**Interaction Effects of Promotion, Research, and Price Support
Programs for U.S. Cotton**

by

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Abstract

Many agricultural commodities have industry-funded generic promotion and/or research ("checkoff") programs designed to improve the economic performance of producers. To determine the effectiveness of these programs, the net benefits to producers attributable to activities funded by the checkoff must be separated from those due to other factors influencing commodity markets. One such factor that is very important in many agricultural commodity markets is the effect of government programs. However, studies evaluating the returns to checkoff programs often do not explicitly discuss the impact of pre-existing distortions caused by federal farm programs. Because the distortions caused by farm programs can be quite large, this omission can lead to seriously biased estimates of the returns to the checkoff programs. In this study, we develop a model that captures the influence of two Federal programs (loan deficiency payments to farmers and subsidies to consuming mills) on the estimated returns to the Cotton Research and Promotion Program. Using an econometrically estimated model of the U.S. cotton market, we find that the program interaction effects have a large impact on checkoff program returns.

1.   Introduction and Background

Agricultural commodity markets are a labyrinth of complex subsidies and other distortions on both the demand and supply sides of the market. Government programs that impact the production of agricultural products have been in existence in various forms since the 1930s, when they were introduced in response to sharp declines in farm product prices. The U.S. Department of Agriculture's (USDA's) Commodity Credit Corporation (CCC) is required to provide assistance to specified agricultural commodities with three primary objectives: support prices, supplement incomes, and manage supplies. Congress has devised a number of techniques for the CCC to employ in achieving these objectives, including nonrecourse loans, commodity purchases, deficiency payments (based on target prices), loan deficiency payments, acreage reduction programs, and marketing quotas, among others. There are also numerous non-CCC farm production and marketing programs that influence agricultural commodity markets such as farm lending, soil and water conservation, and export assistance programs, as well as federally subsidized crop insurance. In addition, there are programs that subsidize consumption of some agricultural commodities. For instance, under the Step 2 marketing provision for upland cotton, subsidy payments are made to exporters and domestic mill users of U.S. cotton when the U.S. price is sufficiently above the world price.

In addition to the government programs described above, many agricultural commodities have industry-funded generic promotion and research ("checkoff") programs that are designed to increase domestic and/or international demand for the commodity. Some of the largest national checkoff programs are for beef, pork, dairy products, cotton, and eggs. The impetus behind these programs from the producers' standpoint is that they may be able to improve the economic performance of commodity producers. In markets characterized by homogeneous commodities produced by numerous suppliers, there is little incentive for any individual producer to unilaterally fund commodity promotion or research. Recognizing this, producers of numerous agricultural commodities have chosen to impose an assessment on themselves to fund programs aimed at increasing the demand for the generic commodity and

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increasing the profitability of all producers in the market.[2] In addition to the national programs, there are

state-level promotion and research programs for many commodities.

Although producers presumably vote to institute checkoff programs because they anticipate

receiving positive net benefits, it is possible that those benefits will not materialize. Thus, checkoff

program funders retain the right the vote the programs out of existence. For instance, programs for

pecans, limes, and fresh cut flowers and fresh cut greens were voted out of existence in 1993, 1995, and

1997, respectively (USDA AMS, 2001). In addition, the majority of pork producers that participated in

an advisory referendum in 2000 voted to end the $50 million pork checkoff program, although that

program continues to operate under a court settlement, subject to several changes, including a

commitment to a future binding referendum. For producers to make well-informed decisions concerning

their support for the checkoff programs in which they participate, it is important to have accurate

estimates of the net returns.

However, many studies of the effectiveness of checkoff programs do not adequately incorporate

the impacts of existing government policies. In particular, the dampening effect of binding price supports

on the gains to producers from generic promotion and research are not

always accounted for (e.g., Capps et al., 1997; Lenz, Kaiser, and Chung, 1998; Pritchett, Liu, and Kaiser,

1998). However, the pre-existing distortions from government interventions can be quite large.

Therefore, ignoring these distortions may lead to substantially inaccurate estimates of the changes in

welfare associated with generic promotion and research.

In this study, we examine these interaction effects for U.S. cotton, a commodity with a substantial

checkoff program used to expand demand in a market that has recently been subject to large subsidies for

producers as well as consuming textile mills. We develop a model of the U.S. cotton market that captures

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[2]The Secretary of Agriculture is authorized under the Commodity Promotion, Research, and Information Act of 1996 to
  issue an order regarding promotion, research, and information activities for an agricultural commodity based on
  proposals submitted by industry representatives. To determine whether the persons to be covered by the order are in
  favor, the order may provide for an initial referendum of persons subject to the assessment. If there is not an initial
  referendum, then a referendum must be held within three years of the starting date of assessments. The order will be
  suspended or terminated if it is not favored by persons voting in a referendum (Wright, 1996). All of the Federal

the influence of Federal programs that may simultaneously affect both the demand for cotton and the supply of cotton on the estimated returns to generic cotton promotion and research. The objective of this paper is to reveal the nature of these interaction effects and to empirically determine their magnitude.

1.1 Cotton Research and Promotion Program

Until the development of petroleum-derived synthetic fibers in the 1950s, cotton was unrivaled as the dominant fiber in clothing and home textiles in the U.S. The introduction and rapid quality and cost improvement of polyester and nylon fibers led to a sustained decline in the demand for cotton for all uses beginning in about 1960. By 1966, cotton's decline had progressed to the point that Congress felt a need to intervene, eventually passing the Cotton Research and Promotion Act of 1966. In passing the law, Congress reasoned that the inroads in the textile fiber market made by synthetic fibers were largely a result of research and promotion conducted by its makers (primarily large chemical firms). Because individual cotton producers did not have the resources to perform these activities or the legal means to join together to fund such work, Congress provided a coordinating mechanism to enable producers to collectively engage in research and promotion.

On December 31, 1966, USDA put into effect the Cotton Research and Promotion Order after a successful referendum of growers. The Order required participating producers to pay a base assessment of $1 per bale of upland cotton. In a 1976 referendum, U.S. producers voted to authorize collection of a supplemental assessment, not to exceed 1 percent, based on the value of the cotton. The supplemental assessment was set at 0.4 percent in 1977, increased to 0.6 percent in 1985, and lowered to the current level of 0.5 percent in 1991. Although the two-thirds vote required by the referendum assured broad support, any producer who did not wish to participate in the checkoff program could apply for a refund of all assessed amounts.

