COTTON BASIS: REGIONAL AND SEASONAL DIFFERENCES

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Introduction

The United States is a major cotton producer, accounting for about 20 percent of total World production annually. US cotton is used both domestically by US mills and exported to foreign mills. Domestic mill use was the leading use for U.S. cotton until 2001. US mill consumption has steadily declined since the late 1990's accompanied by a steady increase in U.S. cotton exports as foreign textile production has increased. Major importers of U.S. cotton are China, Mexico, Korea, Turkey, and Indonesia. Most U.S. cotton exports are shipped through ports along the Pacific and Atlantic coasts. Although the Southeast and the MidSouth regions still enjoy proximity to domestic mills, the dramatic fall in domestic consumption makes cotton from all US cotton-producing states more dependent on the export market.

Research Objective

The objective of this research is to explore possible effects on the monthly cotton basis that may have resulted from the major market shift from domestic mills to the export market. The monthly cotton basis is calculated for seven regions for the most recent six crop years, August 2000 to July 2006. Regional and seasonal patterns from this period are compared with results for an earlier period, August 1988 – July 1998 (Seamon, Kahl, and Curtis, 2001). Statistical tests are conducted and findings reported for differences or changes in regional and seasonal monthly basis patterns between the 2 time periods.

Results and Discussion

Calculating Cotton Basis

The USDA Agricultural Marketing Service (USDA- AMS) reports daily and monthly cotton cash prices for seven regions:

Southeast-- Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia.
North Delta-- Arkansas, Tennessee, Missouri.
South Delta-- Louisiana, Mississippi.
East Texas-Oklahoma-- East Texas, Oklahoma.
West Texas-- West Texas except El Paso area.
Desert Southwest-- Arizona, New Mexico and far West Texas.
San Joaquin Valley-- San Joaquin Valley of California.

The monthly cotton basis for each region as reported by USDA-AMS is calculated averaging the daily average cash price minus the "nearby" daily closing futures price on the New York Board of Trade. Although the nearby future contract is usually used for calculating the basis, the July contract was used by Seamon et al. (2001) to more clearly identify seasonal/regional patterns from August 1988 to July 1998.

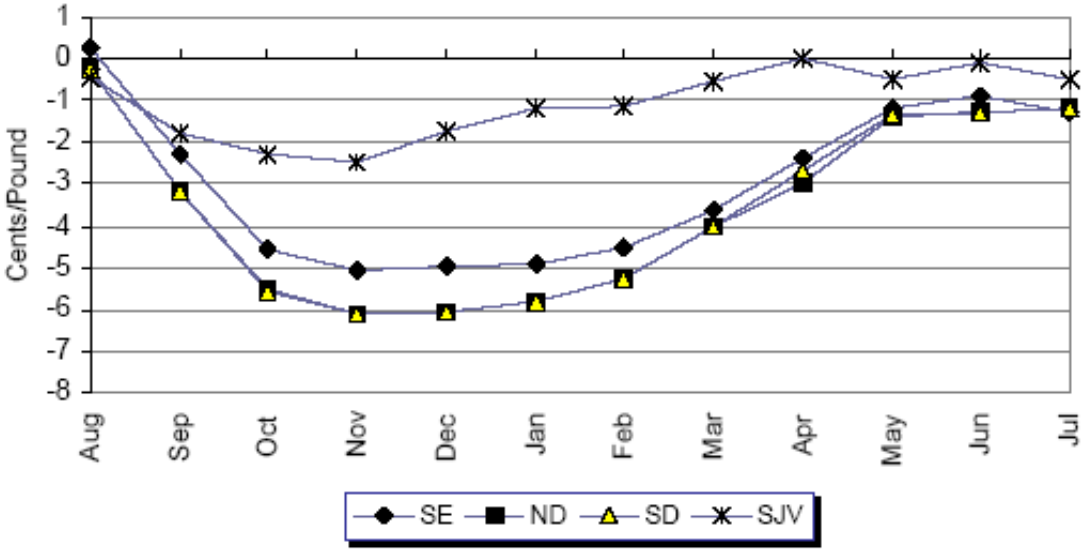
In order to examine possible changes in basis patterns, the same basis calculation was used for this study. For our updated analysis the basis is calculated for each region and month from August 2000 to July 2006 - the six most recent complete crop years.

