and Webster, 2006). Cotton fiber is made up of different attributes whose values together determine its use value and market value. Official grading standards recognize eight attributes - fiber length, fiber length uniformity, fiber strength, micronaire, color, trash, preparation, and extraneous material (USDA, 1993).

Cotton quality is affected by genetics, cultural practices, and weather. Different geographical areas have different climates, soils, and growing conditions, all of which affect cotton quality. Different varieties have different fiber amounts of quality attributes that have been bred into the plants. Also, irrigation and other cultural practices may impact some fiber characteristics at certain stages of plant growth. Once basic genetics are determined in a variety, variations will occur, with environment being the greatest contributor. Some areas receive more or less rainfall than others and some experience warmer or colder weather that can affect the quality of cotton. Over 80 % of annual variations of yield and fiber length are due to extremes in temperature, moisture and sunlight. For example, about 45% of fiber strength variations are due to environment and nearly 70% of micronaire variations are due to environmental stresses (National Cotton Council of America, 2002).

Farmers make decisions about attributes of cotton to produce. To accomplish this, they need to know the values of the attributes. For example, if farmers know the yields and the genetic strength characteristics of different cotton varieties for their areas and they know the discounts and premiums associated with different levels of fiber strength, they can determine the strength to try to produce, and so on with other fiber attributes. However, the values of attributes are not directly observable from the marketplace; they must be estimated and provided to buyers and sellers for them to know the values. The market only produces observations of values of mixed lots of cotton, not of attributes of cotton fiber, so attribute values must be estimated and provided to market participants.

While farmers use reported price information to decide on the amounts of the attributes to produce, textile manufacturers, the users of cotton lint, also use reported price information to decide on the amounts of attributes to purchase. In order for manufacturers to efficiently allocate resources, they also must be able to determine what the values of the individual attributes are. For example, a manufacturer knows that his process works more efficiently with higher cotton fiber length. When manufacturers are determining what bales of cotton to buy, they need accurate price information on values (costs) of different levels of fiber length in order to select optimal fiber length to purchase and use in producing specified products.

Accuracy of market information is known to have positive benefits for farmers, traders and policymakers. Up-to-date, accurate market information enables both sellers and buyers to select and use inputs and produce products and to negotiate with more accuracy, facilitating market pricing efficiency. It facilitates spatial distribution of products by sending clear price signals from consumers to producers regarding quantities and varieties required (FAO, 2006). Well-analyzed historical market information enables farmers to make planting decisions in line with textile manufacturers' demands, including those related to new crops. It also permits traders to make better decisions regarding the viability of intra and, perhaps, inter-seasonal storage. Moreover, information of this type assists agricultural planners and researchers and can make an important contribution to knowledge of marketing systems (FAO, 2006).

The official price reporting system in the United States in the cash (spot) market is the Daily Spot Cotton Quotations (DSCQ), administered by the U.S. Department of Agriculture (USDA) Agricultural Marketing Service (AMS) (Brown, et. al. 1995). AMS reports a price for each region for the "base" combination of quality attributes (color grade 41, leaf grade 4, staple 34, micronaire 3.5- 4.9, strength 27 and 28, and uniformity 80) and the premiums and discounts for variations from that base quality (USDA, 2006). The DSCQ is formulated by market reporters gathering market information through interviews with market participants and by obtaining sales information from cooperating providers (Hudson, Ethridge, and Brown, 1996). The DSCQ provides estimates of prices and quality premiums and discounts for each of the seven designated markets in the U.S. for each trading day, one being the Texas/Oklahoma market (Brown et. al., 1995).

Specific Problem

A primary problem with DSCQ is that its accuracy is not established. Accuracy is defined as the degree of conformity of a measure to a standard or a true value (Merriam-Webster, 2006). Price accuracy is important to the efficiency of allocation of goods. Price accuracy affects producers gin lint cleaning, contracting, and textile mill purchasing decisions. Producers and ginners need accurate price information in order to determine the optimum number of gin lint cleanings and for forward contracting decisions. Textile mill purchasing decisions are based on the reported price information. If price information is inaccurate, textile mills will not purchase cost efficient qualities of cotton.

The only alternative source of cotton price information that includes premiums and discounts for quality attributes is the Daily Price Estimation System (DPES), which was created for the two Texas and Oklahoma markets (West Texas and East Texas/Oklahoma). DPES has been in development since 1988 to complement the more accurate and objective High Volume Instrument (HVI) grading system (Brown et al., 1995) , and the objective of the DPES is to provide an objective and accurate tool to report prices, premiums, and discounts (Brown et al., 1995). The DPES is a computer-automated system for receiving and statistically analyzing sales data, estimating prices and quality premiums and discounts using an econometric model developed from hedonic price research, and transmitting the results to market participants (Brown et al., 1995). Unlike the DSCQ, the reliability of the DPES procedures and results have been tested and verified; all results are reproducible and its results are without systematic error, meaning there is no consistent over- or under-estimation of the values of any of the fiber quality attributes (Hudson, Ethridge, and Brown, 1996)   The DPES is limited to the Texas/Oklahoma markets.

Objectives

The general objective of this research was to determine to what extent USDA's cotton price reporting accuracy has increased over time in the Texas/Oklahoma markets. The specific objectives were to:

1) Determine the DSCQ prices, premiums, and discounts for the individual quality attributes in the Texas/Oklahoma market.
2) Determine the DPES prices, premiums, and discounts for the individual quality attributes in the Texas/Oklahoma market.
3) Determine if the DSCQ and DPES have been converging over time.
4) Evaluate the implications for marketing efficiency in the U.S. cotton market.

Background

The purpose of this section is to summarize prior literature and research as it relates to cotton price information and its impacts. This section is divided into two subsections: (1) the grading system for cotton and (2) price reporting information and its accuracy.

Grading System for Cotton

Cotton was one of the first major agricultural commodities grown in the United States. As the industry grew, the lack of uniform quality factors created increasing problems for the industry's national and international markets. In 1907, an international group of cotton industry representatives met in Atlanta, Georgia, to address problems that had developed in the marketing of cotton. A resolution was passed which recommended the establishment of uniform cotton standards to "eliminate price differences between markets, provide a means of settling disputes, make farmers more cognizant of the value of their product, and, therefore, put them in a better bargaining position, and in general be of great benefit to the cotton trade" (USDA, *Cotton Classing Services*, 2006). In response to this and similar calls for action over the next several years, laws were passed authorizing the USDA to develop cotton grade standards and offer cotton classification services, beginning an industry-government relationship which remains to the present (USDA, *Cotton Classing Services*, 2006).

Cotton is not a homogenous product, and many of the characteristics of the fiber are evaluated to facilitate its marketing and use. Eight attributes are today determined by HVI systems. Leaf grade is determined by human classers who determine the leaf grade by visual comparison with the set of the Universal Standards for the grades. Fiber length, which is related to yarn strength and spinning efficiency, is measured on a beard of cotton fibers and is reported in both hundredths of an inch and equivalent staple length (thirty-seconds of an inch). Length uniformity measures the degree of fiber length uniformity in a sample, which is related to spinning efficiency of the cotton, yarn uniformity, and yarn strength. The fiber strength measurement in grams/tex, made by clamping and breaking the beard of fibers, is related to yarn and fabric strength and to spinning efficiency (USDA, *Cotton Classing Services*, 2006).

Micronaire, a measurement associated with fiber fineness and maturity, is measured by an airflow instrument in the HVI system. Fiber fineness affects yarn appearance, yarn uniformity, and yarn strength. Maturity is affected by weather and low micronaire creates problems in dyeing and finishing of yarn fabrics. Trash content is a measurement made by a video trashmeter, which measures the percentage area of trash on the sample surface. This measurement provides an indicator of the total amount of trash in a bale. Color measurements are made by a colorimeter. The instrument measures grayness (Rd), which indicates how light or dark the sample is, and also yellowness (+b), which indicates how much yellow color is in the sample. Color gives an indication of the fibers' ability to accept dyes in the manufacturing process (USDA, *Cotton Classing Services*, 2006).

Price Reporting and Accuracy

From the mid-1960s until 1973, cotton prices were relatively stable. After 1973, due to liquidation of excess inventories and altered commodity programs, prices became more responsive to variations in production and use (Hudson, Ethridge, and Brown, 1996). Since the inception of HVI grading and its adoption industry-wide in the U.S. in 1991 price reporting has become much more complex (Ethridge, Engels, and Brown, 1992). HVI evaluates quality based on the measured attributes and the technology has allowed cotton grading to become more rapid, accurate, consistent, and objective in the measuring of cotton quality attributes (Brown et al.,1995).

The DSCQ are published prices, premiums and discounts for the seven U.S. cotton producing regions (Hudson, Ethridge, and Brown, 1996). AMS market reporters collect samples (recaps of mixed-lot sales) of market transactions and conduct interviews with market participants (primarily merchants and marketing organizations) to obtain market information. The market reporter then arrives at an intuitive (subjective) determination of the market activity and the DSCQ is formulated (Brown et al., 1995). This procedure for estimating premiums and discounts was developed in the early-1900's when price differences were reported on only two attributes--grade and staple. The difficulty of applying the procedure became much greater with the evolution of HVI grading and the need to report price differences on a larger group of cotton attributes.

The DPES, an alternative method of measuring daily market prices, has been in development since 1988 to complement the more accurate and objective HVI grading system (Brown et al., 1995) and has been developed and tested for the Texas/Oklahoma market (Hudson, Ethridge, and Brown, 1996). This estimation approach views the value of goods as dependent on the values of attributes embodied in the goods. As an econometric system, it derives base prices and quality premiums and discounts in a manner that is objective and results are reproducible. The hedonic model parameters are re-estimated daily, using only actual sales transactions that occur during the day being estimated (Hudson, Ethridge, and Brown, 1996). The system is computer-automated for receiving and statistically analyzing daily sales data, estimating prices using the econometric model developed from hedonic price research, and transmitting the results to market participants (Brown et al., 1995).

The DPES allows prices to be reported on heavy trading days as easily and timely as when trading is less active. However, analysis has shown that for days with less than 40 observed lot sales throughout Texas and Okalahoma the DPES does not produce statistically reliable information (Brown et al., 1995). Therefore, if the required number of observations is not met, then the statistical information is deemed unreliable and estimates are not reported. On the other hand, all DPES results are reproducible and their statistical reliability and absence of systematic error is known.

While the DPES estimates have been shown to be the most reliable for cotton quality premium/discount information, it is only available in the two markets of West Texas and East Texas/Oklahoma. The DSCQ has been shown not to represent producer market prices, premiums, and discounts in the Texas/Oklahoma market, and there is increasing evidence that they do not represent prices at the mill-level of the cotton market (Hudson, Ethridge, and Brown, 1996). The DSCQ smoothes the daily price changes in the market. That is, the market reporter appears to be reporting trends in market movement, but not the daily variation in prices (Ethridge and Hudson, 1998). It is essentially subjective, meaning that it is not reproducible and the accuracy is unknown.

A four year study was conducted to compare price levels of DPES and DSCQ and to determine which of the two was more reliable in the Texas/Oklahoma market. The study indicated that the DSCQ base price average was 56.94 cents/lb, the DPES average was 54.12 cents/lb, and the DSCQ base was higher than the DPES in 3 of 4 years. Thus, on average the reported DSCQ base price was slightly higher than producers received. Results also showed that the DSCQ generally overstated the producer quality discounts and understated the producer quality premiums compared to the DPES (Hudson, Ethridge, and Brown, 1996).

Conceptual Framework

This section presents a conceptual examination of the effects of price information on decisions by cotton market participants and is divided into two subsections: (1) how manufacturing firms determine the amounts of quality attributes they need and how producers determine the amounts of attributes to produce and (2) a conceptual analysis of how inaccurate price information affects selection of fiber attributes to produce and use. This conceptual analysis utilizes concepts explained by Hudson, Ethridge, and Segarra (1998) and Ethridge, Hudson, and Segarra (1998) and extends those analyses.

Quality Attributes in Production

Consider a production function for the technical relationship between fiber length (input) and yarn strength (output), indicating the maximum amount of yarn strength that can be produced by a textile manufacturer using alternative amounts of variable fiber lengths in combination with one or more fixed inputs under a given state of technology. To illustrate this, the total physical product (TPP) in Figure 1 is the relationship between yarn (output) and one variable input (fiber length), *ceterus paribus*.

TPP indicates the total amount of yarn strength produced at each level of fiber length used in the manufacturing process. Average Physical Product (APP) in the lower graph of Figure 1 shows how much yarn strength production, on average, can be obtained per unit of variable fiber length (input) with a fixed amount of other inputs. APP indicates average productivity of the fiber length in producing yarn strength, or how productive each fiber length level is on average. Marginal Physical Product (MPP) represents the amount of additional yarn strength obtained from using each additional unit of fiber length and indicates the rate of change in yarn strength resulting from adding each unit of fiber length. The only part of the MPP that is relevant is where MPP is below APP (i.e.,

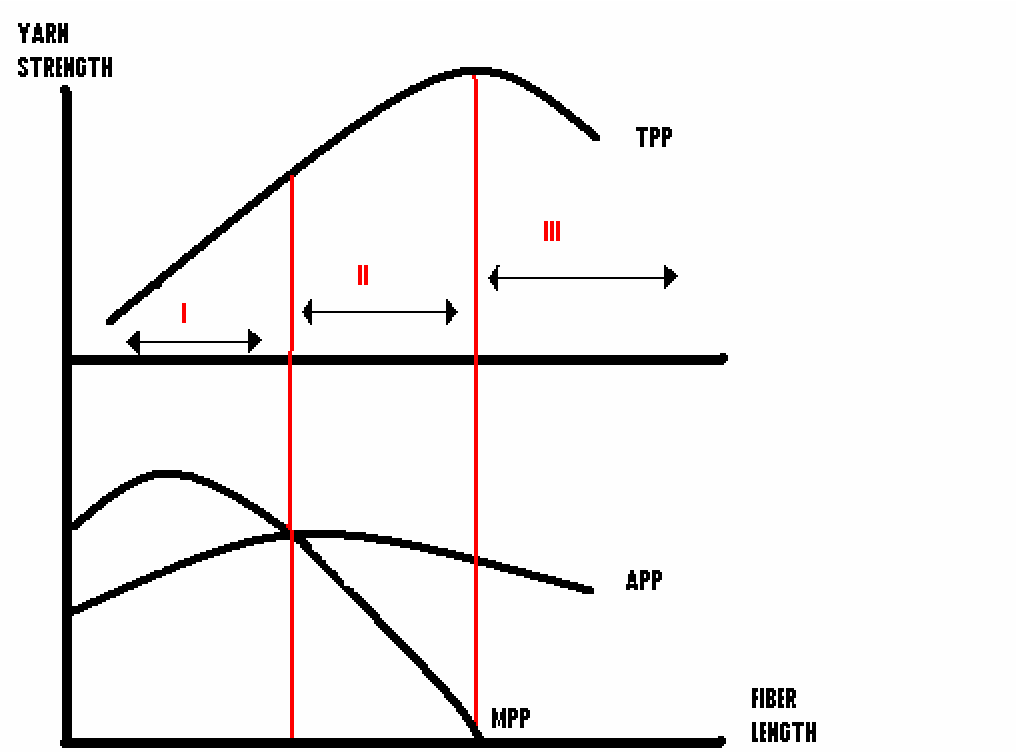

Figure 1 Fiber Length in Production of Yarn Strength

stage II in the production process).