The Cotton Research and Promotion Act was modified significantly in 1990, in an effort to boost its impact on the overall textile market. Most notably, importers of textiles containing upland cotton were

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checkoff programs are overseen by USDA's Agricultural Marketing Service to ensure the programs operate within Congressionally mandated rules of compliance.

to be subject to the same assessments as domestic producers. Collection of assessments on imported

cotton and the cotton content of imported textile and apparel products began in August 1992. In addition,

elimination of the refund provision made participation mandatory for all U.S. growers of upland cotton.

These changes led to substantial increases in the value of assessments collected. In 2000, producers and

importers paid a total of just under $67 million in assessments.

Beginning several years after implementation of the Cotton Research and Promotion Program

(CRPP), funded by these assessments, cotton's market share at U.S. mills leveled off after more than a

decade of steep decline (see Figure 1). Market share then rose sharply throughout the 1980s until the

early 1990s. While market share at U.S. mills has since declined by a few percentage points, U.S.

consumption of cotton has continued to increase rapidly. U.S. cotton consumption increased from 23.6 to

34.6 pounds per capita and from 35.3 percent to 39.5 percent of all fibers consumed between 1990 and

2000.[3] This provides some compelling anecdotal evidence that the CRPP has been effective. However,

many other factors must be considered in evaluating the CRPP, one of which is the influence of

government programs on the market for cotton.

1.2 Federal Farm Programs for Cotton

Beginning with the Agricultural Adjustment Acts of 1933 and 1938, the government has

attempted to support cotton growers' incomes by restricting output and supporting domestic prices. The

Federal Agricultural Improvement and Reform (FAIR) Act of 1996, also called the "Freedom to Farm

Act," kept several of the long-standing loan and payments provisions but swept away a complicated set of

price targets and acreage quotas that had been in place for decades. The FAIR Act covers the period from

1996 to 2002 and includes the following elements: marketing assistance (MA) loans, loan deficiency

payments (LDPs), and agricultural marketing transition assistance (AMTA) payments.[4] The FAIR Act

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[3]The quantity of imported textile products nearly tripled during the 1990s, allowing cotton to increase its share of U.S.
   fiber consumption despite a lower share at U.S. mills by increasing the share of cotton in imports.
[4]These payments are also known as production flexibility contracts (PFCs).

Figure 1. Cotton Market Share at U.S. Mills
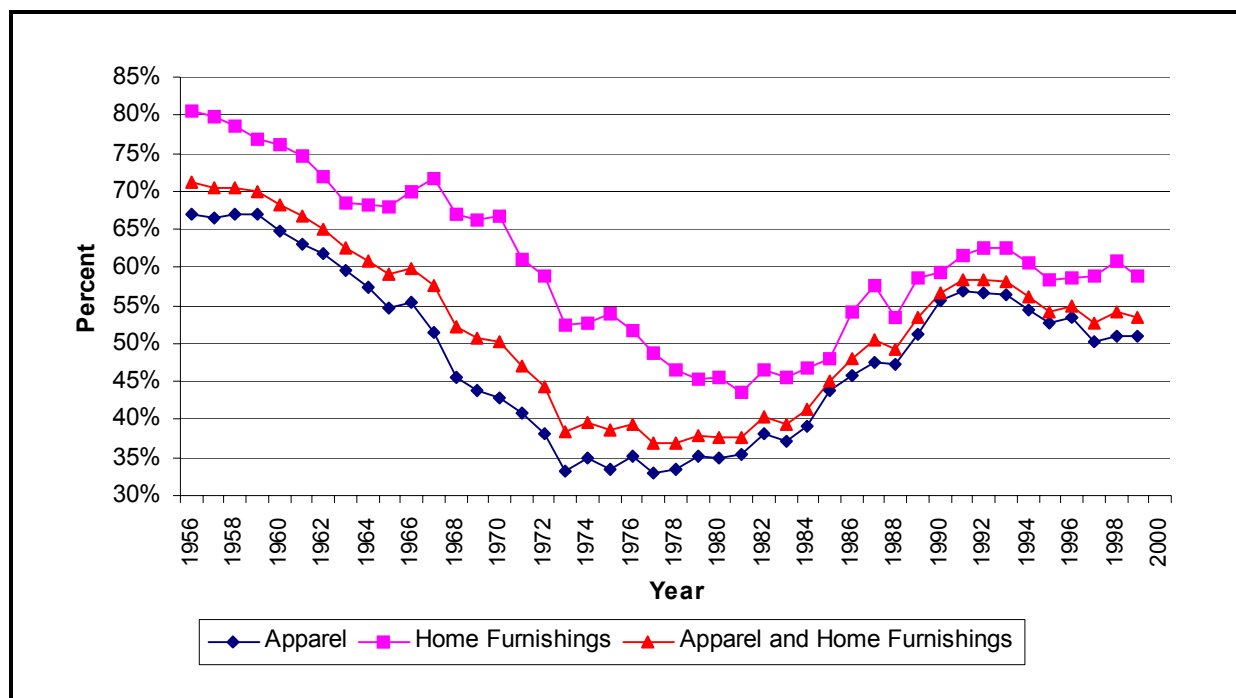
Source: Textile Economics Bureau. Textile Organon (serial). Various issues. New York: Textile Economics Bureau.

also includes a special three-step marketing provision to maintain competitiveness of U.S. cotton on world markets (USITC, 2001).

The CCC has been offering nonrecourse MA loans to cotton growers since its founding in 1938. Farmers may request loans on any bales of cotton they have harvested and ginned, as long as they insure them and store them in a USDA-approved warehouse. The loan rate is based on the lower of the adjusted world price (AWP) or 85 percent of the price received over the past 5 years but is guaranteed to be no lower than 50 cents per pound and no higher than 51.92 cents.[5] If market prices were to rise during the term of the loan, the grower would be free to sell the cotton and repay the loan, plus fees and charges. If the loan is not paid off within 10 months of the issue date, the grower defaults on the loan and the cotton is forfeited to the CCC. As an alternative to placing cotton into the CCC loan program, growers can apply for a LDP, which allows them to sell their cotton on the market and receive a payment from the CCC for the difference between the loan rate and the AWP. Growers can also use this provision to pay

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off their MA loans at the AWP rather than at the loan rate. The LDP option allows the producer to receive the benefits of the marketing loan program without having to take out and subsequently repay a commodity loan.

