FACTORS EFFECTING REGIONAL COTTON ACREAGE SHIFTS

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Introduction

During the period 1960 to 1996, U. S. cotton planted acreage shifted from the East to the West and then shifted back toward the East. Generally cotton production is divided into four regions: Southeast (Alabama, Georgia, Florida, North Carolina, South Carolina and Virginia), Mid South (Arkansas, Louisiana, Mississippi and Tennessee), Southwest (Oklahoma and Texas), and the West (Arizona, California, New Mexico and Nevada). Based on average annual data, Figure 1 shows that in the 1960s, 16.2% of cotton planted acres were in the Southeast with 9.5% in the West. Figure 2 reveals that the 1970s saw 9.4% in the Southeast and 13.3% in the West. In the 1980s, (Figure 3), there was 7.1% in the Southeast and 16.4% in the West. By the 1990s, however, 16.5% of the planted acres were back in the Southeast with 11.3% remaining in the West (Figure 4). During this period (1960-1996), the other two regions remained relatively constant in percentage terms with the Delta ranging from 26.3% in the 1960s to 25.3% in the 1990s. The Southwest ranged from 48% in the 1960s to 46.9% in the 1990s (the Southwest peaked in terms of percent planted acres with 56.4% in the 1980s) (USDA). The cause(s)/effect(s) of this shift are of importance to producers, ginners, policy makers and textile manufacturers as they move through the period of planting flexibility since the inception of the Federal Agricultural Improvement and Reform (FAIR) Act of 1996.

History

Beltwide Cotton Proceedings and USDA publications were reviewed to explore potential reasons for these changes in acreage allocation. These publications were reviewed in order to qualitatively describe the factors that were contributing to these shifts. Two early factors limiting production in the West were acreage allotments (Mathews et. al.) and irrigation (Diener). The 1970s saw the abolishment of these allotments, giving the West capacity to increase acreage. The 1970s also saw low cotton prices, which enhanced export opportunities, especially through western ports (Brue). These low cotton prices also favored western production in terms of alternative crops (i.e., other regions, especially the Southeast, had better alternatives than cotton) (Larson and Meyers). The West was also considered to produce cotton of higher quality, which was an advantage in times of low prices (Raney). The cost of insect damage and control in the eastern portions of the cotton belt likely contributed to the relative shift in acreage from east to west (Shurley). Primary insect damage was from the boll weevil. This combination of factors meant higher production costs and a more management intensive production process for cotton producers in the Southeast and Mid South. Therefore, many farmers in these regions switched to alternative crops. The availability of alternative row crops for Southeast producers likely meant more acreage shifted out of cotton production as compared to the West. These switches were, for the most part, for profit reasons as one might expect. However, many part-time farmers simply did not have the time to properly manage/produce cotton (Hacklander).

These same characteristics carried over into the early 1980s. Again, export considerations and the importance of quality, consistency and cleanliness of western cotton favored western ports. However, by the late 1980s and early 1990s, the Boll Weevil Eradication (BWE) program started in Virginia in 1978 had began to spread westward. North Carolina, South Carolina and Georgia had implemented programs to eradicate boll weevils in the 1980s. This program initially raised production costs, thereby giving these areas a disadvantage relative to other (more western) states. However, after the initial implementation period, the BWE program lowered production costs and increased yields (Larson and Meyers). Also, the introduction of Bt cotton increased interest in cotton in the eastern portion of the cotton belt. The above mentioned discussion identifies several important variables. However, these variables are qualitative in nature and difficult to use in quantitative models. The purpose of this paper is to attempt to quantify these factors. Nevertheless, it should be noted that this research is exploratory and the results presented here are preliminary.

Related Literature

Several authors have discussed acreage changes/responses. Evans and Bell addressed the problem in 1978. The authors' purpose was to determine how price and/or government support programs affected cotton acreage. The authors state that economic theory would suggest a cotton supply function of the form Q = g (P/PI, HA) in which cotton output (Q) is a function of cotton price (P), prices of variable inputs (PI) and a fixed land input (HA) (harvested acres). In a regional acreage response model, Evans and Bell add the opportunity costs of growing cotton (i.e., the returns that are available from alternative crops), and variables for government programs. The implication of this research was that cotton's response to price will depend on how responsive planted acreage is to yield. That is, price increases stimulate additional acreage on land that generates economically effective yields. In contrast, land that is"marginal" in cotton production is less responsive to price changes.