Value Marginal Product (VMP) represents the value added in the production process by fiber length. Conceptually it is obtained as (MPP of fiber length in producing yarn strength)x(value of yarn strength). So, VMP for the stage II portion of MPP in Figure 2 represents the firm's demand for fiber length. In this process, the manufacturer equates the VMP of fiber length with the marginal cost of adding fiber length (PL), or the premiums associated with length. This is illustrated as PLl and L1 in Figure 2. Thus, with a value of fiber length of PL (Figure 2), the manufacturer's production relationships (Figure 1), and value of yarn strength, the manufacturer would purchase L1 amount of fiber length (Figure 2), *ceteris paribus*.

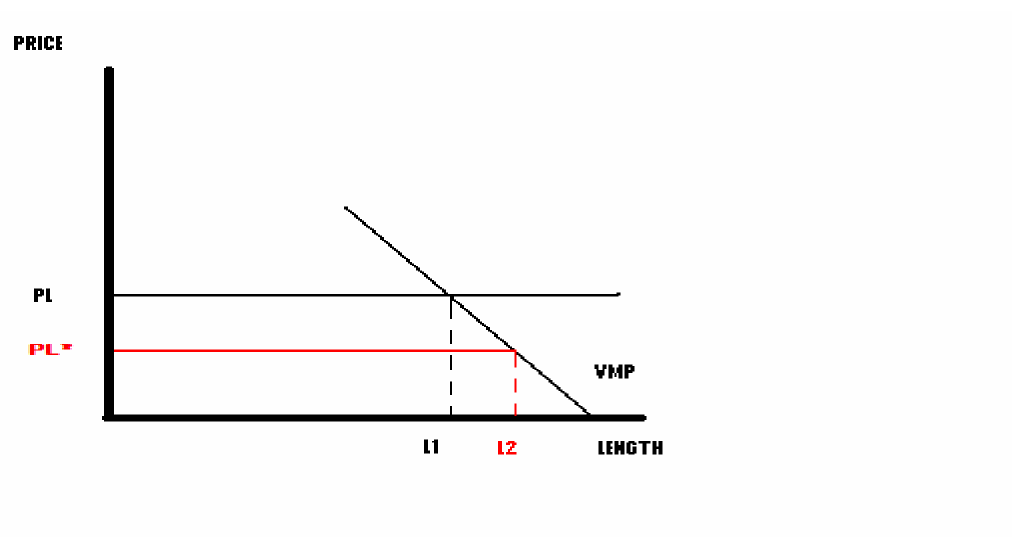

Figure 2. Manufacturer's Demand for Fiber Length

Now consider the farmer's decision process for producing fiber length. The producer has costs associated with producing fiber length, illustrated in Figure 3 with an average cost curve and a marginal cost curve. In this process, the farmer equates the marginal cost of producing an additional unit of fiber length with the marginal revenue of an additional unit of fiber length (PL), or the premiums associated with length. Thus, the farmer would produce (L1) amount of fiber length given (PL) (Figure 3).

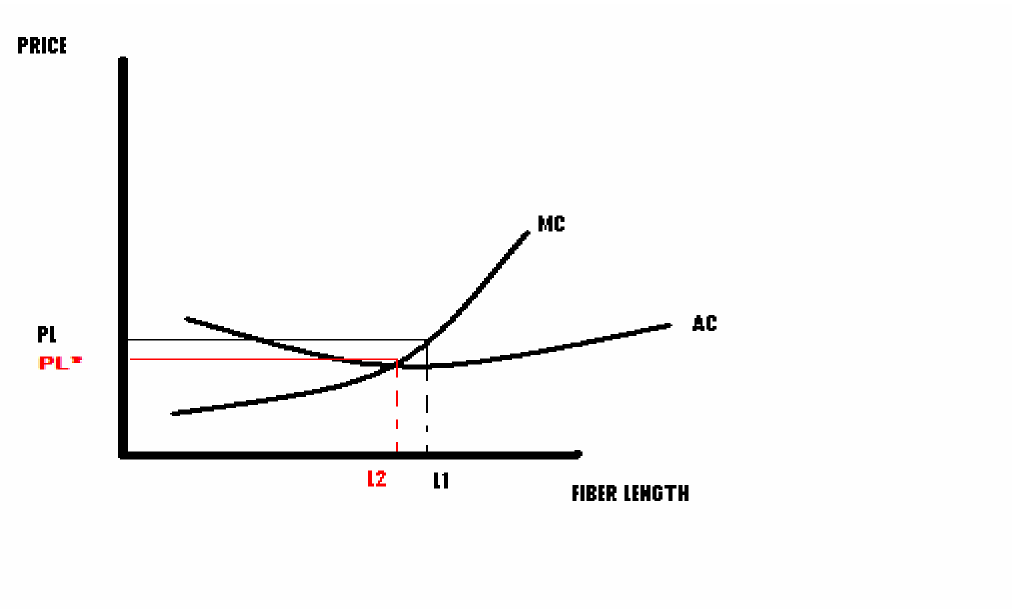

Figure 3. Farmer Cost of Producing Fiber Length

Effects of Incorrect Price Information

The optimum selection of fiber length by buyers (manufacturers in Figure 2) and sellers (producers in Figure 3) of L1 assumes that the buyers and sellers both have information about PL that is accurate. As noted, the marginal impact of quality on price, PL (premium or discount), is not observable in the market but must be derived from the aggregate price of cotton, usually not by market participants. Thus, market participants rely on price information to make input decisions (Hudson, Ethridge, Segarra, 1998).

Consider what would happen if the government reports a price of length that is inaccurate, say PL*, which is below the true PL in Figures 2 and 3. Looking at Figure 2, the manufacturers (suppliers) would want to buy more fiber length than at PL. Conversely, looking at Figure 3, the farmers (producers) would be inclined to produce less fiber length than at PL. Thus, the suppliers will try to consume more fiber length than the market-clearing amount (L1) and the producers will produce less fiber length than the market-clearing amount. This will result in an imbalance in the cotton market, creating an artificial shortage of length, and, because both have assumed that the reported price of length, PL*, is correct, neither group can understand why the market imbalance exists.

Methods and Procedures

This section summarizes the methods and procedures that were performed in order to determine if the DSCQ reported cotton quality premiums and discounts are converging or diverging over time relative to the market (DPES) premiums and discounts. Two basic methods were employed, one visual (graphs) and one analytic (tests of differences). The section is divided into four subsections: data, average differences over the study periods, time patterns, and evaluation of results.

Data

The time series data were collected from two different sources--the USDA'S Agricultural Marketing Service (USDA, "Cotton Price Statistics," 2000-2001 through 2005-2006) and various Texas Tech University Cotton Economics Research Institute

DPES publications.[1] The data were annual mean summary premiums and discounts for crop years 2000 through 2005. The quality attributes that were selected to be compared were color, leaf, staple, micronaire, fiber strength, length uniformity, and bark content. Preset quality levels were selected above and below base (color 41, leaf 4, staple 34, micronaire 3.5-4.9, strength 27/28, uniformity 80, and level 1 bark).

The grades for color selected for evaluation were 21, 61, and 43. Color is measured in two dimensions—yellowness and grayness. Color grade 43 is below base for grayness and the color grade 21 and 61 are above and below base for yellowness, respectively. The selected grades for the other attributes were leaf grades 2 and 6, staples 32 and 36, micronaires 3.3 and 5.0, strengths 25 and 30, uniformity 78 and 83, and level 1 bark. All data were compiled in spreadsheets, one set for West Texas and one for East Texas/Okalahoma. The data sets are shown in Appendix A.

Average Differences over the Study Period

The first analytical step was to run tests of differences on the annualized premiums and discounts. A t-test was used to determine if the two groups of premiums and discounts (DPES and DSCQ) were, on average, statistically different from one another over the 6-year study period. The t-test analysis was performed in the Excel spreadsheet using the t-test function based on a .05 significance level. The data were paired (DPES vs. DSCQ) for each individual attribute

[1] Nelson et. al., 2001; Ward, Misra, and Ethridge, 2002; Sanders, Misra, and Ethridge, 2003; Sanders, Misra, and Ethridge, 2004; Fadiga, Misra, and Ethridge, 2005; Fadiga, Misra, and Ethridge, 2006.

Time Patterns

The first step in determining if the USDA reported premiums and discounts have converged over time was to compare the DPES and the DSCQ graphically. The graphs depicted the annual premiums and discounts through the 2000-2005 time period. The basis of using the time period since 2000, as opposed to a longer time period, was that a change was made in 2000 in the USDA price reporting system. The change involved two shifts in reported premiums and discounts: (1) the base strength was changed from 24 and 25 grams/tex to 27 and 28 grams/tex (due to average fiber strength being produced rising significantly and users' expectations increasing steadily) and (2) length uniformity premiums and discounts were added to the reports. Prior analyses had evaluated the similarities/differences before the changes (Hudson, Ethridge, and Brown, 1996), but no analyses had been done since the price reporting changes.

The next step was to run time-series linear regressions analysis on the separate data sets. The resulting regression lines showed both the direction of movement of both the DSCQ and market premiums and discounts and the rate of change in each over time. The regression analysis was conducted within the spreadsheet software using the regression function. Individual attribute trends for the West Texas and East Texas/Okalahoma markets were developed. The time trend lines were graphed to indicate if the DSCQ was converging relative to the market.

Evaluation of Results

The last step was to examine the implications for marketing efficiency in the U.S. cotton market. If the DSCQ premiums/discounts converge toward the DPES, the implication is that the USDA price information is increasing in its accuracy, thereby increasing market price transmission efficiency. If the price reporting accuracy has not increased over time, the implication is that market efficiency is diminished or not improved. By comparing the DSCQ and the DPES prices, premiums, and discounts in this study, it is possible to determine if the USDA's cotton price reporting accuracy has changed over time in the Texas/Oklahoma markets. If it has become more/less accurate in the Texas/Oklahoma markets, it may suggest that it has become more/less accurate in other regions as well.

Results

This section, which summarizes the results of the study, is divided into three subsections: (1) explanation of tests and differences between the DPES and the DSCQ, (2) explanation of patterns through time, and (3) interpretations of the results.

Average Differences Between the DPES and DSCQ

Table 1 shows the mean premiums (+) and discounts (-) of the DPES and DSCQ for West Texas over the 6 years of the data used for the analysis.[2] The differences between the two are calculated by taking the absolute value of (DPES-DSCQ). The probability level is the level of significance at which they are statistically different. To illustrate how to interpret Table 1, consider Color 21. The average market premium for color 21 over color 41 (the base color) in the market (as measured by the DPES) over the 6 years was 22 points per pound of lint (.22 cents/lb). The average premium reported by AMS/USDA over that same period was 155 points/lb. The numerical average difference was 133 points and there was a significant difference (O = 0.0007) on the average between the DSCQ estimate of the premium and the market premium. Consider

[2] The East Texas/Oklahoma table is in Appendix B.

Table 1. Means of DPES and DSCQ and Differences, West Texas Cotton Market

Quality Attributes	Mean DPES	Mean DSCQ	Difference (DPES-DSCQ)	Probability Level α=.05
Color 21	22	155	133	0.0007
Color 61	-444	-265	179	0.019
Color 43	-419	-309	110	0.077
Leaf 2	98	120	22	0.31
Leaf 6	-208	-301	93	0.02
Staple 32	-278	-246	32	0.43
Staple 36	147	190	43	0.58
Micronaire 3.3	-172	-163	9	0.57
Micronaire 5.0	-245	-255	10	0.56
Strength 25	-57	-104	47	0.006
Strength 30	13	38	25	0.027
Uniformity 78	-27	-42	15	0.39
Uniformity 83	18	7	11	0.11
Bark 1	-220	-177	43	0.23

strength 25, or "low" strength. The DSCQ significantly (P = .006) over-discounted low strength compared to the market over the 6-year period.

Using statistical significance levels of P < .10 to denote significant differences, .11 < P < .15 as marginally different, and P > .15 as no difference in conjunction with Tables 1 and 2 yields the following results. "Good" color (color 21) premiums were on the average over-stated and "poor" colors (color 61 and color 43) were on the average under-discounted between 2000 and 2005. High leaf content (leaf 6) and low strength (strength 25) were over-discounted and high strength (strength 30) was over-premiumed during the study period. The average deviations from the market were not statistically significant for low leaf (leaf 2), high and low staple (32 and 36), low and high micronaire (3.3 and 5.0), low uniformity (uniformity 78), or bark content. High uniformity was marginally under-premiumed on the average.

Overall, for quality attributes below the base there were no significant differences between the market and DPES discounts for 5 of those 9 attributes on the average over the study period (short staple, high and low micronaire, low uniformity, and bark content); the DSCQ under-discounted on the average two attributes (high yellowness and grayness) and over-discounted two attributes (high leaf and low strength). For quality attributes above base quality, there was no difference between the market and DSCQ premiums with 2 of the 5 attributes (low leaf and long staple), and the DSCQ over-premiumed on two (low yellowness and high strength) and under-premiumed on one (high length uniformity). The East Texas/Oklahoma average premiums and discounts show the same pattern as for the West Texas region, with some differences in statistical significance (Appendix B).