To mitigate potential negative impacts of the price support programs on cotton exports and the domestic textile industry, a complicated three-step competitiveness process was also put in place by the FAIR Act. Step 1 allows the Secretary of Agriculture to further reduce loan repayment rates if the AWP falls below 115 percent of the loan rate and the lowest U.S. Northern Europe[6] price exceeds the Northern Europe[7] price (known as the A Index). Step 2 provides for payments to U.S. mills, marketers, and exporters when the U.S. price exceeds the A Index by more than 1.25 cents per pound for 4 consecutive weeks and the AWP does not exceed 134 percent of the U.S. loan rate. These payments are equal to the difference between the U.S. price and the A Index minus 1.25 cents per pound. The 1996 FAIR Act capped total expenditures for Step 2 during FY 1996-2002 at $701 million. However, the cap was reached less than halfway through this period, in mid-December 1999 and payments could no longer be made. The program was reinstated in October 1999 when the 2000 Appropriations Act removed the program's expenditure cap. Step 3 protects domestic cotton users by increasing cotton import quotas when the U.S. price (adjusted for Step 2 payments) exceeds the A Index by more than 1.25 cents per pound for 4 consecutive weeks.

2.   Conceptual Model

2.1 Model of the U.S. Cotton Market

To assess the changes in supply and demand resulting from the CRPP, a structural model of the domestic cotton industry is developed. The linkages between the relevant market levels must be included to ensure that all of the CRPP impacts are considered. The framework for such a market linkage model is

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[5]From this base loan rate, a premium or discount is applied, depending on the region and cotton quality.

[6]The U.S. Northern Europe price is the weekly (Friday-Thursday) average price quotation for the lowest priced U.S. upland cotton, as quoted for Middling (M) quality 1 3/32 inch fiber length cotton, delivered c.i.f. (cost, insurance, freight) to Northern Europe.

[7]The Northern Europe price is the weekly average of world price quotes for the five lowest priced growths of upland (M 1 3/32 inch) cotton delivered c.i.f. Northern Europe.

found in Piggott, Piggott, and Wright (1995); Wohlgenant (1993); and Wohlgenant and Clary (1993), among others. The retail market consists primarily of the apparel market and the home furnishings market. The textile market consists of intermediate textile producers and consumers in the U.S. and is the major demander of raw cotton.[8] The structural market model for domestic cotton is defined as follows:[9]

$$Q_{rd}^d = D_{rd}(P_{rd}, P_{rm}, A_g, A_b, A_f, Z_r)$$
Retail demand for domestic cotton products (1)

$$Q_{rd}^s = S_{rd}(P_{rd}, P_{td}, P_{tm}, W_r)$$
Retail supply of domestic cotton products (2)

$$Q_{td}^d = D_{td}(P_{rd}, P_{td}, P_{tm}, W_r)$$
Derived demand for intermediate cotton textiles (3)

$$Q_{td}^s = S_{td}(P_{td}, P_{tm}, P_{cd}, P_{cf}, R_t, W_t)$$
Supply of intermediate cotton textiles (4)

$$Q_{fd}^d = D_{fd}(P_{td}, P_{tm}, P_{cd}, P_{cf}, R_t, W_t)$$
U.S. demand for domestic raw cotton fiber (5)

$$Q_{fd}^s = S_{fd}(P_{cd}, R_a, W_f)$$
U.S. supply of raw cotton fiber (6)

$$Q_{fx}^d = D_{fx}(P_{cd}, P_{cf}, Z_x, W_m, T_f)$$
Export demand for raw U.S. cotton fiber (7)

$$P_{tm} = MC_{tm}(P_{cd}, P_{cf}, W_m)$$
Price of imported textile products (8)

$$P_{td} = MC_{td}(P_{cd}, P_{cf}, W_t)$$
Price of domestic textile products (9)

$$Q_{rd}^d = Q_{rd}^s$$
Retail market clearance (10)

$$Q_{td}^d = Q_{td}^s$$
Textile market clearance (11)

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[8]The term "textiles" as used in this model includes all intermediate products that will be used as inputs into making apparel, home furnishings, or other retail products.

[9]This model assumes a fixed-proportions marketing technology. In other words, a unit of fiber input is combined with a fixed amount of "marketing" inputs to generate a unit of output. We believe that this is a reasonable assumption for cotton product production, at least for the range of production levels being examined. However, it does have somewhat different implications for producers compared with variable proportions technology. Kinnucan, Xiao, and Yu (2000) show that if marketing technology is variable proportions, then research that reduces marketing costs can potentially result in a negative effect on producers.

$$Q_{fd}^d + Q_{fx}^d = Q_{fd}^s$$
<div align="center">Farm-level market clearance (12)</div>

where Q_{ij}^k represents quantities for which k denotes quantity supplied (s) or demanded (d); i denotes

market level (retail [r], textile [t], or farm [f]); and j denotes domestic (d), export (x), or foreign (f). In

addition, P_{rd} is the retail price for domestic cotton products, P_{rm} is the retail price for imported cotton

products, A_g is generic promotion expenditures for cotton, A_b is branded advertising expenditures for

cotton, A_f is advertising expenditures for man-made fibers, Z_r is a vector of demand factors in the retail

market other than advertising (e.g., income), P_{td} is the price of domestic intermediate cotton textiles, P_{tm}

is the price of imported intermediate cotton textiles, W_r is a vector of supply factors in the retail market

(e.g., retail wages, energy costs), P_{cd} is the domestic price of cotton at the mill level (net of Step 2

subsidies), P_{cf} is the price of foreign cotton fiber, R_a is agricultural cotton research expenditures (made by

both Cotton Incorporated (CI), the legal entity that implements the research and promotion activities

under the CRPP, and public institutions funding cotton research), R_t is nonagricultural research

expenditures made by CI, W_t is a vector of supply shifters for the cotton textile market (e.g., textile

wages, energy costs), W_f is a vector of supply factors for cotton producers (e.g., input costs, prices of

alternative crops), Z_x is a vector of demand factors for export markets, W_m is a vector of supply factors

for foreign cotton textiles, and T_f represents shifters of the supply of raw foreign cotton.[10]

    Because our emphasis is on raw cotton producers and that is the market level for which data are

most readily available, partially reduced-form supply and demand equations at the farm level are

estimated. To estimate these equations while incorporating effects from the other levels of the market, the

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[10]Both branded promotional expenditures for cotton-containing products and promotional expenditures for substitute products such as man-made fibers are important to consider and were part of our theoretical model. However, in the final model estimated empirically, these variables are not included. Promotional expenditures for man-made fibers were not included because no data were available. Branded promotional expenditures were proxied using Levi Strauss expenditures, but their inclusion revealed no significant impact on the coefficient for CI promotion. Because the available data series for these expenditures was shorter than for the other demand variables (and was available only quarterly rather than monthly for part of the series) and did not reveal significant interaction effects with CI promotion, they were dropped from the final model.