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Duffy, Richardson and Wohlgenant also looked at acreage response. In their study, the authors grouped together similar years under specific government programs to develop a cotton price based on the market and the effects of the government program. A price for alternative crops was established in a similar manner. One implication from their study was that the Southeastern region was very susceptible to cross price effects (i.e. alternative crops). That is, even with government programs, the price of cotton relative to alternative crops was important. The Southwest and Mid South did not show the same results. There is a large difference between cotton break even price and that of alternative crops in the Southwest. The Mid South showed negative effects to own price, which was puzzling. However, Duffy, Richardson and Wohlgenant suspected a reluctance to switch from cotton to alternative crops, suggesting some rigidity in cotton acreage in the Mid South. For the Southwest, this appears to be an economic decision, but may not be the case for the Mid South. The West showed similar results in that cotton price effects were not statistically significant.

Methods and Results

Duffy, Richardson and Wohlegenant's study was based on data through 1983. Since that time, there have been three additional farm bills as well as the implementation of the BWE program and the development and adoption of biotechnology. Also, the period from 1983-1996 saw an eastwardly shift of cotton production. Therefore, a preliminary attempt was made to analyze this period (1983-1996). This attempt to estimate the factors effecting this shift was done using Seemingly Unrelated Regression (SUR). The SUR model was chosen because of hypothesized contemporaneous correlation of the error terms. The purpose was to evaluate the previously mentioned qualitative factors as quantitative estimates. It was hypothesized that the effects of BWE and technology would be captured in cost of production estimates. The basic model for each of the four regions was:

$$PROi = f (LPRi, RCPi, FB80, FB85, FB90),$$

where PROi was each region's planted acres as a percentage of the U. S. total, LPRi is the log of the ratio of cotton price for each region divided by the region's alternative crop price, RCPi is the real of cost of production for each region, and FB80, FB85, FB90, and FB95 were dummy variables to capture the structural effects of the respective farm programs. The alternative crops were corn, soybeans, sorghum and barley for the Southeast, Mid South, Southwest and West, respectively. The system consisted of four"share" equations, one for each region. One equation must be dropped from the system to prevent singularity of the error matrix. Limited success with ordinary least squares estimates for acreage response in the Western region led to a conclusion to drop the Western region from this preliminary model.

National Agricultural Statistics Service (NASS) data were used for this analysis. Annual data for the time period 1979-1996 was obtained. Cost of production data was obtained through the NASS home page. Data for price and acreage were taken from the USDA's Cotton and Wool Report. Cost of production was adjusted by the CPI to obtain real cost of production data.

The results of this analysis showed some findings similar to Duffy, Richardson and Wohlegenant (Table 1). The Southeast price ratio was statistically significant and had the correct sign. The Southwest's price ratio was not of the correct sign, although it was statistically significant . The Delta region's effects were somewhat similar to Duffy, Richardson and Wohlgenant, suggesting that own price was not a factor. These results seem puzzling econometrically, but the historical acreage shifts show that the Mid South has not changed dramatically in terms of percent planted acres. These results are consistent with the Southwest, which has not changed in terms of percentage of total acres. The West (results not presented) did not perform well, which is consistent with previous studies.

In the Mid South, the dummy variables for the farm programs were significant, indicating the relative importance of these Bills in determining whether cotton was planted (i.e, government price). This also suggests that this region would be very responsive to shifting to alternative crops without government programs. This appears to be happening in the Delta as well as the Southeast. For the Southwest and West, the farm bill dummy variables were not significant, which is somewhat consistent with previous work for the Southwest suggesting the lack of adequate alternative crops (Evans and Bell). The model did not perform well for the West, but this could also be an indication of where cotton stands versus alternative crops.

Implications

The results of this preliminary analysis have some interesting implications. First, it appears that cotton production in the Southwest is relatively unaffected by cotton price or farm programs. This suggests that the proportion of cotton grown in the Southwest is relatively fixed. This result is likely due to the lack of availability of economically viable alternative crops.

In contrast, the Mid South and Southeast showed a greater responsiveness to both own price and government programs. Both regions have several crops that are economically viable depending on relative prices, suggesting more opportunities to switch between crops. The 1996 FAIR Act has afforded producers more planting flexibility. The results of this analysis suggests that acreage shifts will occur more frequently in the Southeast and Mid South than in the Southwest or West. This appears to be occurring now in the Mid South. Nevertheless, continued research in this area needs to be conducted.