<u>Premium/Discount Patterns Through Time</u>

This subsection discusses patterns in West Texas market premiums and discounts and is divided into 7 components, one each for Color, Leaf, Staple, Micronaire, Strength, Uniformity, and Bark. Patterns in the East Texas-Oklahoma (ET-O) premiums and discounts are similar, so are not discussed separately, but graphs for ET-O are presented in Appendix C.

Color. Figure 4 compares the DPES and DSCQ over the 6-year period of the study based on their annual premiums of Color Grade 21. Both the annual premiums (solid lines) and trends (dashed lines) are shown for the market (DPES) and the USDA reported premiums (DSCQ). Figure 4 shows that the market and DSCQ premiums trended in the same direction, and the trend lines are parallel (slopes are not significantly different). The DSCQ premiums were capturing the *increasing* value of good (low) color over time, but the premiums were consistently above the measured market premiums (note Table 1) and was neither diverging nor converging with the market over time.

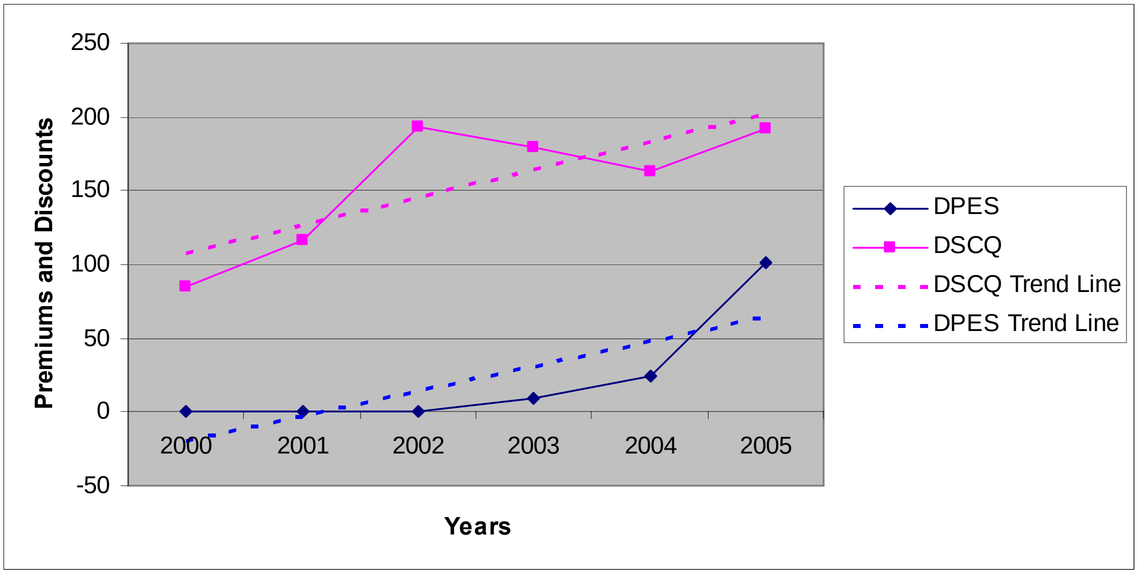

Figure 4. Average Annual West Texas Premiums for Color Grade 21 from DPES and DSCQ, with Trends.

Figures 5 and 6 show the patterns for high yellow color (Color 61) and high gray color (Color 43), respectively. For Color 61, the DSCQ discount showed a pattern of significantly diverging from market discounts. For Color 43, the trend lines are parallel, consistently under-discounting grayness but neither converging nor diverging. However, closer inspection of the pattern of the DSCQ suggests that it may be converging to the market discounts; the trend lines in this instance may not be a reliable indicator of convergence.

Leaf. Figures 7 and 8 show the patterns for low leaf (Leaf 2) and high leaf (Leaf 6), respectively. In Figure 7, the USDA reported discounts have been diverging. On the other hand, the leaf discounts for high leaf (Figure 8) shows a pattern of DSCQ discounts converging toward the market.

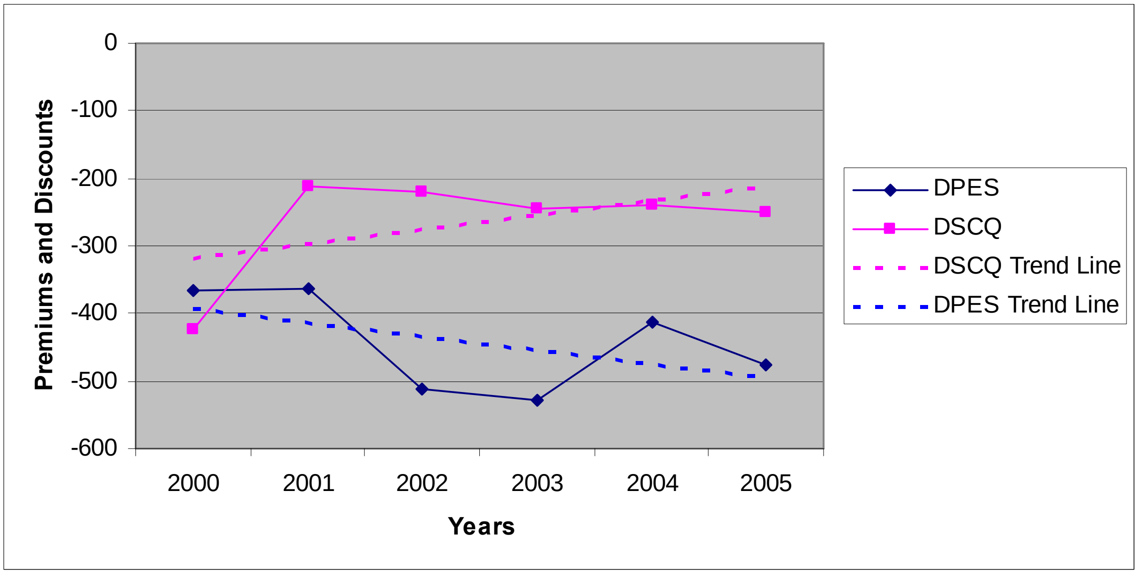

Figure 5. Average Annual West Texas Discounts for Color Grade 61 from DPES and DSCQ, with Trends.

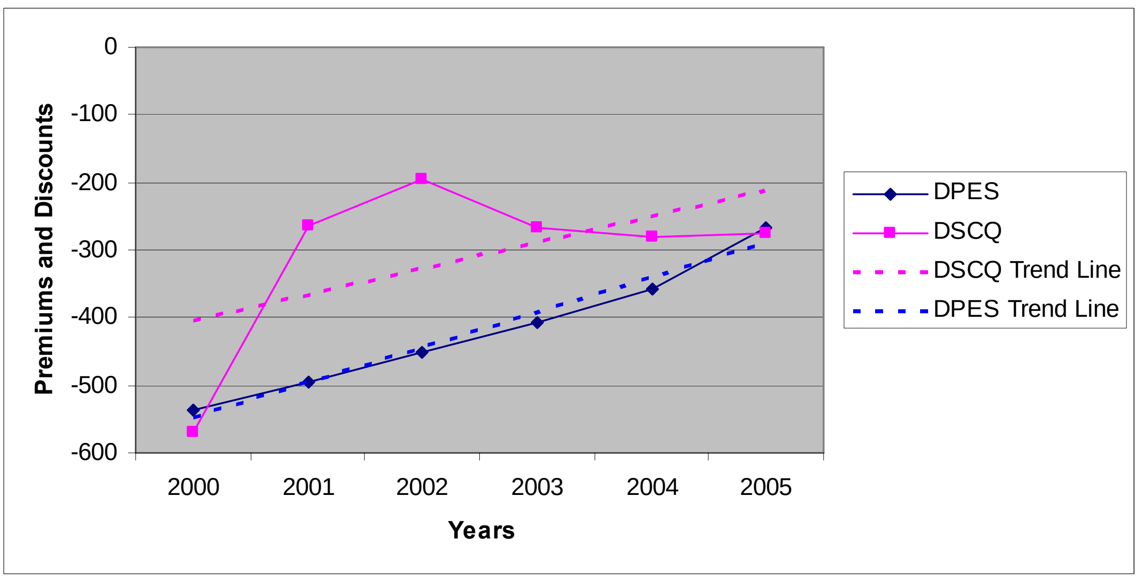

Figure 6. Average Annual West Texas Discounts for Color Grade 43 from DPES and DSCQ, with Trends.

Staple. Figures 9 and 10 illustrate the patterns for low fiber length (Staple 32) and high fiber length (Staple 36), respectively. In Figure 9, the trend lines indicate a pattern of slight divergence of DSCQ discounts from the market, but the trend slopes are not statistically different. Further, examination of individual years suggests potential convergence for long staple, shown in Figure 10; trends indicate divergence but patterns are erratic and the evidence on staple appears inconclusive.

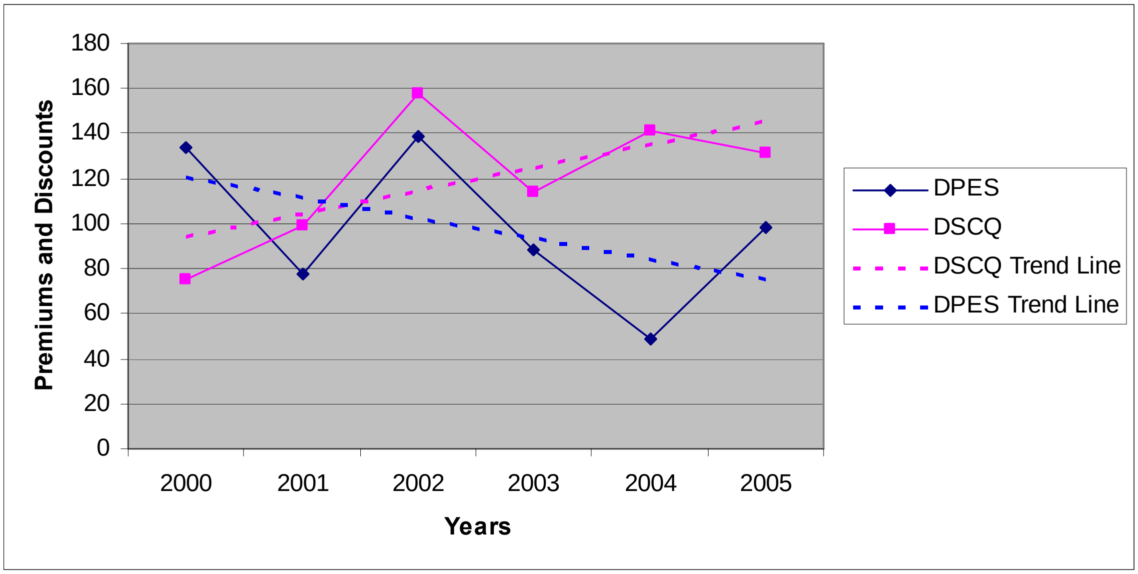

Figure 7. Average Annual West Texas Premiums for Leaf Grade 2 from DPES and DSCQ, with Trends.

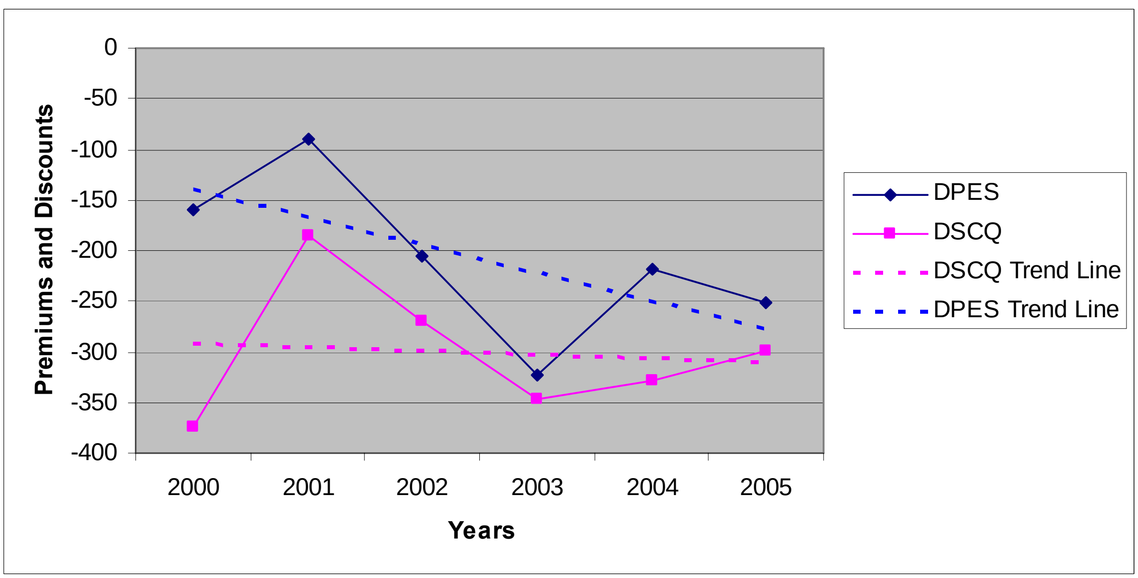

Figure 8. Average Annual West Texas Discounts for Leaf Grade 6 from DPES and DSCQ, with Trends.