determinants of retail and intermediate textile demand are substituted into the farm-level demand equation. This results in reduced-form equations for prices, which have the following form:

$$P_{rd} = P_{rd}(P_{td}, P_{tm}, A_g, A_b, A_f, W_r, Z_r), \text{ and} \tag{13}$$

$$P_{rm} = P_{rm}(P_{td}, P_{tm}, A_g, A_b, A_f, W_r, Z_r). \tag{14}$$

Substituting (8) and (9) into equations (13) and (14) for P_{tm} and P_{td}, respectively, and substituting (13) and (14) into (5) yields a partially reduced-form equation for domestic textile mill demand for domestically produced cotton:

$$Q_{fd}^d = D_{fd}(P_{cd}, P_{cf}, A_g, A_b, A_f, R_t, W_r, W_t, Z_r). \tag{15}$$

In addition, we modeled the export demand for raw U.S. cotton as

$$Q_{fx}^d = D_{fx}(P_{cd}, P_{cf}, W_m, Z_x, T_f). \tag{16}$$

Domestic demand plus export demand gives us total demand for domestically produced cotton.

In addition to a model of the demand for domestically produced cotton, a model of the domestic supply of cotton is developed so that we could simulate equilibrium price and quantity under different conditions. Annual production of cotton depends on the expected effective price of cotton (i.e., the price producers expect to receive when they sell their output, adjusting for government programs) and other factors that shift the supply function (e.g., input costs). Thus, the domestic supply of cotton is modeled as

$$Q_{fd}^s = S_{fd}(EP_{cd}, R_a, W_f) \tag{17}$$

where EP_{cd} is the expected effective price of cotton. An expected price is used because of the lag between planting, harvesting, and selling cotton. It includes not only the market price expected by producers, but also the expected effects of government payments. The higher the expected market price, the more producers are willing to supply, everything else being equal. However, in addition to the effects of the market price, U.S. government price support programs for cotton may also influence cotton producers' decisions. When producers are anticipating government payments that vary with the quantity produced, the relevant supply price they face is the expected market price plus the expected government payment per unit.

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2.2 Cotton Program-Induced Market Shocks

Commodity research and promotion may lead to shifts in retail demand, production costs, and/or marketing costs. It is expected that the activities performed under the CRPP will simultaneously cause each of these three types of shifts to occur in the domestic market for cotton. This is because the CRPP engages in promotion designed to increase retail demand, research into fiber and textile quality that is aimed at increasing mill-level demand directly (because of reductions in the cost of processing cotton),[11] and agricultural research into methods of reducing production costs or increasing yields.[12] In addition, there is a shift in the supply curve resulting from the assessment itself. The assessment increases the cost of production, resulting in a decrease in supply, all else equal. Because the assessment and the results of agricultural research shift the supply curve in opposite directions, the net shift of the supply curve depends on which effect is larger.

The existence of federal farm programs greatly complicates the calculation of the effects of these shifts on price, consumption, and returns to producers. Although the 1996 FAIR Act was ostensibly going to eliminate commodity price subsidies, they remain for cotton producers in the form of LDPs. Moreover, cotton demanders (mills) receive payments under the Step 2 program to cover the gap between the U.S. cotton price and the world cotton price. Figure 2 provides a diagram of these interactions assuming an increase in demand due to the CRPP.[13]

Panel (a) in Figure 2 represents the undistorted market solution. Here supply and demand intercept without subsidies on either the demand side or the supply side. A shift in the market demand induced by the CRPP will cause a rise in the market price from P_{m0}^{*} to P_{m1}^{*}. The shaded area (producer surplus) represents the return to producers.

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[11]This research may also increase retail demand if the quality of retail products improves as a result of the research activities.

[12]There is compelling empirical evidence that producers should not be indifferent to the type of shift being funded (i.e., it is important to separate the effects of promotion, agricultural research, and nonagricultural research because they may have very different returns to producers (Wohlgenant, 1993).

[13]Supply shifts resulting from the CRPP are not shown in this diagram to simplify the graphs and focus on the demand effects of promotion and nonagricultural research, the areas where the majority of CRPP funds are allocated.

Figure 2. Farm Program Interactions

The influence of U.S. farm programs such as the loan deficiency payment (LDP) system and Step 2 program greatly complicates the calculation of Return on Investment (ROI).

(a) Free Market: No Program Effects From LDP or STEP 2

Here P_m^* = Market Price = Supplier Price = Demand Price
ΔPS = Producer Benefits from Demand Shift

(b) LDP Effects (When Binding)
$$P_W < P_L$$

P_M = Market Price = Demand Price
$P_S = P_M + (\overline{P}_L - P_W)$ = Supply Price
P_W = World Price, where $P_W = F(P_M)$
$\overline{P}_L$ = LDP Rate (Fixed)
(Shift effects on producer price:)
$\Delta P_S = (P_{S1} - P_{S0}) = (P_{M1} - P_{M0}) - (P_{W1} - P_{W0}) = \Delta P_M - \Delta P_W$
Since $\Delta P_W > 0$, then $\Delta PS < \Delta PM$ (Also $LDP_1 < LDP_0$)
Calculate ΔP_S accordingly

(c) Step 2 Program Effects

P_m = Market Price = Supply Price
P_W = World Price = Demand Price (Demanders are guaranteed to pay world price + $0.0125)
(Shift Effects)
ΔP_M is larger than it would be in a free market (ΔP_M^*)
ΔQ is larger than it would be in a free market (ΔQ^*)

(d) Combined Effects of LDP & Step 2

P_s = Supply Price = P_M & $(\overline{P}_L - P_W)$
P_W = Demand Price = World Price (Guaranteed + $0.0125—not depicted)
P_M = "Market" Price, though it is neither a supply nor a demand price
P_M^* = Free market price
(Shift Effects)
$\Delta P_S < \Delta P_M$, but ΔP_M vs ΔP_M^* is an empirical issue

Panel (b) introduces the effects of the LDP system. If the adjusted world price (AWP) of cotton falls below the loan rate of 51.92 cents per pound, cotton growers are eligible for a supplemental payment equal to the difference between the loan rate and the AWP. The total price received by the grower is equal to the price they receive in the market (P_M) plus the supplemental payment ($\overline{P}_L - P_W$), where $\overline{P}_L$ is the loan rate and P_W is the AWP. The demand shift raises the U.S. market price from P_{M0} to P_{M1}. However, the total price to suppliers will be less than PM1 if the loan rate is binding and the rise in the