Regional Cotton Basis in Two Time Periods

Basis is the difference between the local cash price and the futures price, usually defined as the local cash price minus the futures price. For a seasonally produced storable commodity with stable demand, the cash price and the futures price will converge as the futures contract nears maturity. Regional differences in the basis are expected to reflect differences in transportation costs. Seamon, Kahl and Curtis (2001) indicated that the Southeast, San Joaquin Valley, North Delta and South Delta regions had a stronger basis than other regions during their study period from August 1988 to July 1998, due to their proximity to domestic mills or western ports. Since they incur higher costs to transport cotton to eastern domestic mills or western ports, the East Texas-Oklahoma, West Texas and Desert Southwest had a weaker basis.

Seamon, Kahl and Curtis (2001) suggested the cotton basis calculated using the futures contact expiring in July theoretically should have a seasonal pattern which weakens from July until harvest and then strengthens afterward. However, this theoretical seasonal basis pattern relies on the assumption of stable monthly demand. The cotton basis in the Southeast, North Delta and South Delta were consistent with the theoretical seasonal pattern (Figure 1.1).

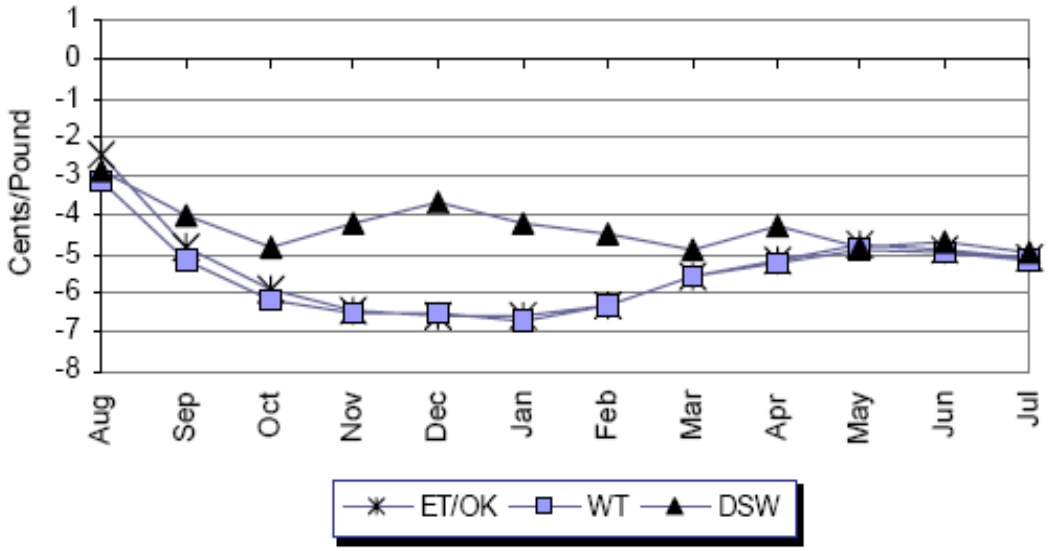
Figure1.1 Average Monthly Cotton Basis for SE, ND, SD, and SJV, August 1988—July 1998



Source: Seamon et al. (2001), Journal of Agribusiness.

Within the study period from August 1988 to July 1998, most cotton from these regions went directly to domestic mills which had relatively stable demand. Seasonal patterns for regions more dependent on export markets, such as San Joaquin Valley and Desert Southwest, were less apparent (Figure 1.2).