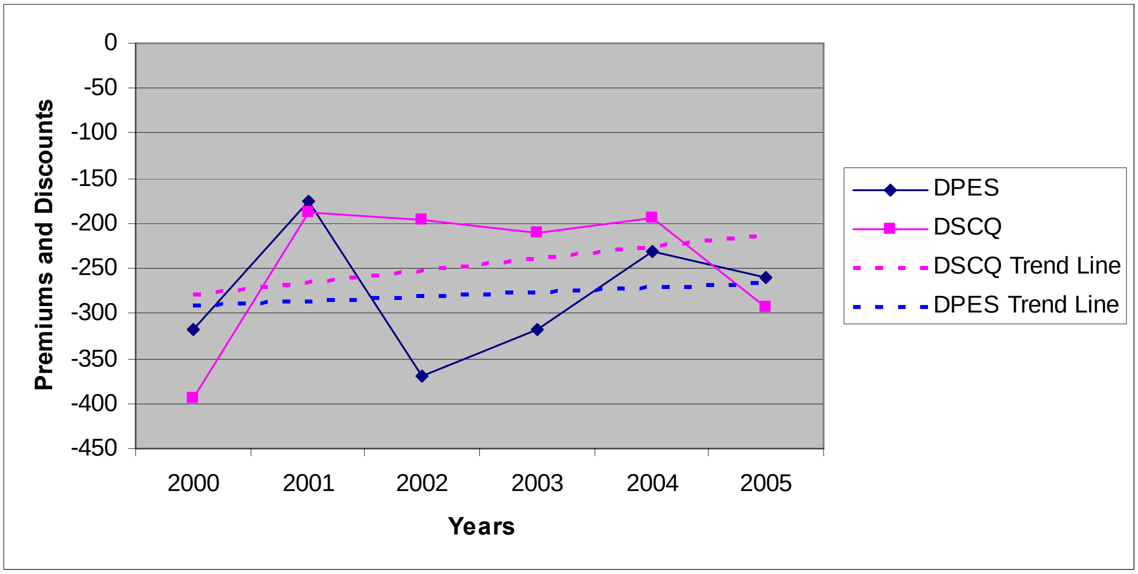

Figure 9. Average Annual West Texas Discounts for Staple 32 from DPES and DSCQ, with Trends.

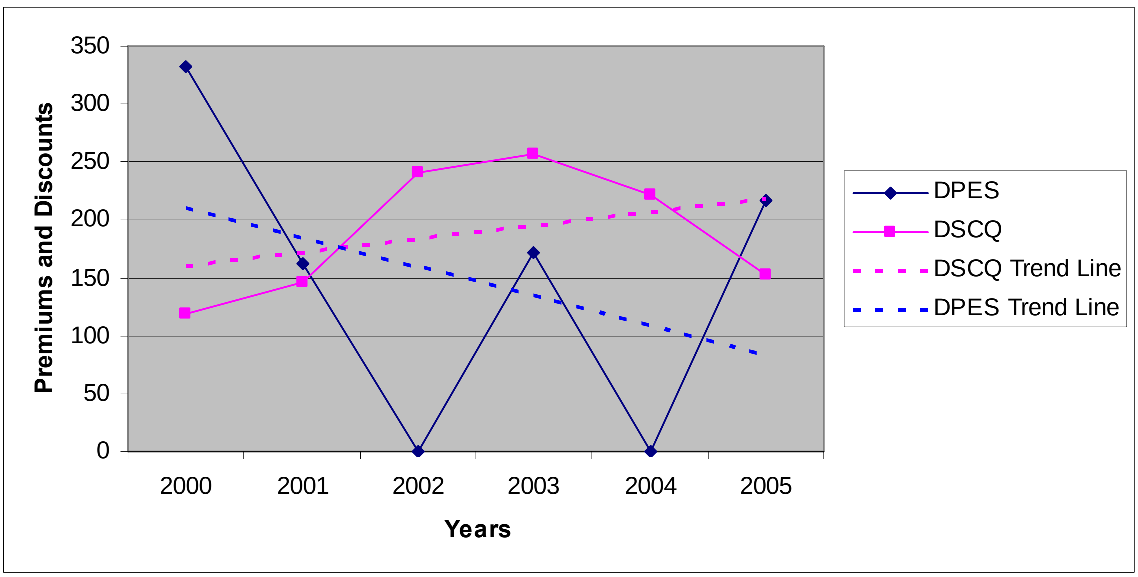

Figure 10. Average Annual West Texas Premiums for Staple 36 from DPES and DSCQ, with Trends

Micronaire. Figures 11 and 12 provide the patterns for low micronaire (Micronaire 3.3) and high micronaire (Micronaire 5.0), respectively. Low micronaire DSCQ discounts have been less than market discounts in recent years (although on the average they were not significantly different—Table 1), but appear to have been converging with the market discounts. The USDA reported discounts for high micronaire (Figure 12) have been slightly higher than market (also not significantly different over the entire period), but seem to be converging toward the market discounts.

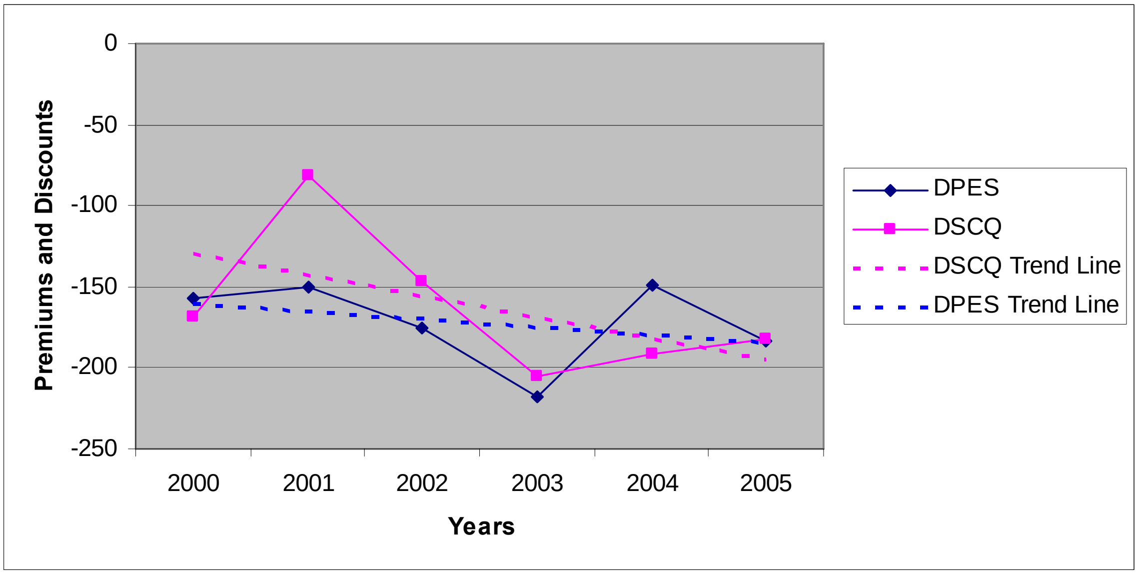

Figure 11. Average Annual West Texas Discounts for Micronaire 3.3 from DPES and DSCQ, with Trends.

Strength. Figures 13 and 14 show the patterns for low strength (Strength 25) and high strength (Strength 30). The DSCQ reported discounts for low strength have been consistently greater than the market discounts (trend slopes are not significantly different). For high strength, the DSCQ have been consistently over-stating the premiums, but have shown gradual convergence toward market premiums.

Uniformity. Figures 15 and 16 display the patterns for low uniformity (Uniformity 78) and high uniformity (Uniformity 83), respectively. With low uniformity, the DSCQ shows a pattern of overstating the discount and diverging (Figure 15). For high uniformity, DSCQ has been understating the market premium, but the discrepancy has been narrowing (Figure 16).

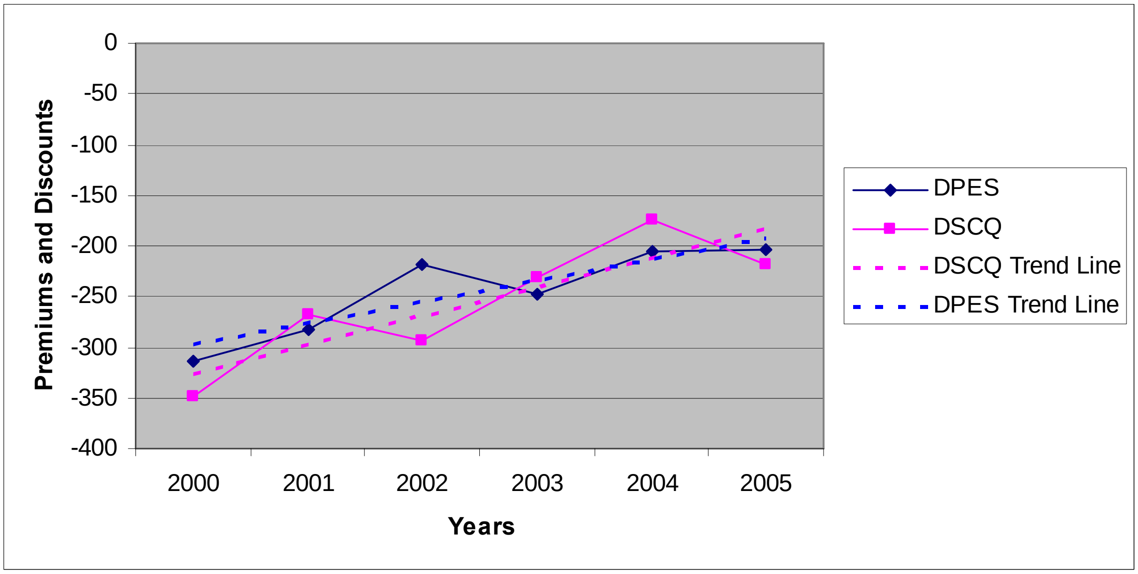

Figure 12. Average Annual West Texas Discounts for Micronaire 5.0 from DPES and DSCQ, with Trends.

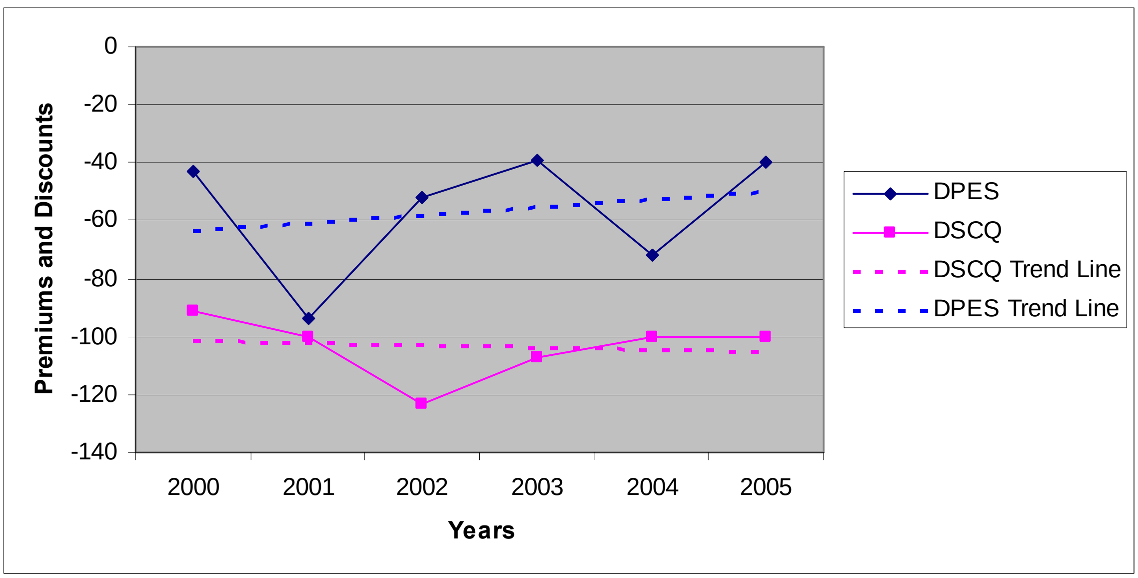

Figure 13. Average Annual West Texas Discounts for Strength 25 from DPES and DSCQ, with Trends.

Bark. Figure 17 shows the pattern for low bark content (Bark 1). The USDA reported discounts for low bark have been less than market discounts in recent years, but have been converging over time.

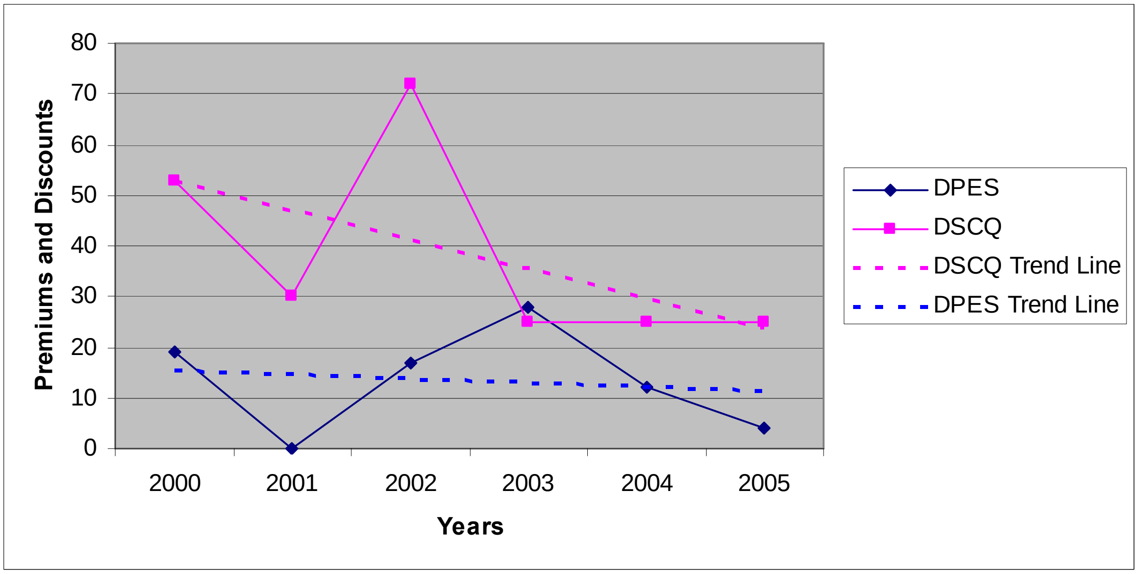

Figure 14. Average Annual West Texas Premiums for Strength 30 from DPES and DSCQ, with Trends.