U.S. market price causes a corresponding rise in the AWP (thereby diminishing the supplemental payment to farmers). If the relationship between the U.S. price and the world price is 1:1, then the rise in the world price causes a decline in the supplemental payment that, from the producer's perspective, completely offsets the rise in the market price. In this case, there would be no net benefit of the demand shift to producers.[14] However, there are a number of reasons to expect that the U.S. market price and the AWP do not move in parallel fashion. First of all, U.S. cotton is widely regarded to be of a superior quality and not perfectly substitutable with cotton from elsewhere in the world (thus they are not exactly the same commodity and may not receive the same price in the market). There are also transportation costs to consider, which also keep U.S. prices from directly tracking the AWP. To test for this empirically, we ran a price transmission regression of the AWP on the U.S. price and estimated a statistically significant price transmission parameter of 0.3. This implies that a $1 change in the U.S. price will lead to a 30 cent change in the world price. Thus, this feedback on the world price diminishes the benefit to producers of positive demand shifts when the loan rate is binding, but not enough to wipe out CRPP benefits entirely.

Panel (c) illustrates the effects of the Step 2 program. When the U.S. price is above the A Index price by at least 1.25 cents per pound for 4 consecutive weeks, U.S. mills, marketers, and exporters receive a supplemental payment to use U.S. cotton that is equal to the difference between the U.S. price and the A Index. In this case, a CRPP-induced shift in U.S. demand raises the domestic market price. If Step 2 is in effect, then demanders do not effectively pay the higher U.S. price; rather, they receive a higher supplemental Step 2 payment from the government. By foregoing a negative demand response, U.S. prices increase more than they would without Step 2. Therefore, this enhances the price benefits of the cotton program to U.S. producers. The price transmission issue applies here as well. The size of the Step 2 supplement is diminished in part by the corresponding rise in the world price. We adjust for that using the price transmission parameter of 0.3 referenced above.

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[14]We thank Dr. Henry Kinnucan for raising this point in his review of the first draft of a longer report on which this paper is based.

It is possible for both the LDP and Step 2 programs to be in effect simultaneously. The world price may be low enough to trigger LDP payments in the U.S., but the U.S. price may still be more than high enough above the world price to trigger the Step 2 payments. This was, in fact, the case for much of 1999 through 2001 and persists into 2002. Panel (d) demonstrates how prices are determined when both programs are in effect. Because the LDP tends to diminish the price benefits of the CRPP-induced demand shift and the Step 2 tends to enhance this effect, it is not possible to determine *a priori* whether the net interactive effects of the programs are positive or negative. It is an empirical issue.

3.   Data

Monthly data for the period January 1986 through December 2000 were used to estimate domestic mill demand and export demand for domestic cotton. The quantity of domestic cotton consumed by domestic mills and the quantity exported were obtained from various issues of the USDA's *Cotton and Wool Outlook.* The prices used in the model were the price of cotton at the U.S. mill level, the A Index (foreign cotton price), and the prices of rayon and polyester. These prices were all obtained from the National Cotton Council (2001) web site. The mill price was adjusted for government subsidies by subtracting the average user certificate subsidy value for each month from the reported price. Data on the monthly value of this subsidy for the use of domestic cotton were obtained from Cotton Incorporated (CI). All prices obtained from the National Cotton Council were converted into raw fiber equivalent form.[15] CI also provided monthly data on CRPP expenditures for advertising, nonagricultural research, and agricultural research expenditures for the period 1986 through 2000.

The domestic demand model is estimated using per capita quantities. To calculate these quantities and convert other variables to per capita terms, we collected monthly population data for the U.S. from the U.S. Census Bureau (2001). We obtained the wage in the domestic textile industry and a monthly index of energy costs from the U.S. Bureau of Labor Statistics (BLS, 2001). For the domestic

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[15]More waste is associated with cotton fiber than with polyester or rayon. From the mills' perspective, the relevant price is the price per unit of useable fiber. This is taken into account by adjusting prices so that the price per unit of useable fiber is being compared instead of the price of fiber (cotton price is divided by 0.9, while polyester and rayon prices are divided by 0.96).

demand model, data on income were derived from monthly data on total personal disposable income for

the U.S. taken from the St. Louis Federal Reserve Bank's FRED database on their web site (FRED,

2001). For export demand, the income variable was foreign gross domestic product (GDP), proxied by

GDP for Organization for Economic Cooperation and Development (OECD) countries after subtracting

U.S. GDP from the total.[16] These data were available from various issues of *Quarterly National Accounts*

and *National Accounts of OECD Countries*, but monthly values were interpolated from the available

quarterly data by fitting a cubic spline to the data using PROC EXPAND in SAS. A similar procedure

was used to estimate monthly values of the level of foreign cotton stocks based on annual data obtained

from USDA's Foreign Agricultural Service (FAS).

Annual data from 1975 through 2000 were used to estimate the cotton supply function.

Production levels were collected from various issues of the annual USDA publication, *Cotton and Wool*

Yearbook. For the annual supply function, the relevant price is the price that producers expect to receive

when they make their planting decision. This price determines the quantity that producers will choose to

supply (subject to random variation due to weather or other factors). After the planting decision has been

made, the quantity that will be produced is fairly unresponsive to price because biological factors (e.g.,

optimal planting season) largely prevent supply response in the short run.

To capture producers' expectations of the market price, we used the average of the nearby

December futures prices over the months when most cotton is planted each year, calculated based on

information from CI's monthly database.[17] These futures prices should reflect all information available to

growers when they make their planting decision. An increase in the futures price implies that growers

expect to receive a higher market price for their crop at harvest. Other things being equal, a higher

expected price at planting time should induce growers to plant more cotton, either on land that was

formerly idle or previously had other crops grown on it.

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[16]In addition, the Czech Republic, Korea, Hungary, and Poland were not included in the series for consistency because
their data were not included in OECD GDP estimates for the entire period from 1986 through 2000.