Figure1.2 Average Monthly Cotton Basis for ET/OK, WT and DSW, August 1988—July 1998



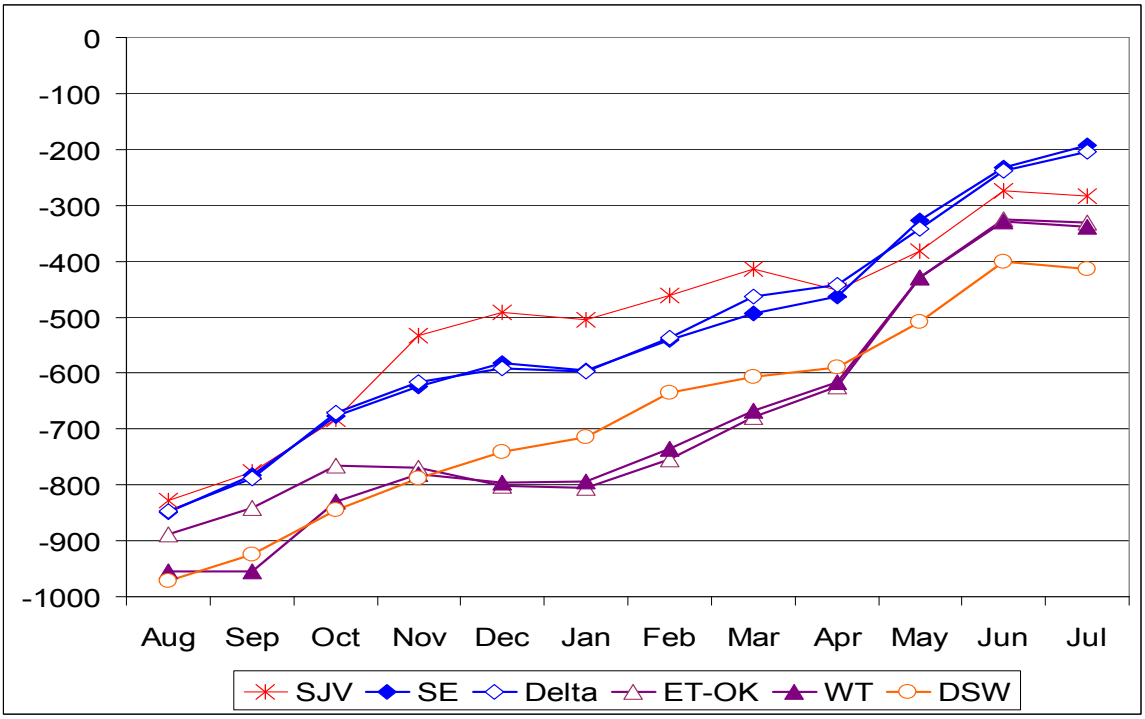
Source: Seamon et al. (2001), Journal of Agribusiness.

The average monthly cotton basis for each region from August 2000 to July 2006 is shown in Figure 2. The average monthly basis for North Delta and South Delta were almost identical, so these regions were averaged and combined into a single Delta region to simplify Figure 2. A comparison of Figures 1.1, 1.2, and 2 reveals apparent differences in regional and seasonal basis patterns for the two data periods. Changes in the regional basis patterns will be discussed first, followed by a discussion of changes in the seasonal basis patterns.

Changes in the Regional Basis

In the more recent period, the monthly cotton basis in the Southeast, the Delta, and the San Joaquin Valley were stronger than the basis in the other regions—East Texas-Oklahoma, West Texas and Desert Southwest. These regional differences are similar to what Seamon et al. (2001) found in their research for the period August 1988 to July 1998. Although domestic consumption fell dramatically since the late 1990's, the proximity to the domestic mills and eastern ports helped the Southeast and Delta regions keep a stronger basis. Furthermore, as the export market became more important and, more and more cotton exports are traded through the western ports, the monthly cotton basis of San Joaquin Valley continue to be strong. The monthly cotton basis for East Texas-Oklahoma, West Texas and Desert Southwest are still weakest of the seven regions since transportation costs to eastern/western ports for export or eastern domestic mills for domestic consumption continue to disadvantage these regions.

Figure 2. Average Monthly Cotton Basis for Six Regions, August 2000—July 2006



Source: AMS, USDA; NYBOT

Although visual examination of average monthly basis data suggests regional differences in the basis, these differences may not be statistically significant because the regional monthly patterns vary from year to year. Seamon, Kahl, and Curtis used Friedman tests to determine whether the apparent regional differences were statistically significant, and we employed the same tests for the more recent data.