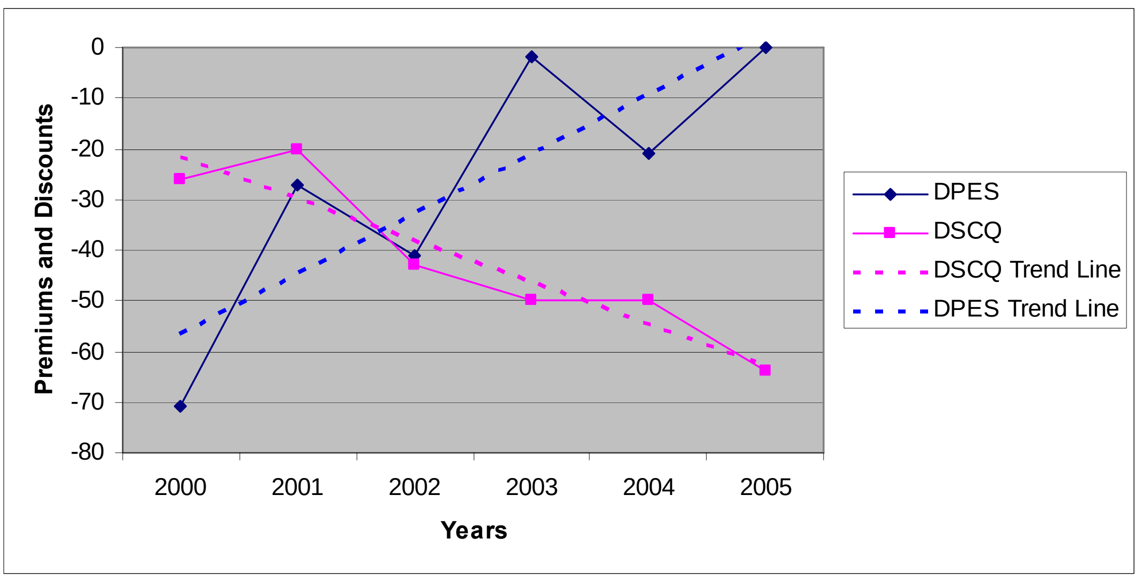

Figure 15. Average Annual West Texas Discounts for Uniformity 78 from DPES and DSCQ, with Trends.

<u>Interpretations of the Results</u>

The individual quality premiums and discounts examined, which were chosen to represent deviations from the standardized "base" quality of cotton, show very different

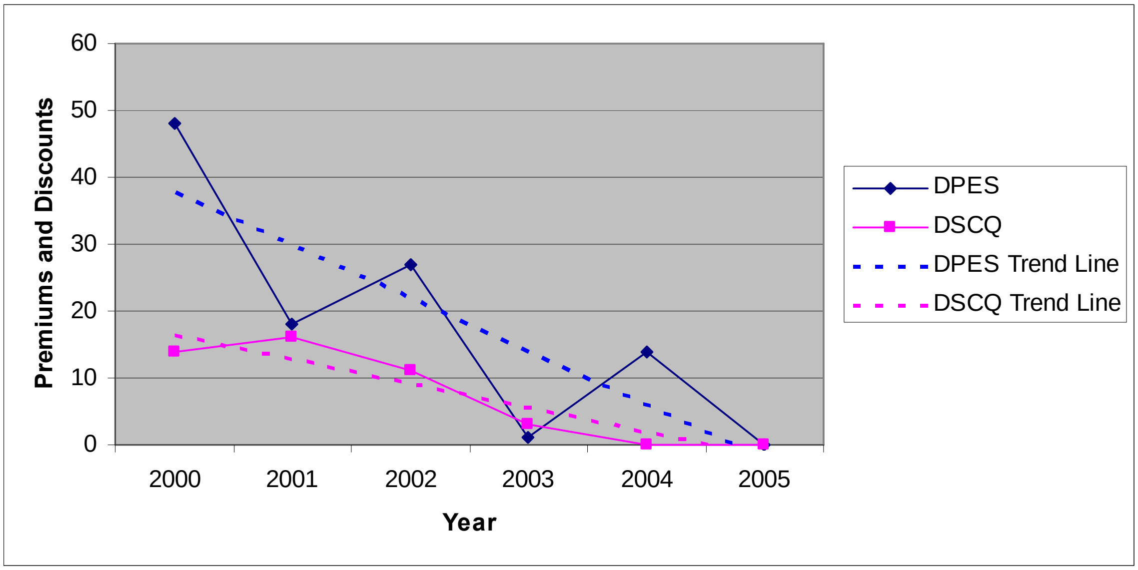

Figure 16. Average Annual West Texas Premiums for Uniformity 83 from DPES and DSCQ, with Trends.

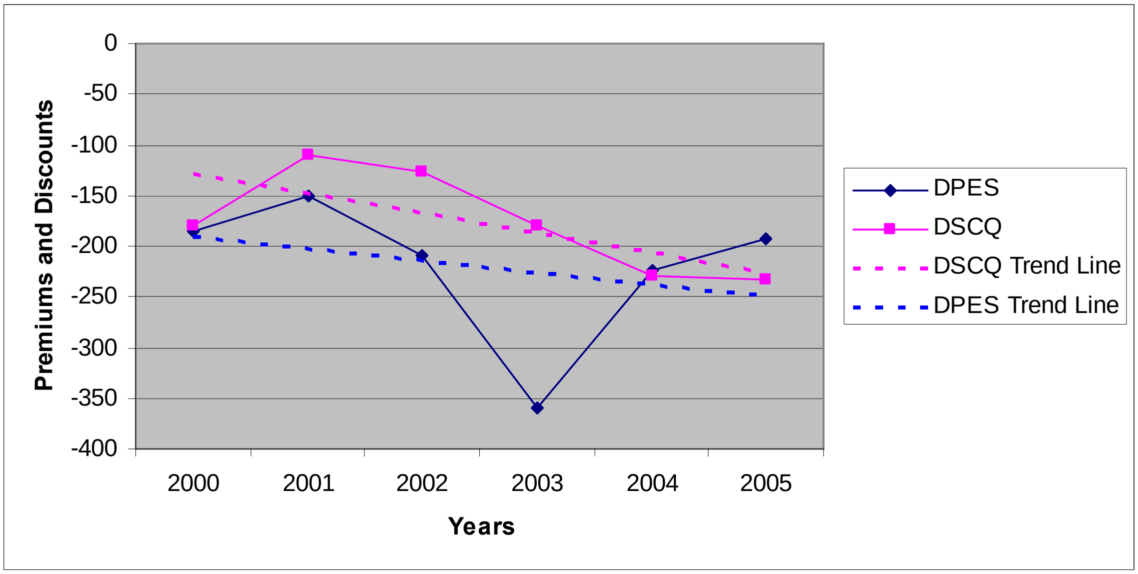

Figure 17. Average Annual West Texas Discounts for Bark Level 1 from DPES and DSCQ, with Trends.

patterns over time. Table 2 summarizes the overall results given both the statistical and observational evidence for West Texas as discussed in the previous sections. The first column is based on the tests of average differences over the study period. The second and third columns are from the graphical/trend analyses and the last two columns rely on

Table 2. Summary Results of DSCQ Deviations from Cotton Market Quality Attribute Premiums and Discounts, West Texas, 2000-2005.

Attributes	Average Difference for Study Period?	Converging with Markets?	Diverging from Markets?	Deviations from Market	
				Premium	Discount
Color 21	Yes	No	No	Overstated	
Color 61	Yes	No	Yes		Understated
Color 43	Yes	Yes	No		Understated
Leaf 2	No	No	Yes	Overstated	
Leaf 6	Yes	Yes	No		Overstated
Staple 32	No	No	No		
Staple 36	No	No	?	?	
Micronaire 3.3	No	Yes	No		
Micronaire 5.0	No	Yes	No		
Strength 25	Yes	No	No		Overstated
Strength 30	Yes	Yes	No	Overstated	
Uniformity 78	No	No	Yes		Overstated
Uniformity 83	Yes	Yes	No	Understated	
Bark 1	No	Yes	No		

both. The results for the attributes may be divided into four categories, summarized below.

- Accurate. This includes those attributes, four of them, for which their premiums/discounts (P/D) are not significantly different from market P/D and are either converging with the market (improving) or not diverging from the market. These attributes were: short staple (32), low (3.3) and high (5.0) micronaire, and bark (level 1). All are lower than base quality.
- Not accurate but improving. This includes attributes, four of them, for which the reported P/D are significantly different from the market over the entire study

period, but the reported is converging toward the market. These attributes were: high grayness (43), high leaf (6), high strength (30), and high uniformity (83). Two are lower and two are higher than base quality.

- Not accurate or deteriorating. This includes attributes, five of them, for which the P/D are (1) significantly different from the market and not converging or (2) not significantly different from the market on the average but are diverging from the market. These attributes were: low yellowness (21), high yellowness (61), low leaf (2), low strength (25), and low uniformity (78). Two of these attributes are above base quality and three are below.
- Evidence is unclear. This included high staple (36), for which the reported premium was not significantly different from the market but unclear if it is converging or diverging from the market.

The implications for market pricing efficiency is that the market reporting in the West Texas market is good or improving for 8 of the 14 attributes evaluated, deteriorating for 5, and uncertain for one.

For the East Texas/Oklahoma market, the results differ slightly, summarized in Table 3 (differences from the West Texas Results are highlighted in red). Results for this region, extracted from Appendices B and C, are somewhat different, as summarized below using the same classifications as above.

- Accurate. These attributes, three of them, were: low and high micronaire and level 1 bark, all lower than base quality.
- Not accurate but improving. These attributes, three of them, were: high leaf, low strength, and high uniformity (two below base quality and one above).

- Not accurate or deteriorating. These attributes, eight of them, were: low yellowness, high yellowness, high grayness, low and high staple, low strength, low leaf, and low uniformity (five below base quality and three above).

Table 3. Summary Results of DSCQ Deviations from Cotton Market Quality Attribute Premiums and Discounts, East Texas-Oklahoma, 2000-2005.

Attributes	Average Difference for Study Period?	Converging with Markets?	Diverging from Markets?	Deviations from Market Premium	Deviations from Market Discount
Color 21	Yes	No	Yes	Overstated	
Color 61	Yes	No	Yes		Understated
Color 43	Yes	No	No		Understated
Leaf 2	No	No	Yes	Overstated	
Leaf 6	Yes	Yes	No		Overstated
Staple 32	No	No	Yes		
Staple 36	No	No	Yes	Overstated	
Micronaire 3.3	No	Yes	No		
Micronaire 5.0	No	Yes	No		
Strength 25	Yes	No	No		Overstated
Strength 30	Yes	Yes	No	Overstated	
Uniformity 78	No	No	Yes		Overstated
Uniformity 83	Yes	Yes	No	Understated	
Bark 1	No	Yes	No		

In the East Texas/Oklahoma market, market reporting was good or improving for 6 of the 14 attributes evaluated and deteriorating for 8.

Summary and Conclusions

The Daily Spot Cotton Quotations (DSCQ) is the USDA's reported estimate of cotton market premiums and discounts for the U.S. The only alternative for daily market premiums and discounts is the Daily Price Estimation System (DPES), which is available only for the two Texas/Oklahoma markets. Since the DPES has been shown to be more reliable than the DSCQ, it was used to evaluate the accuracy of information being provided to the U.S. cotton industry through the DSCQ. The reason this price information accuracy is so important is that it affects the efficiency at which the marketing system can operate.

The general objective of this research was to determine if USDA's cotton price reporting accuracy has increased over time in the Texas/Oklahoma market. In order to determine this, data on both DSCQ and DPES were compiled and the two price series were tested for average differences over the 6-year study period and the behaviors of the two data series over time were examined to determine whether the DSCQ was converging toward the market over time.

The findings showed that the DSCQ were accurate within an acceptable margin of error during the study period (2000-2005) in the two market reporting regions for 7 of the 28 cases (14 attributes in each of the two regions) studied, not accurate but improving for 7 of the cases studied, inaccurate and deteriorating for 13 cases, and indeterminate for one case. Stated alternatively, the official market reporting on cotton quality premiums and discounts is either adequate or improving for 14 of the 27 cases on which there was clear evidence (52%) and inadequate or deteriorating for 48% of the cases.

Overall conclusions regarding implications for market pricing efficiency from the AMS market reporting for cotton are mixed. The "good or getting better" for 52% of the cases clearly improves the efficiency of the cotton marketing system for those attributes in those regions, and "poor or getting worse" for 48% of the cases clearly diminishes the efficiency of the cotton marketing system. Are the economic efficiency gains from the 52% greater than the economic efficiency losses from the 48%? That is unknown because there are no reliable estimates of the relative gains and losses, and estimation of that is beyond the scope of this study. It is a question that is recommended for future research. That said, it is important to underscore that for the goal of market efficiency, whether premiums or discounts are reported too high or too low is not as important as how close its reported level is to the true market level. Referring back to the Conceptual Framework section of this report, it can be readily observed that the market imbalances occur irrespective of the direction of error.

These findings and conclusions hold for the study period and for Texas/Oklahoma markets. While the study does not provide evidence that the same is the case in other U.S. regional markets, the implication is that the same could very well be the case in the other markets. If the procedures used by AMS cannot accurately track the quality premiums and discounts in the two markets examined, can they accurately track them in the other markets?

This brings into question why the DPES approach has not been adopted to replace the DSCQ as the U.S cotton market price estimator. Only USDA can provide an answer to that, but there are at least two possible contributing reasons. First, the cotton industry has not demanded that the procedures be changed. The industry may be unaware of the costs imposed by the inaccurate information because those costs are not transparent or intuitively obvious. Also, some participants in the market may be able to exploit the misinformation. Second, the DPES is a complex econometric-based system that requires a minimum volume of actual market sales data in each market and specialized knowledge of both the econometric procedures and the structure of the cotton marketing system.

There is a question as to the volume of market sales data available/accessible and USDA may lack the technical expertise to run the more sophisticated price analysis system.

Should USDA decide to adopt a version of the DPES system nationwide, the system would need adjustments for different markets. Most of the adjustments are logistical; arrangements would have to be made to compile all of the daily information for each of the regional markets. This would probably require participation of merchant groups and marketing associations in order to compile all of the data efficiently. Another factor is that different markets have different qualities of cotton. This would require model development and testing for each individual region.