However, another important influence on their supply decision is the level of government support payment expected, if that payment varies with output.[18] Prior to 1996, eligible cotton production was guaranteed to receive at least that year's target price established by the USDA. Thus, the relevant supply price for eligible cotton was the greater of the target price and the expected market price. Approximately 85 percent of production received payments under this program (USDA, 1995b). Therefore, in years from 1975 through 1995 when the target price was binding (i.e., target price > market price), the supply price used in the economic model was calculated as the weighted average of the target price and the expected market price. In years when the target price was not binding (i.e., target price < market price), the supply price was simply set equal to the expected market price. The FAIR Act of 1996 eliminated price supports under the target price program, but kept the LDP program. The availability of LDP payments also influences the supply decisions, but these payments differ from price supports under the target price program because they are based on the difference between the loan rate and the AWP and all cotton production is eligible. Thus, in the economic model, the supply price for each year from 1996 through 2000 was calculated as the expected market price plus the expected LDP payment for that year. The expected LDP payment was assumed to equal the loan rate minus the average AWP at planting if the loan rate was above the AWP and zero otherwise. Changes in farm input prices were estimated using the index of prices paid by farmers for the series production, interest, taxes, and wage rates obtained from various issues of *Agricultural Statistics*, an annual USDA publication.

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[17]The available data on cotton futures prices were monthly based on the value at the end of each month. To represent expectations during the planting season, we averaged the futures prices reported for the end of February, the end of March, and the end of April.

[18]A government program paying a lump sum regardless of output, such as the current AMTA program, should not influence planting decisions because it does not change growers' incentives.

We deflated all data series denominated in dollars using the CPI prior to use in estimation, including all promotion and research expenditure data.[19] CPI data are available online from the U.S. Bureau of Labor Statistics (2001). For all of the models, we used the series for all U.S. urban consumers.

4.   Econometric Estimation

4.1 Equation specifications

Mill-level demand for cotton was modeled as described by (15). In this specification, per capita mill consumption of cotton is a function of the price of cotton, prices of substitute fibers, demand and supply shifters of domestically produced textile products, and demand and supply shifters of foreign-produced textile products. The demand and supply shifters of foreign-produced textile products represent the impact of the price of imported textile products on mill-level demand for cotton.

The model was estimated in linear form and the following variables were included (the corresponding variable name from (15) is included in parentheses):

$MILLUSE_t$ (Q_{fd}^d)	=	U.S. per capita raw cotton used by mills (pounds per person)
$M_{i,t}$	=	monthly dummy variables (Mi =1 for ith month, 0 otherwise) for i = 1,...,11 where December is the reference month with its effect represented by the intercept
$PCOTTON_t$ (P_{cd})	=	real U.S. raw fiber equivalent price of cotton (cents/lb)
$PPOLY_t$ (Z_r)	=	real U.S. raw fiber equivalent price of polyester (cents/lb)
$PRAYON_t$ (Z_r)	=	real U.S. raw fiber equivalent price of rayon (cents/lb)
$DTEXW_t$ (W_t)	=	real domestic wage in U.S. textile manufacturing industry ($/hour)
$WPCOT_t$ (P_{cf})	=	real A Index of world cotton price (cents/lb)
$DECI_t$ (W_t, W_r)	=	U.S. real energy cost index (1982-84=100)
DPI_t (Z_r)	=	U.S. per capita real disposable income ($1,000/person)
$FGDP_t$ (Z_r)	=	real GDP of OECD countries, excluding U.S. (billions of $)
$SAGPROM_t$ (A_g)	=	seasonally adjusted CI real promotional expenditures ($)

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[19]Another option for deflating the promotional expenditures would be to use a media cost index. However, using a media cost index implies that the question of interest is the effectiveness of a given quantity of promotion, whereas the question we are interested in for this study is the effectiveness of a real dollar of promotion. The opportunity cost of using a dollar for promotion is that it cannot be used for other activities (e.g., nonagricultural research) or returned to those paying assessments, so that is the relevant comparison. Unless the rapid increase in the costs of promotion relative to the general price level in recent years has been accompanied by an equal or greater increase in its effectiveness relative to other CI activities, the rapid media cost increases may suggest that promotion is becoming relatively less attractive over time as the real price of a unit of promotion becomes more expensive. This point is not captured by the use of a media cost index to deflate expenditures.

SAGNARES$_t$ (R$_t$)   =   seasonally adjusted CI real nonagricultural research expenditures ($)

In addition to promotional and nonagricultural research expenditures (SAGPROM$_t$ and SAGNARES$_t$), other domestic demand shifters in the model include prices of competing fibers (PPOLY$_t$, PRAYON$_t$), prices of other factors in textile manufacturing (DTEXW$_t$, DECI$_t$), and per capita real disposable income (DPI$_t$). Proxies for the impact of the price of imports on domestic mill demand include foreign income (FGDP$_t$) and the world price of cotton (WPCOT$_t$).

Our study focused on quantifying the impact of generic promotion and research on demand for cotton. One complication we had to address is the timing of these explanatory variables. It is important to allow for the possibility that their impact on consumption may be more complicated than simply affecting consumption contemporaneously (i.e., in the same period that they occur). That is, the effects of promotion and research on demand may be distributed over time. Unfortunately, economic theory does not offer much guidance in determining the appropriate value for the number of periods that these effects continue, m. Thus, it is necessary to consider alternative lag lengths for both advertising and research to determine the "best" lag structure. With the correct lag length m* unknown, the number of regressors that must be included in the model is also unknown. If the researcher chooses an m other than m* (m ≠ m*) the parameter estimates of the model will either be biased or inefficient (imprecise). It will be biased if m < m* because there are omitted variables, but it is inefficient if m > m* due to overspecification of the model.

Thus, we embarked on grid search procedures for several types of distributed lag models (e.g., polynomial distributed lag, geometric lag) in an attempt to find the best model (see Murray et al. (2001) for details on the grid search). In all cases of model selection across alternative specifications, we relied on the Akaike Information Criteria (AIC), the Schwartz-Bayesian Criteria (SBC), the adjusted R^2 value and the implied estimated economic effects (elasticities) to compare competing models and arrive at a preferred model. Given the economic and statistical considerations as a whole, we arrived at a relatively simple model with a 3-month lag on research, no lags on promotion, and no lags on cotton price. The

long-run impacts of promotion and research are not too different in this model than in models with longer lag lengths, and this model has superior performance from a theoretical standpoint (e.g., expected sign for variables).

The export demand for U.S. cotton is specified as a partially reduced-form equation given by (16) in which exports of U.S. cotton are modeled as a function of the price of domestic cotton, prices of substitute fibers, and demand and supply shifters of foreign-produced textile products.[20] The relevant information provided by the export demand equation is the price elasticities of export demand with respect to the price of U.S. cotton and the world cotton price.