Regional Differences

The Friedman test determines whether the observations differ by treatment after the effect of the blocks has been removed. Each region is treated as the treatment and each month of each crop year is the block. Since the cotton basis for seven regions and recent 6 crop years is used in this research, there are 7 treatments and 72 blocks included in this analysis. Each observation, B_{ij} with i=1,2,…,72 and j=1,2,…,7 represents the monthly basis of the month i and in region j. The seven observations within each block are ranked from smallest to largest with 1 assigned to the smallest and 7 assigned to the largest observation. When there are ties within each block, each observation receives the average rank they would have received. The rank sums for each treatment (region) are recorded in Table 1.

The cotton basis in at least one region is significantly different from any other region if there are significant differences in the rank sums for each region. The formula for the Friedman test statistic is as the following (Daniel, W.W., 1990):

$$X_r^2 = \frac{12}{bk(k+1)} \sum_{j=1}^{k} R_j^2 - 3b(k+1)$$

where b is the number of blocks, k is the number of the treatments and R_j is the rank sum of the region j. When ties occur, the test statistic need to be adjusted by dividing it by (Daniel, W.W., 1990):

$$1-\sum_{i=1}^{b}\frac{\sum t_i^3-\sum t_i}{bk(k^2-1)}$$

where t_i is the number of observations tied for a given rank in the ith block. The calculated Friedman statistic is 187.5266. Compared with tabulated χ^2 value with k-1 degrees of freedom, the null hypothesis is rejected at 99% confidence level which implies that cotton basis in at least one region is different from any other regions.

After the significant difference is observed by using the Friedman test, multiple-comparison analysis is applicable to determine the regions in which the cotton basis differs. The q value is defined as (Zar, J. H., 1984):

$$q=\frac{R_j-R_{j+1}}{\sqrt{\frac{bk(k+1)}{12}}}$$

where the $R_j - R_{j+1}$ is the difference of the rank sum of any two regions. The third column of the Table 1 shows the results of the multiple-comparison. The regions found to have significantly different basis at 95% confidence level are identified by different alphabetical letters. For the study period from August 2000 to July 2006, there is no significant difference in the basis found for the following regions: a) North Delta, South Delta, Southeast and San Joaquin Valley; b) East Texas-Oklahoma, West Texas and Desert Southwest.

The result of the multiple-comparison coincides with Figure 2 which shows that the basis of Southeast, San Joaquin Valley, North Delta and South Delta are similar and stronger than the remaining regions through the crop year. Starting from the same level from the beginning of the crop year, the basis of Southeast and San Joaquin Valley are slightly stronger than the basis of the Delta regions for several months. Then the basis of the Delta regions becomes stronger later in the crop year. So the basis is not significantly different across these four regions. The basis for East Texas-Oklahoma, West Texas and Desert Southwest is generally weaker than that in the other four regions. While the basis of the East Texas-Oklahoma is stronger than the other two regions early in the crop year, the basis of Desert Southwest becomes stronger in the following several months and then becomes weaker later in the crop year. Overall, there is no significant difference among the basis for these three regions.

Table 1. Statistical Results of the Friedman Test for the Regional Differences in Monthly Cotton Basis for Seven Regions, August 2000—July 2006.

Region	Rank Sum	Q Grouping
North Delta	372	A
South Delta	370	A
Southeast	368	A
San Joaquin Valley	367	A
East Texas-Oklahoma	197	B
West Texas	174	B
Desert Southwest	170	B

This result is different from the results of Seamon, Kahl and Curtis (2001). They concluded there was no significant difference in the basis for the following regions: a) Southeast and San Joaquin Valley; b) North Delta, South Delta, and Desert Southwest; c) East Texas-Oklahoma and West Texas. The basis of Delta regions is no longer significantly different from the basis in the Southeast and San Joaquin Valley. The Southeast and San Joaquin Valley basis appear to have weakened from the earlier to the latter study periods, while the Delta regions basis has not weakened as much. Seamon, Kahl and Curtis (2001) attributed the strong San Joaquin basis during the November through March period to increased export demand during those months. The relative weakening of the San Joaquin Valley basis may be due to the end of this seasonal pattern in export demand and to the increased participation of all regions in the export market.