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Appendix A
Cotton Premium/Discount Data

Table A1. West Texas DPES Average Premiums/Discounts

	Color 21	Color 61	Color 43	Leaf 2	Leaf 6
2000	0	-367	-536	134	-159
2001	0	-364	-496	78	-89
2002	0	-513	-452	139	-206
2003	9	-529	-407	88	-323
2004	24	-413	-358	49	-219
2005	101	-477	-266	98	-251

	Staple 32	Staple 36	Mic. 3.3	Mic. 5.0	Strength 25
2000	-318	332	-157	-313	-43
2001	-175	162	-150	-282	-94
2002	-369	0	-176	-218	-52
2003	-317	171	-218	-247	-39
2004	-231	0	-149	-206	-72
2005	-260	216	-183	-204	-40

	Strength 30	Uniformity 78	Uniformity 83	Bark 1
2000	19	-71	48	-186
2001	0	-27	18	-151
2002	17	-41	27	-209
2003	28	-2	1	-359
2004	12	-21	14	-224
2005	4	0	0	-193

Table A2. East Texas/Oklahoma DPES Average Premiums/Discounts

	Color 21	Color 61	Color 43	Leaf 2	Leaf 6
2000	85	-424	-571	75	-375
2001	117	-212	-263	99	-185
2002	193	-219	-195	158	-270
2003	179	-246	-268	114	-347
2004	163	-240	-281	141	-329
2005	192	-250	-275	131	-300

	Staple 32	Staple 36	Mic. 3.3	Mic. 5.0	Strength 25
2000	-394	119	-169	-348	-91
2001	-187	146	-81	-267	-100
2002	-197	241	-147	-293	-123
2003	-211	257	-205	-231	-107
2004	-194	222	-192	-174	-100
2005	-294	152	-182	-218	-100

	Strength 30	Uniformity 78	Uniformity 83	Bark 1
2000		-26	14	-180
2001	30	-20	16	-110
2002	72	-43	11	-127
2003	25	-50	3	-180
2004	25	-50	0	-230
2005	25	-64	0	-233

Table A3. West Texas DSCQ Average Premiums/Discounts

	Color 21	Color 61	Color 43	Leaf 2	Leaf 6
2000	85	-424	-571	75	-375
2001	117	-212	-263	99	-185
2002	193	-219	-195	158	-270
2003	179	-246	-268	114	-347
2004	163	-240	-281	141	-329
2005	192	-250	-275	131	-300

	Staple 32	Staple 36	Mic. 3.3	Mic. 5.0	Strength 25
2000	-394	119	-169	-348	-91
2001	-187	146	-81	-267	-100
2002	-197	241	-147	-293	-123
2003	-211	257	-205	-231	-107
2004	-194	222	-192	-174	-100
2005	-294	152	-182	-218	-100

	Strength 30	Uniformity 78	Uniformity 83	Bark 1
2000	53	-26	14	-180
2001	30	-20	16	-110
2002	72	-43	11	-127
2003	25	-50	3	-180
2004	25	-50	0	-230
2005	25	-64	0	-233

Table A4. East Texas/Oklahoma Average DSCQ Premiums/Discounts

	Color 21	Color 61	Color 43	Leaf 2	Leaf 6
2000	83	-450	-589	82	-389
2001	137	-225	-296	109	-185
2002	203	-228	-195	176	-270
2003	184	-250	-281	111	-339
2004	323	-233	-300	153	-325
2005	270	-250	-281	175	-304

	Staple 32	Staple 36	Mic. 3.3	Mic. 5.0	Strength 25
2000	-429	117	-179	-374	-95
2001	-175	169	-95	-275	-101
2002	-206	270	-143	-292	-119
2003	-239	253	-204	-235	-107
2004	-165	226	-175	-174	-100
2005	-205	269	-184	-218	-100

	Strength 30	Uniformity 78	Uniformity 83	Bark 1
2000	52	-26	14	-192
2001	28	-22	15	-118
2002	62	-44	11	-134
2003	25	-50	3	-196
2004	25	-50	0	-244
2005	25	-64	0	-233

Appendix B.

Table B1. Means of DPES and DSCQ and Differences, East Texas/Oklahoma Cotton Market.

	Mean		Difference	Probability Level
Quality Attributes	**DPES**	**DSCQ**	**(DPES-DSCQ)**	**α=.05**
Color 21	22	200	178	0.002
Color 61	-442	-273	169	0.028
Color 43	-418	-324	94	0.11
Leaf 2	97	134	37	0.15
Leaf 6	-208	-302	94	0.026
Staple 32	-277	-237	40	0.32
Staple 36	147	217	70	0.36
Micronaire 3.3	-146	-163	17	0.62
Micronaire 5.0	-266	-261	5	0.83
Strength 25	-56	-104	48	0.005
Strength 30	13	36	23	0.02
Uniformity 78	-27	-43	16	0.37
Uniformity 83	18	7	11	0.11
Bark 1	-220	-186	34	0.32

Appendix C
Time Patterns of Fiber Quality Premiums/Discounts, East Texas-Oklahoma

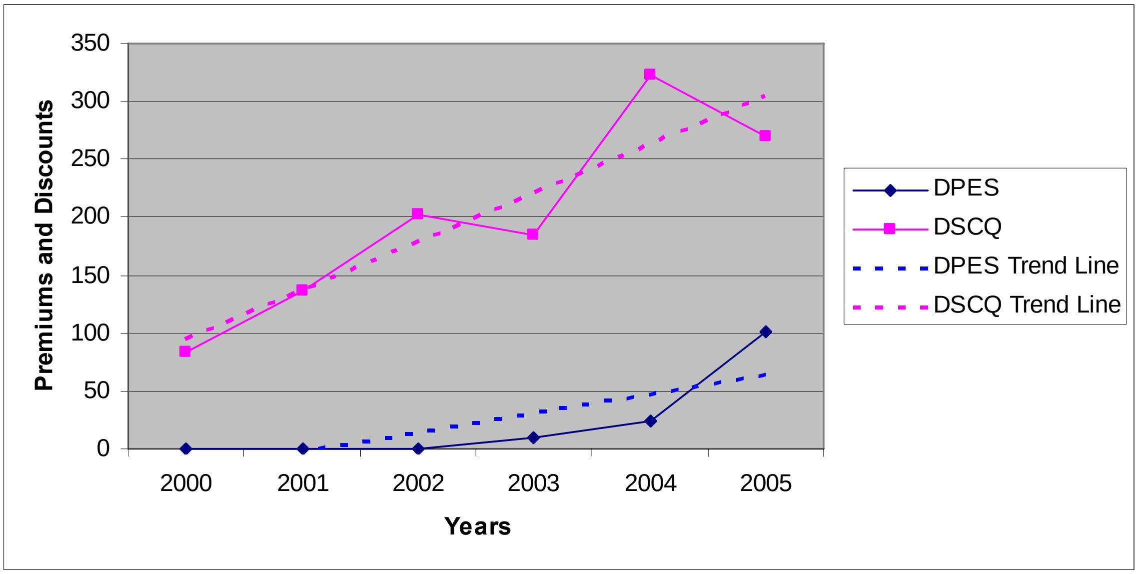

Figure C1. Average Annual East Texas/Oklahoma Discounts for Color Grade 21 from DPES and DSCQ, with Trends.

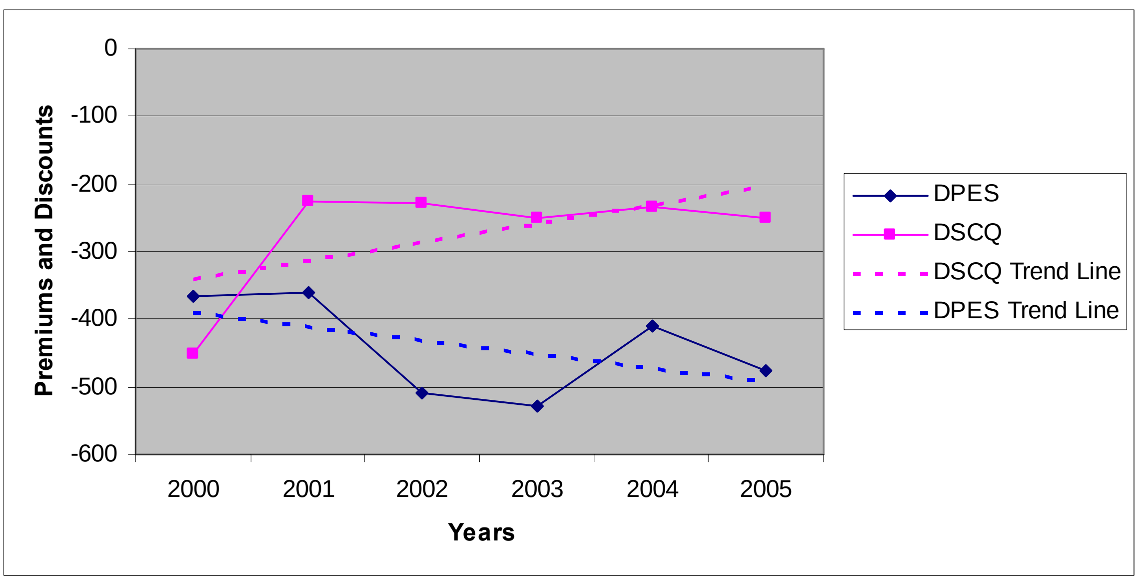

Figure C2. Average Annual East Texas/Oklahoma Discounts for Color Grade 61 from DPES and DSCQ, with Trends.

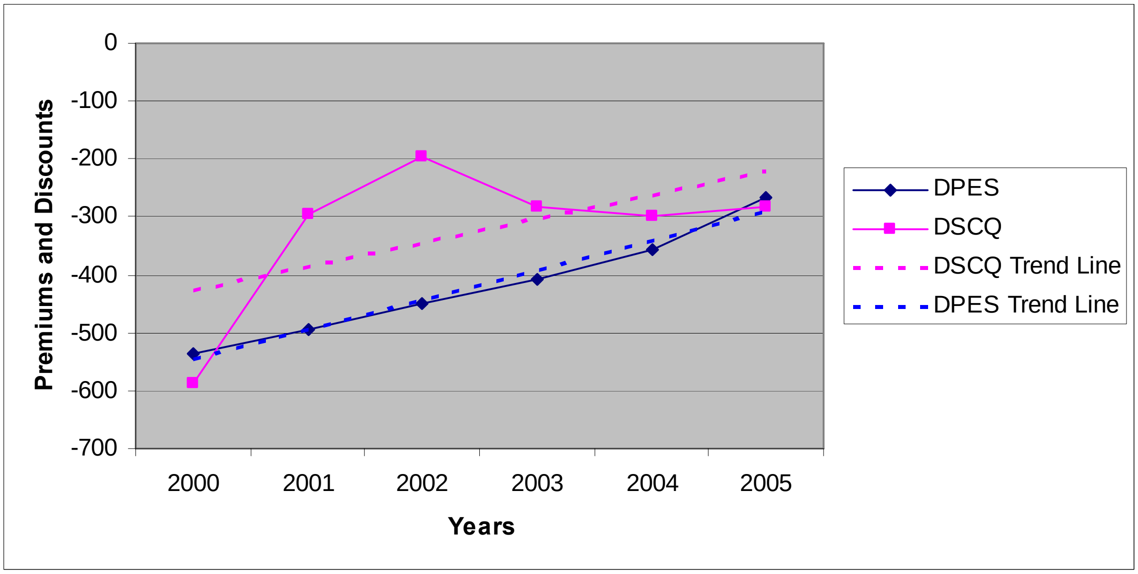

Figure C3. Average Annual East Texas/Oklahoma Discounts for Color Grade 43 from DPES and DSCQ, with Trends.

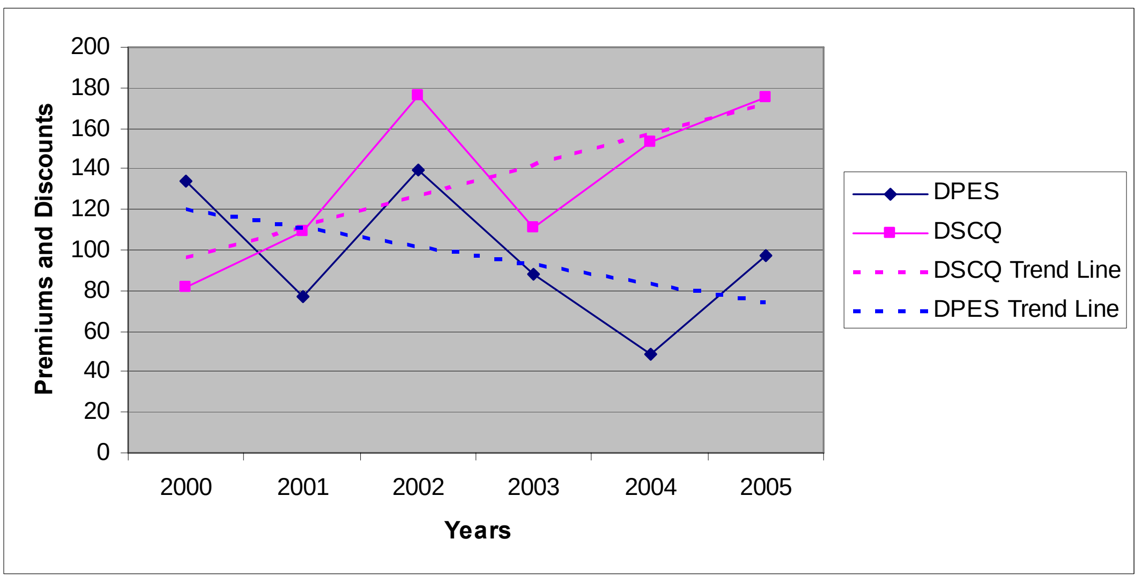

Figure C4. Average Annual East Texas/Oklahoma Premiums for Leaf Grade 2 from DPES and DSCQ, with Trends.