The model was estimated in linear form[21] using the following variables (the corresponding variable name from (16) is included in parentheses):

$M_{i,t}$	=	monthly dummy variables (M_i=1 for ith month, 0 otherwise) for i=1,...,11 where December is the reference month
$EXPORTS_t$ (Q_{fx}^d)	=	U.S. exports of raw cotton (thousands of bales)
$PCOTTON_t$ (P_{cd})	=	U.S. real raw fiber equivalent price of cotton (cents/lb)
$PPOLY_t$ (Z_r)	=	U.S. real raw fiber equivalent price of polyester (cents/lb)
$FTEXWAGE_t$ (W_m)	=	real foreign manufacturing wage ($/hour)
$WPCOTTON_t$ (P_{cf})	=	real A Index of the world cotton price (cents/lb)
$DECI_t$ (W_m)	=	U.S. real energy cost index, used as a proxy for foreign energy costs
$FGDP_t$ (Z_x)	=	foreign real GDP for OECD countries other than U.S. (billions of $)
$ROWSTK_t$ (Z_x)	=	foreign cotton stocks (pounds)
$EXPORTS_t$-1 (Q_{fx}^d)	=	lagged U.S. exports of raw cotton (thousands of bales)
rho	=	first-order autocorrelation parameter value

The foreign supply and demand shifters included in the model include prices of competing fibers in the foreign fiber market ($PPOLY_t$, $WPCOTTON_t$), prices of other factors affecting foreign textile manufacturing demand for U.S. cotton ($FTEXWAGE_t$, $DECI_t$, $ROWSTK_t$), and foreign income ($FGDP_t$).

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[20]In addition, we estimated a variety of specifications including promotion and nonagricultural research. However, neither seems to have a significant effect on export demand in our preferred model. Thus, in this paper, we focus on the effects of the CRPP on domestic demand and exclude the impacts on exports.

[21]Other specifications were also estimated, including double-log and semi-log models, but the linear model cannot be rejected based on the results from any of the models that we estimated. In other words, the linear model is at least as good as any alternative models that we tried. Therefore, we chose to use the linear model because it is relatively simple.

The real exchange rate, promotion, and nonagricultural research were initially included as well, but inclusion of these variables did not lead to significant improvement in the model. It appears that $WPCOTTON_t$ is a much better indicator of export demand for cotton than a more general exchange rate.

The domestic supply of raw U.S. cotton was modeled at the annual level because the planting decision is made on an annual basis. Although there may be some response of production to changes in price after planting (e.g., higher abandonment at low price), it is likely to be relatively small. The supply function is based on a simplified version of (17). It is modeled as a function of expected cotton price, an index of farm input prices lagged one year, and a trend variable (to capture technical change). A linear model was estimated incorporating the following variables (the corresponding variable name from (17) is included in parentheses):

$PROD_t$ (Q_{fd}^s)	=	annual U.S. cotton production (thousands of bales)
$FPCOTTON_t$ (EP_{cd})	=	real cotton futures price averaged over planting months (cents/lb)
$PINPUT_{t-1}$ (W_f)	=	index of real prices paid by farmers for inputs
$TREND_t$ (R_a)	=	trend variable that indexes years, increasing from 1 in 1975 to 26 in 2000[22]

More complex specifications were considered,[23] but the data currently available are inadequate to allow much complexity beyond the current model. For instance, the data series is not long enough to permit inclusion of additional variables that may influence supply (e.g., agricultural research, labor productivity, returns to alternative crops) while maintaining sufficient degrees of freedom, especially given the long lags expected on agricultural research.

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[22]A trend variable was included as a proxy for the effects of agricultural research due to the difficulty in estimating a robust specification as a function of agricultural research directly. The trend variable will provide an upper bound on the supply shift caused by agricultural research because it also captures other factors that may increase supply over time.

[23]For example, we estimated models that included CI agricultural research expenditures; total cotton agricultural expenditures (including USDA, the State Agricultural Experiment Stations [SAES], and other nongovernmental organizations such as CI); cumulative research at a variety of depreciation rates; and other variants on research expenditures. In addition, we attempted to estimate production functions and to relate yield and production costs to cotton agricultural research independently.

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4.2 Estimation Results

The statistical results for the preferred models for domestic and export demand are shown in Table 1. Domestic demand was estimated using 2SLS because of the endogeneity of the price of cotton. Because first-order autocorrelation in the residuals was found, 2SLS was applied with correction for first-order autocorrelation in the residuals using the two-step procedure developed by Hatanaka (1976). Overall, the results seem quite reasonable and suggest a strong and significant impact of promotion and research on mill consumption of cotton. There is significant seasonality in mill consumption as indicated by highly significant monthly dummy variables (not included in table). The own-price elasticity of

Table 1. Regression Results for Monthly Demand for U.S. Cotton, 1986-2000

Domestic Demand				Export Demand			
	2SLS and First-Order Autocorrelation				**2SLS and First-Order Autocorrelation**		
Independent Variable	**Para-meters**	**t-values**	**Elasticity**	**Independent Variable**	**Parameters**	**t-values**	**Elasticity**
$CONSTANT_t$	1.75181	2.07		$CONSTANT_t$	338.440	0.77	
$PCOTTON_t$	–0.01089	–3.21	–0.413	$EXPORTS_{t-1}$	0.601	9.27	0.601
$PPOLY_t$	–0.00361	–1.65	–0.129	$PCOTTON_t$	–6.757	–1.98	–0.692
$PRAYON_t$	0.00261	1.50	0.137	$PPOLY_t$	0.748	0.31	0.072
$DTEXWAGE_t$	–0.13169	–0.87	–0.453	$WPCOTTON_t$	7.266	2.23	0.732
$WPCOTTON_t$	0.01264	4.08	0.427	$DECI_t$	–0.389	–0.13	–0.037
$DECI_t$	–0.00723	–2.14	–0.256	$FGDP_t$	0.016	0.52	0.211
DPI_t	–67879.7	–0.87	–0.616	$ROWSTK_t$	–3.790E-09	–0.57	–0.103
$FGDP_t$	0.000061	0.79	0.309				
$SAGPROM_t$	2.12E-08	2.00	0.023				
$SAGNARES_t$	5.12E-07	4.72	0.152				
$SAGNARES_{t-1}$	7.30E-08	0.68	0.022				
$SAGNARES_{t-2}$	2.79E-07	2.75	0.083				
$SAGNARES_{t-3}$	3.16E-07	3.06	0.094				
rho	0.19303	2.62		rho	0.07600	–0.53	
N	176			N	178		
R^2	0.7990			R^2	0.7540		
$\overline{R}$	0.7671			$\overline{R}$	0.7290		
DW	2.0318			DW	1.8939		

demand for cotton is –0.4, which is close to estimates of about –0.3 by Lowenstein (1952), Wohlgenant

(1986), and Waugh (1964) and in the range between Shui, Behgin, and Wohlgenant (1993), which found

an elasticity of –0.6 and Capps et al. (1997), which estimated an elasticity of –0.16.