Changes in Seasonal Basis Patterns

The seasonal pattern of this most recent period (2000-2006) appears to be different from the seasonal pattern for the previous 1988-1998 study period. The theoretical seasonal pattern, which was to weaken from July to harvest time and then strengthen as the crop year progresses, generally applied for those regions which mostly supplied domestic mills. This seasonal pattern doesn't appear to hold for any of the seven regions any longer. As Figure 2 shows, the basis is weakest right after the July contract expires, and it then strengthens as the crop year progress to approach the strongest at the end of the crop year. The basis in August was almost always the strongest within the crop year in the earlier period. In the more recent period, however, the basis in August is the weakest within the crop year. This change may be partly due to the carry-over of larger U.S. cotton stocks than before, which can relieve the shortage of the cotton supply right before harvest, decreasing the cash price and basis in August.

To determine if the monthly cotton basis has a significant seasonal pattern, the Friedman test is used again. Table 2 presents the seasonal Friedman statistic for each region. After comparing the Friedman statistic for each region with the tabulated χ^2 values with k-1 degrees of freedom, the null hypothesis is rejected at 99% confidence level, implying that the monthly cotton basis is found to be different in at least one month for all these seven regions. The results of seasonal Friedman test coincide with Figure 2. Figure 2 shows that the monthly cotton basis of all seven regions follow a stable increasing pattern throughout the crop year, which indicates that the monthly basis is likely to be different early in the crop year from late in the crop year.

Table 2. Statistical Results of the Friedman Test for the Seasonal Differences in Monthly Cotton Basis for Seven Regions, August 2000—July 2006.

Region	Seasonal Friedman Statistic
North Delta	52.3846
South Delta	52.7102
Southeast	56.5627
San Joaquin Valley	37.6410
East Texas-Oklahoma	36.3609
West Texas	38.7631
Desert Southwest	43.9744

Since significant differences within the crop year for all seven regions are observed by using the Friedman test, multiple-comparison analysis is applied for each region to determine the months in which the cotton basis differs. The months found to have significantly different basis at 95% confidence level are identified by different letters. Table 3 reports the rank sums and the results of monthly differences in the basis for Southeast and San Joaquin Valley.

Table 3. Statistical Results of the Friedman Test for the Seasonal Differences in Monthly Cotton Basis for Seven Regions, August 2000—July 2006.

SOUTHEAST				SAN JOAQUIN VALLEY			
Month	Rank Sum	Q Grouping		Month	Rank Sum	Q Grouping	
June	68	A		June	63	A	
July	66	A		July	52	A	
May	60	A		May	50	A	
April	48	A	B	February	50	A	
March	45	A	B	March	49	A	B
February	41	A	B	December	43	A	B
December	34	A	B	November	42	A	B
November	30	A	B	January	37	A	B
January	29	A	B	April	36	A	B
October	26		B	October	24	A	B
September	14		B	September	14		B
August	8		B	August	8		B

The results for San Joaquin Valley indicate that the monthly basis in June, July, May and February is stronger than the monthly basis in September and August at the 95% confidence level. The results for the Southeast indicate that the monthly basis in June, July and May is stronger than the monthly basis in October, September and August at the 95% confidence level. The multiple-comparison analysis for the other five regions indicates a similar pattern as the two mentioned above. The monthly cotton basis for all seven regions follows the same pattern-- weaker at the beginning of the crop year and stronger as the crop year progresses.

Conclusions

As the major consumption market shifted from domestic mills to the export market, the cotton cash price and basis are more affected by demand and supply in the world market. Regional and seasonal differences in the monthly cotton basis are different from that earlier reported by Seamon et al. (2001) for an earlier period, August 1988 – July 1998.

Because of their proximity to the western or eastern ports, the Southeast, Delta, and San Joaquin Valley regions had a stronger basis than the East Texas-Oklahoma, West Texas and Desert Southwest regions for the period of August 2000 – July 2006. The basis in the Delta regions was weaker than the basis in the Southeast and San Joaquin Valley for the previous study period, but there is no significant difference found for these four regions for the current study period.

The monthly cotton basis for all regions is now mostly affected by export market demand. The seasonal basis pattern coincides with the monthly average cotton export pattern during the more recent study period and a similar seasonal cotton basis pattern exists for all regions.

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