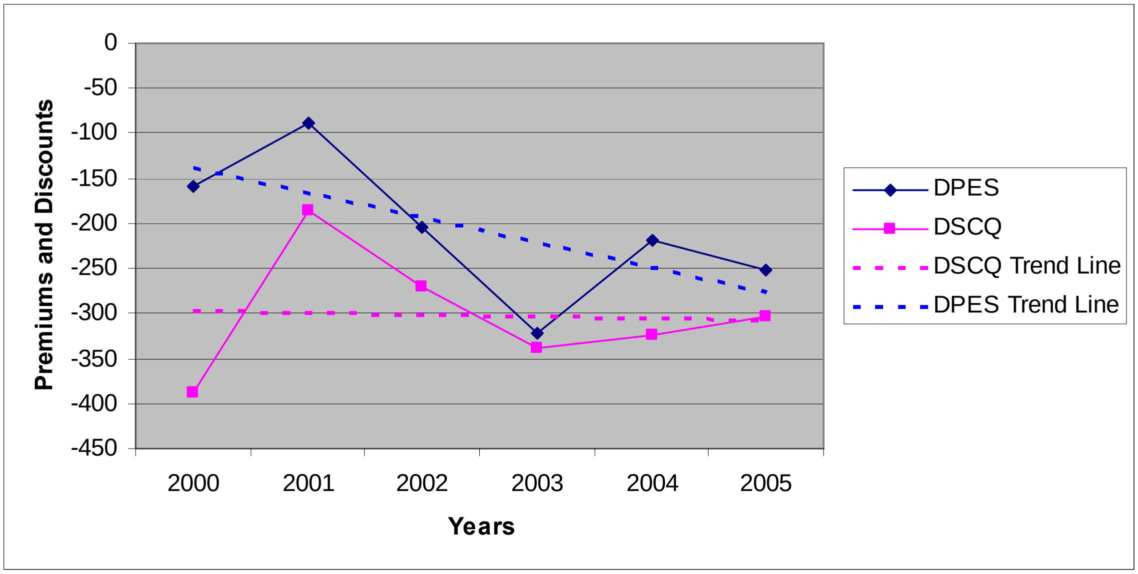

Figure C5. Average Annual East Texas/Oklahoma Discounts for Leaf Grade 6 from DPES and DSCQ, with Trends.

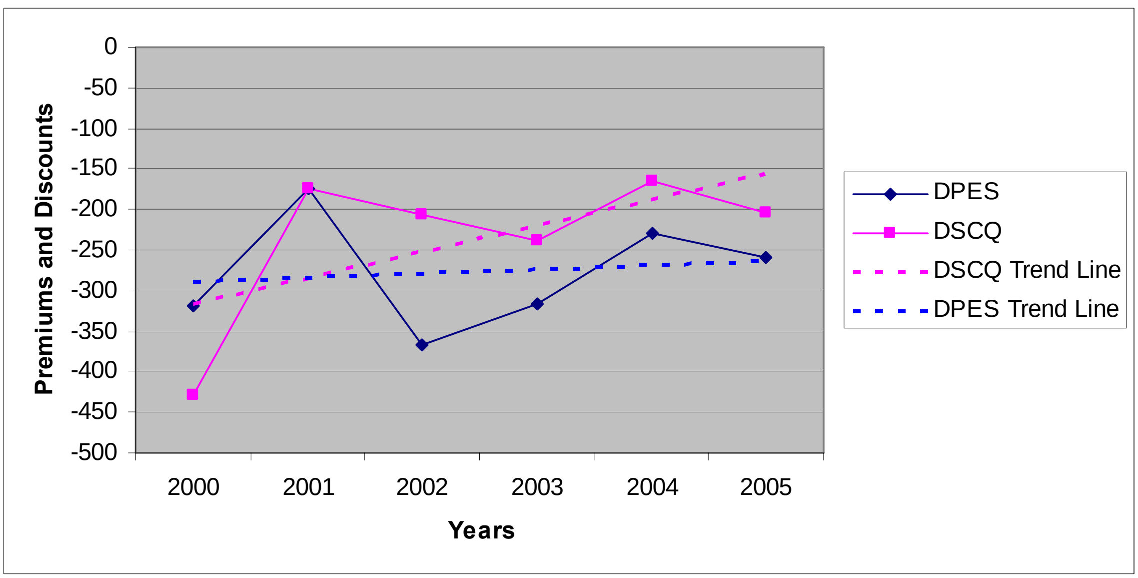

Figure C6. Average Annual East Texas/Oklahoma Discounts for Staple 32 from DPES and DSCQ, with Trends.

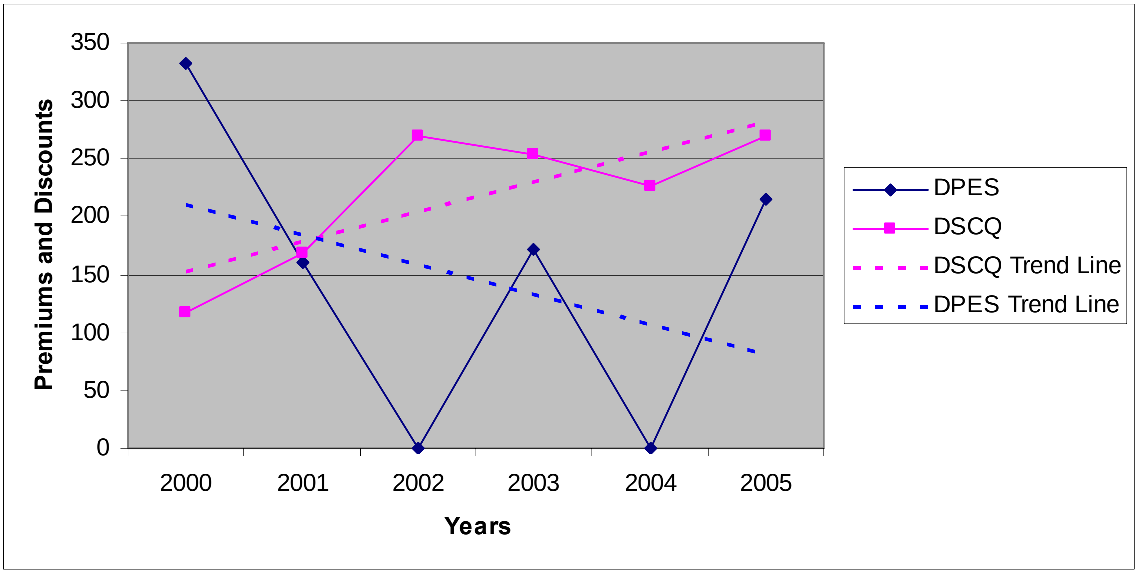

Figure C7. Average Annual East Texas/Oklahoma Premiums for Staple 36 from DPES and DSCQ, with Trends.

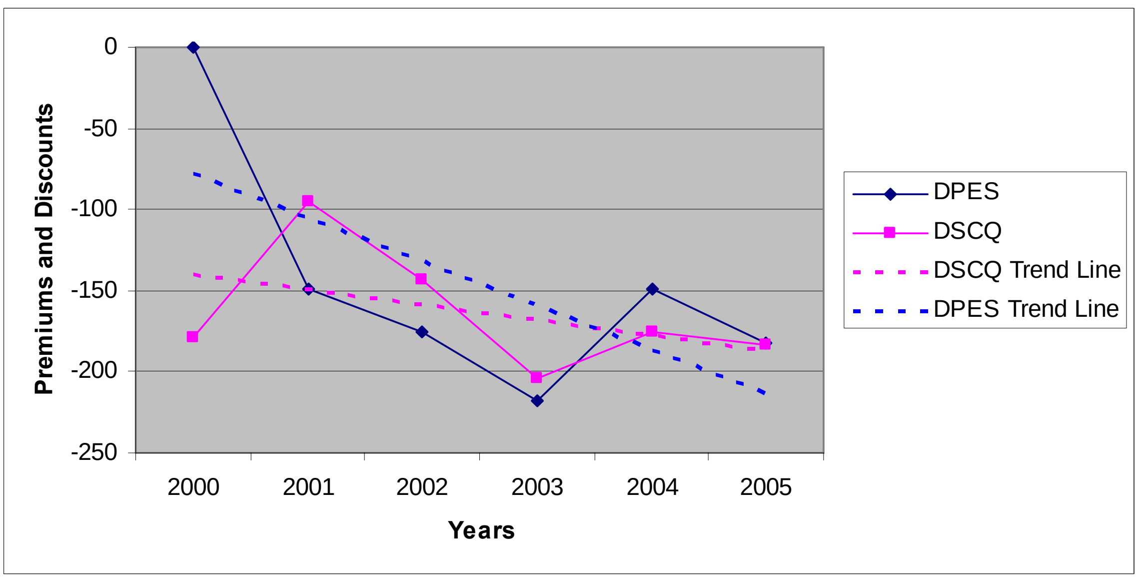

Figure C8. Average Annual East Texas/Oklahoma Discounts for Micronaire 3.3 from DPES and DSCQ, with Trends.

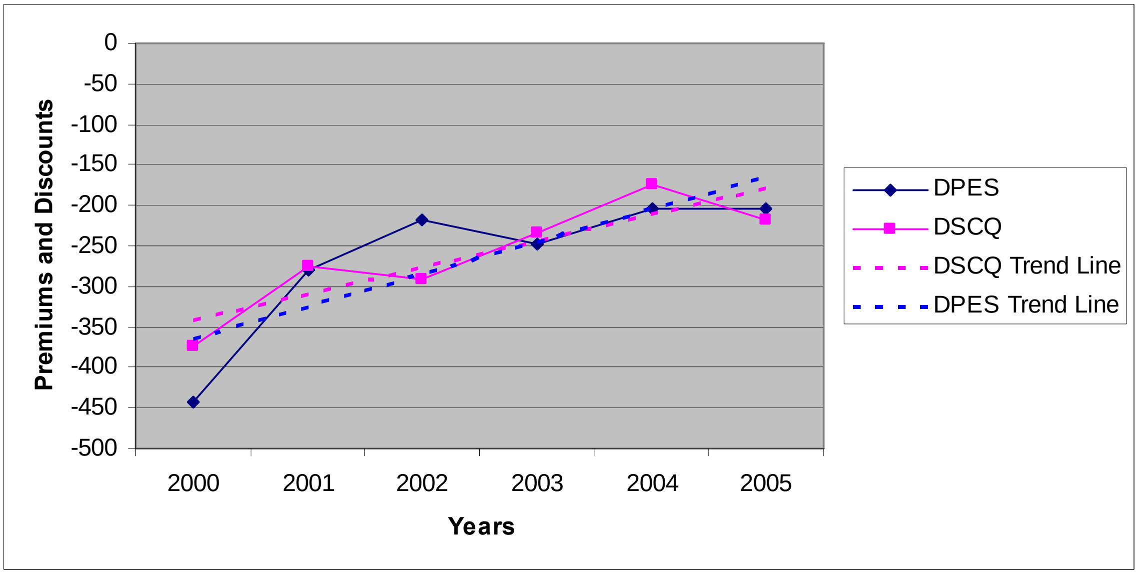

Figure C9. Average Annual East Texas/Oklahoma Discounts for Micronaire 5.0 from DPES and DSCQ, with Trends.

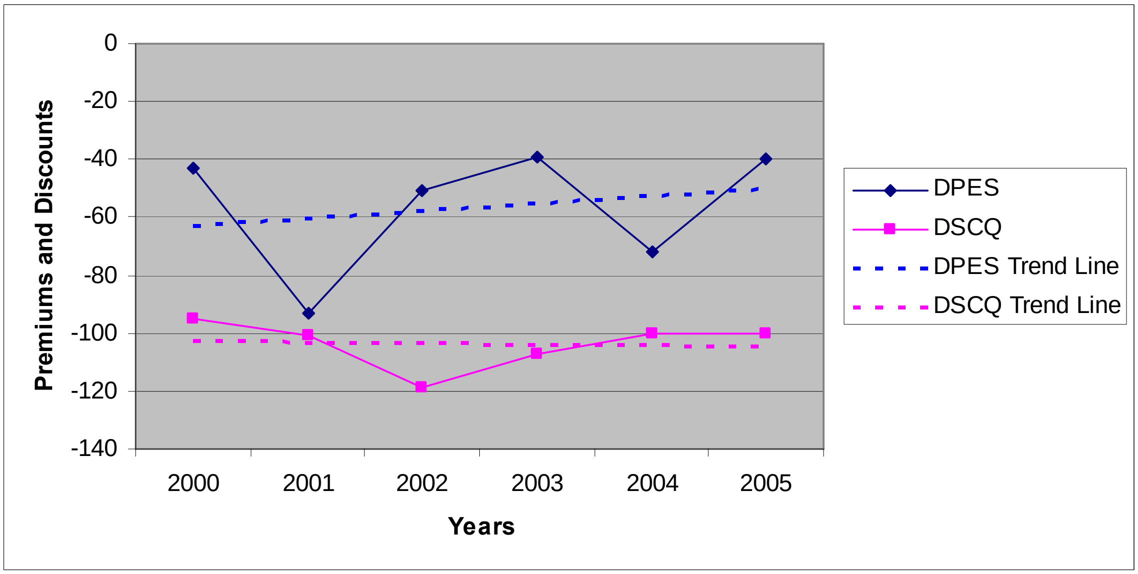

Figure C10. Average Annual East Texas/Oklahoma Discounts for Strength 25 from DPES and DSCQ, with Trends.