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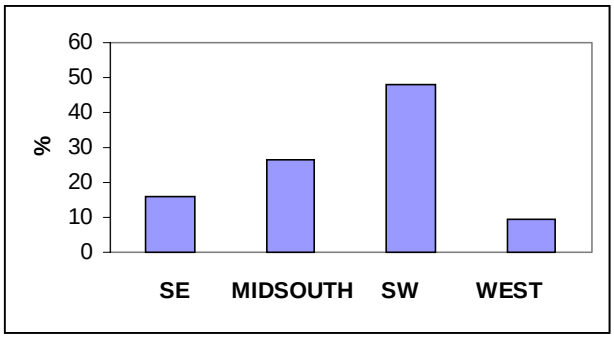

Figure 1. Regional percentage of U.S. total planted acres - 1960s

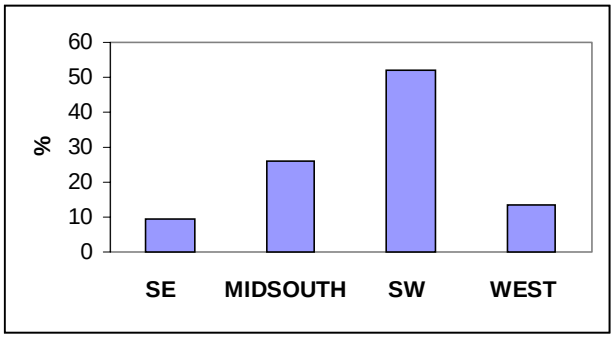

Figure 2. Regional percentage of U. S. total planted acres - 1970s

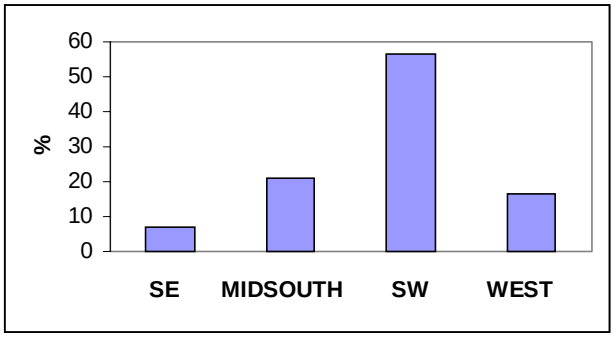

Figure 3. Regional percentage of U. S. total planted acres - 1980s

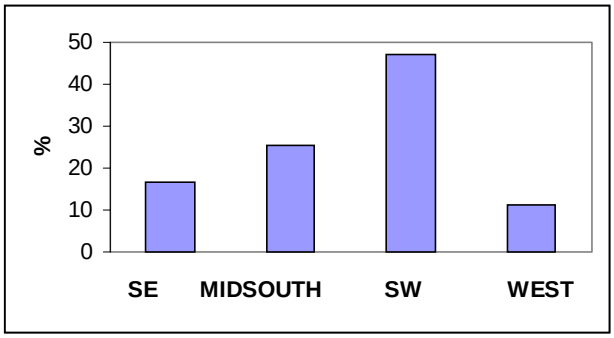

Figure 4. Regional percentage of U. S. total planted acres - 1990s

Table 1. Estimates of Factors Affecting Acreage Shifts

	Dependent Variable		
Independent Variable	Pro SE	Pro DL	Pro SW
intercept	.278403	.490613	.110180
	(2.159)	(6.524)	(.705)
ln (price ratio)[a]	.102036	-.001592	-.083014
	(4.449)	(-.067)	(-2.222)
ratio cp[b]	-.000822	-.000871	.001553
	(-3.678)	(-5.469)	(2.037)
fb 80	-.020550	.013154	-.004849
	(-.788)	(1.9926)	(-.155)
fb 85	-.072554	.022591	-.002904
	(-2.346)	(2.089)	(-.096)
fb 90	-.034057	.042414	-.033550
	(-1.049)	(3.737)	(-.970)

* Numbers in parenthesis are t-values.

[a] log of the ratio of each region's cotton price to each region's alternative crop price.

[b] real cost of cotton production in each region.