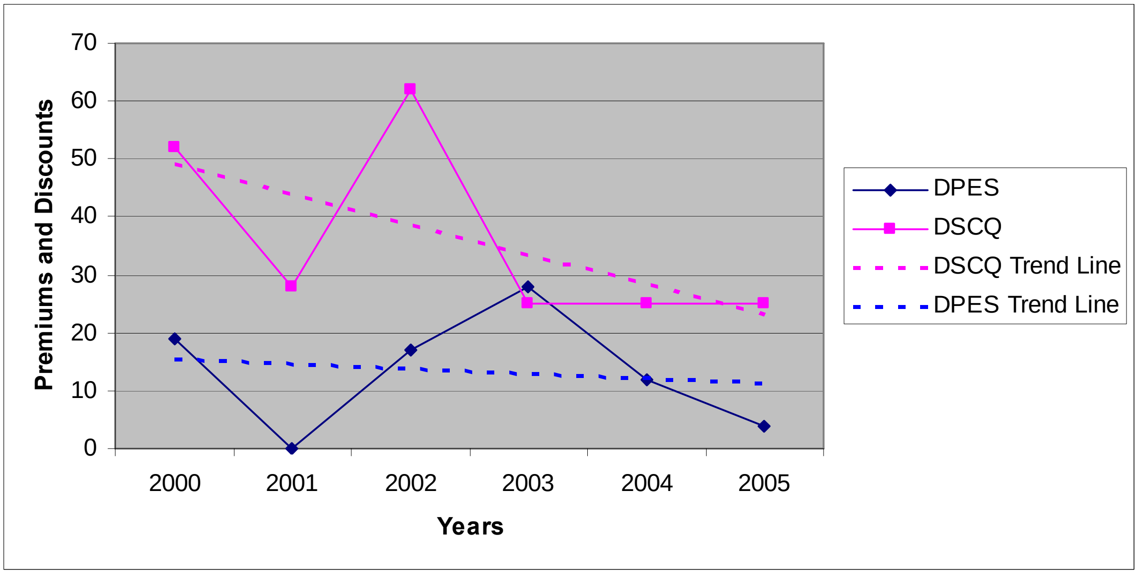

Figure C11. Average Annual East Texas/Oklahoma Premiums for Strength 30 from DPES and DSCQ, with Trends.

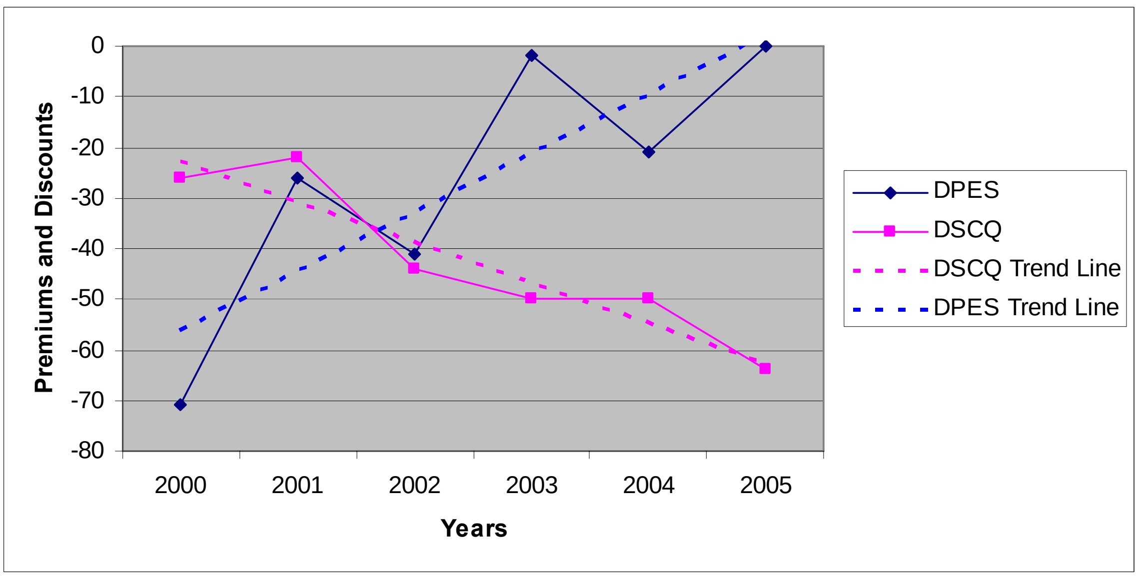

Figure C12. Average Annual East Texas/Oklahoma Discounts for Uniformity 78 from DPES and DSCQ, with Trends.

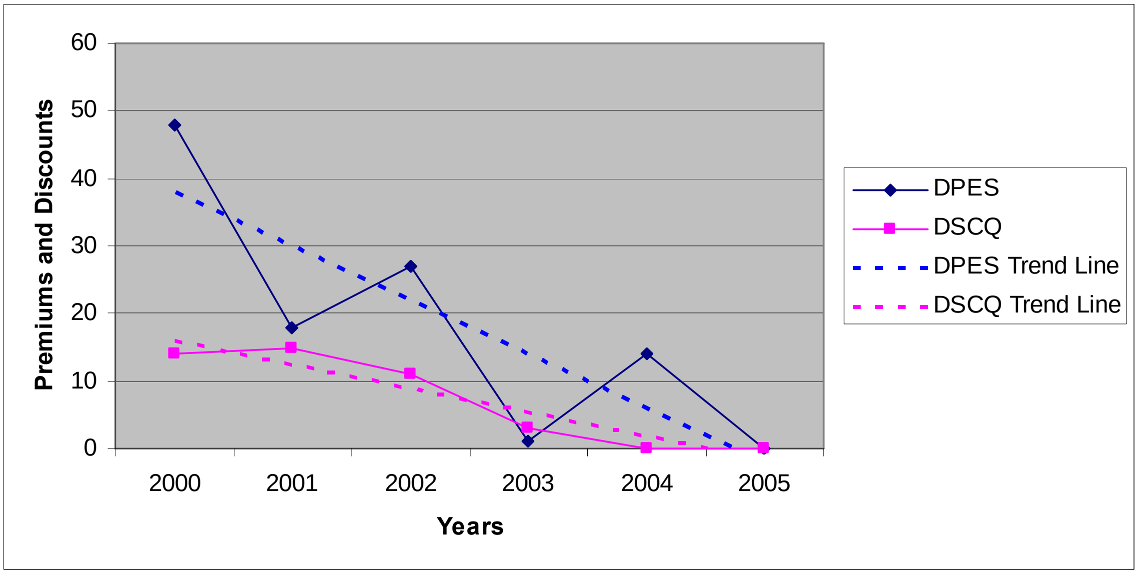

Figure C13. Average Annual East Texas/Oklahoma Premiums for Uniformity 83 from DPES and DSCQ, with Trends.

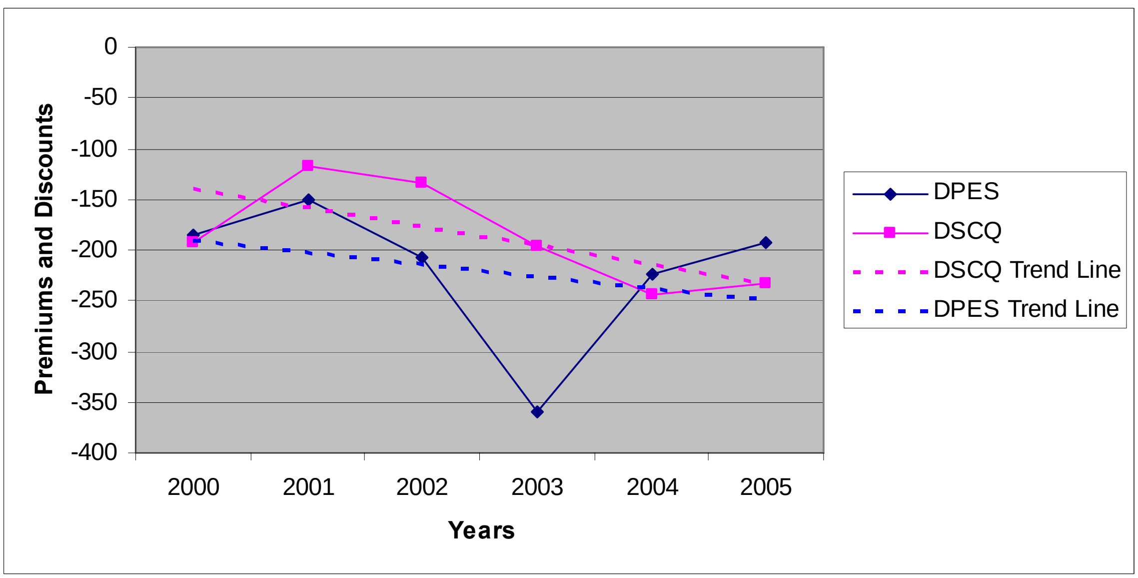

Figure C14. Average Annual East Texas/Oklahoma Discounts for Bark Level 1 from DPES and DSCQ, with Trends.

Appendix D.

West Texas Trend Lines 2000-2005

Color 21
P (DPES) = -33505.20 + 16.74(year)
T-stat = (-2.57) (2.57)
P (DSCQ) = -37,549.40 + 18.83(year)
T-stat = (-2.62) (2.63)

Color 61
P (DPES) = 40,349.95 – 20.37(year)
T-stat = (1.22) (-1.23)
P (DSCQ) = -43,690.80 + 21.69(year)
T-stat = (-1.20) (1.19)

Color 43
P (DPES) = -103,920 + 51.69(year)
T-stat = (-12.37) (12.32)
P (DSCQ) = -77,719.80 + 38.66(year)
T-stat = (-1.31) (1.31)

Leaf 2
P (DPES) = 18,291.81 – 9.09(year)
T-stat = (1.15) (-1.14)
P (DSCQ) = -20,591.90 + 10.34(year)
T-stat = (-1.68) (1.69)

Leaf 6
P (DPES) = 55,118.38 – 27.63(year)
T-stat = (1.70) (-1.70)
P (DSCQ) = 7,365.71 – 3.83(year)
T-stat = (0.20) (-0.21)

Staple 32
P (DPES) = -10,233.60 + 4.97(year)
T-stat = (-0.28) (0.27)
P (DSCQ) = -26,850.80 + 13.29(year)
T-stat = (-0.64) (0.63)

Staple 36
P (DPES) = 51,353.62 – 25.57(year)
T-stat = (0.80) (-0.80)
P (DSCQ) = -23,211.10 + 11.69(year)
T-stat = (-0.82) (0.82)

Micronaire 3.3
P (DPES) = 9,497.05 – 4.83(year)
T-stat = (0.71) (-0.73)
P (DSCQ) = 25,927.05 – 13.03(year)
T-stat = (1.29) (-1.30)

Micronaire 5.0
P (DPES) = -42,812.40 + 21.26(year)
T-stat = (-3.98) (3.96)
P (DSCQ) = -56,954.50 + 28.31(year)
T-stat = (-3.47) (3.45)

Strength 25
P (DPES) = -5,434.81 + 2.69(year)
T-stat = (-0.47) (0.47)
P (DSCQ) = 1,555.71 – 0.83(year)
T-stat = (0.27) (-.29)

Strength 30
P (DPES) = 1,615.33 – 0.80(year)
T-stat = (0.30) (-0.30)
P (DSCQ) = 11,595.62 – 5.77(year)
T-stat = (1.31) (-1.31)

Uniformity 78
P (DPES) = -23,599.30 + 11.77(year)
T-stat = (-2.98) (2.97)
P (DSCQ) = 16,378.33 – 8.20(year)
T-stat = (5.16) (-5.17)

Uniformity 83
P (DPES) = 15,923.57 – 7.94(year)
T-stat = (2.96) (-2.95)
P (DSCQ) = 7,216.33 – 3.60(year)
T-stat = (5.28) (-5.28)

Bark Level 1
P (DPES) = 22,894.24 – 11.54(year)
T-stat = (0.62) (-0.63)
P (DSCQ) = 38,614.62 – 19.37(year)
T-stat = (2.02) (-2.03)

East Texas/Oklahoma Trend Lines, 2000-2005

Color 21
P (DPES) = -33,505.20 + 16.74(year)
T-stat = (-2.57) (2.57)
P (DSCQ) = -84,133.90 + 42.11(year)
T-stat = (-4.23) (4.24)

Color 61
P (DPES) = 40,122.76 – 20.26(year)
T-stat = (1.21) (-1.22)
P (DSCQ) = -54,855.10 + 27.26(year)
T-stat = (-1.44) (1.43)

Color 43
P (DPES) = -103,690 + 51.57(year)
T-stat = (-12.42) (12.37)
P (DSCQ) = -82,826.70 + 41.20(year)
T-stat = (-1.39) (1.38)

Leaf 2
P (DPES) = 18,405.90 – 9.14(year)
T-stat = (1.15) (-1.15)
P (DSCQ) = -30,303.70 + 15.20(year)
T-stat = (-2.10) (2.11)

Leaf 6
P (DPES) = 55,233.14 – 27.69(year)
T-stat = (1.70) (-1.71)
P (DSCQ) = -3,359.71 – 1.83(year)
T-stat = (0.09) (-0.10)

Staple 32
P (DPES) = -10,347 + 5.03(year)
T-stat = (-0.30) (0.27)
P (DSCQ) = -64,144.90 + 31.91(year)
T-stat = (-1.55) (1.54)

Staple 36
P (DPES) = 51,467.71 – 25.63(year)
T-stat = (0.81) (-0.80)
P (DSCQ) = -52,076.50 + 26.11(year)
T-stat = (-2.55) (2.56)

Micronaire 3.3
P (DPES) = 54,379.71 – 27.23(year)
T-stat = (1.81) (-1.82)
P (DSCQ) = 18,488.52 – 9.13(year)
T-stat = (1.00) (-1.00)

Micronaire 5.0
P (DPES) = -80079.80 + 39.86(year)
T-stat = (-2.81) (2.80)
P (DSCQ) = -65,485.60 + 32.57(year)
T-stat = (-3.70) (3.69)

Strength 25
P (DPES) = -5,205.62 + 2.57(year)
T-stat = (-0.46) (0.45)
P (DSCQ) = 468.48 – 0.29(year)
T-stat = (0.10) (-0.13)

Strength 30
P (DPES) = 1,615.33 – 0.80(year)
T-stat = (0.30) (-0.29)
P (DSCQ) = 10,391.95 – 5.17(year)
T-stat = (1.45) (-1.45)

Uniformity 78
P (DPES) = -23,427.50 + 11.69(year)
T-stat = (-2.91) (2.90)
P (DSCQ) = 15,977.33 – 8.00(year)
T-stat = (5.46) (-5.48)

Uniformity 83
P (DPES) = 15,923.57 - 7.94(year)
T-stat = (2.96) (-2.95)
P (DSCQ) = 7,044.52 - 3.51(year)
T-stat = (5.70) (-5.69)

Bark Level 1
P (DPES) = 22,951.95 – 11.57(year)
T-stat = (0.62) (-0.63)
P (DSCQ) = 36,717.05 – 18.43(year)
T-stat = (1.82) (-1.83)