The world price of cotton also has a large and significant effect on cotton mill use. This variable

is a strong indicator of the cost of imported cotton textile products. Higher world cotton prices raise the

cost of producing cotton in foreign countries, which translates into higher prices of cotton products

imported and higher U.S. mill consumption of cotton. It is important also to recognize that, because the

U.S. is not a small country in international trade of cotton, feedback effects may exist from changes in the

U.S. cotton price on the world cotton price. Therefore, the effect is included in simulations of the impact

of promotion and research on returns to cotton producers this feedback effect needs to be considered.

The elasticity of promotion is estimated to be 0.023 and the long-run elasticity estimates of mill

consumption with respect to research (the sum of current and lagged effects) is 0.35. These elasticities

imply that a 10 percent increase in promotion expenditure would lead to a 0.23 percent increase in cotton

demand, while a 10 percent increase in nonagricultural research expenditures would lead to a 3.5 percent

increase in cotton demand.

The results for the preferred model[24] for export demand provided in Table 1 conform with other

studies of the cotton market. There is significant seasonality to U.S. cotton exports as indicated by highly

significant monthly dummy variables (not included in table), although the seasonal pattern of exports is

quite different from that of mill consumption. The export demand price elasticity for cotton is about –0.7,

which is just below the lower end of the range estimated for the export demand elasticity by Duffy,

Wohlgenant, and Richardson (1990) and is more elastic than domestic demand, as trade theory would

suggest. The effect of lagged exports is highly significant. It seems that the major factors contributing to

export demand are the domestic cotton price, the world cotton price, seasonality, and partial adjustment of

exports over time to these and other unobserved trade shocks, with none of the other variables having a

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[24]An LM test (used because of the inclusion of a lagged dependent variable) reveals the presence of autocorrelation, so a
first-order autocorrelation correction was included in the model.

very important role. The price elasticity for the world price of cotton is around 0.7, suggesting that

foreign cotton and U.S. cotton are substitutes for one another, and that U.S. export demand is fairly

sensitive to the world cotton price.

   Although a relatively simple model, the results of the supply equation estimation appear

reasonable in terms of the estimated supply elasticity and the signs of the parameters. Table 2 provides

the results of the estimation for the model estimated with OLS both with and without the input price

index. The trend term is very significant when the farm input price index is not included in the model.

Once the input price is added to the specification, the trend variable becomes much smaller in magnitude

and is no longer significant. This suggests that an important part of the outward supply shifts over time

being captured by the trend variable is due to reductions in input costs. Due to difficulties in separating

out the impacts of CI expenditures on supply shifts over time, the primary use of the supply model is to

obtain econometric estimates of the supply elasticity, rather than to estimate the supply side impacts of

the CRPP.

Table 2. Regression Results for Annual Supply of U.S. Cotton, 1975-2000

Independent Variable	OLS without Input Price Index			OLS with Input Price Index		
	Parameters	**t-values**	**Elasticity**	**Parameters**	**t-values**	**Elasticity**
CONSTANT$_t$	432.3066	0.10		18,957.7	1.49	
FPCOTTON$_t$	94.7157	2.31	0.454	103.8293	2.21	0.498
TREND$_t$	546.6276	4.66	0.038	301.9883	1.43	0.021
PINDEX$_{t-1}$				−190.0750	−1.61	−1.099
N	26			25		
R^2	0.6092			0.5952		
R^2-bar	0.5752			0.5374		
DW	2.2059			2.3368		
SSE	1.04×10^8			9.31×10^7		

   There was no evidence of significant autocorrelation for either model. The price elasticity of

supply is about 0.45 for the model without the input price index and 0.49 in the model including that

index, which is in the range of supply elasticities in the literature. Duffy and Wohlgenant (1991) use a short-run supply elasticity for cotton of 0.3, and Duffy, Shalishali, and Kinnucan (1994) report a value of 0.92 for the cotton supply elasticity.

5.   Simulation of Interaction Effects

The econometric results presented in the previous section allow us to estimate the change in the price and quantity of cotton that has resulted from CRPP expenditures. To simulate the market with a marginal increase in CRPP expenditures, we simply increase those expenditures by 1 percent and observe what the supply and demand responses would look like. The simulated equilibrium provides the information necessary to calculate the return on investment (ROI) for producers.

To measure the effect of the CRPP on domestic producers in the absence of distortions from the LDP and Step 2 programs, the proportionate change in price expected to result from a marginal change in CRPP expenditures was simulated using

$$EP_{cd}^{s} = \frac{s_1 b_1 EA + s_1 b_2 ENAR}{e - s_1(\eta + \eta_{fd}\eta_f) - (1-s_1)(\eta_x + \eta_{fd}\eta_f)} \tag{18}$$

where E in front of a variable denotes a proportional change in that variable; s_1 is the share of domestic cotton production sold domestically; e is the estimated supply elasticity; η is the estimated domestic demand elasticity; η_x is the estimated export demand elasticity; η_{fd} is the estimated elasticity of price transmission between U.S. and foreign cotton prices; η_f is the estimated elasticity of U.S. mill consumption with respect to the foreign cotton price; η_{xf} is the estimated elasticity of export demand with respect to the foreign cotton price; P^S is the effective price received by domestic producers;[25] A is promotional expenditures; NAR is nonagricultural research expenditures; and β_1 and β_2 are the domestic promotion and nonagricultural research elasticities, respectively. For more details on the derivation of this equation, see Murray et al. (2001).

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[25]Note that this price is generally not the same as the price paid by demanders because of gaps created by the assessment, by U.S. government subsidies to buyers of U.S. cotton, and by government support payments to producers.

Given the change in price estimated using (18), the change in producer surplus can be calculated by the following equation:

$$\Delta PS = P_{cd}^{s0} \, Q_{fd}^{s0} \, EP_{cd}^{s} \, (1 + 0.5 \, EQ_{fd}^{s}) - \cfrac{1}{1 - \cfrac{e}{s_1(\eta + \eta_{fd}\eta_f) + (1-s_1)(\eta_x + \eta_{fd}\eta_f)}} \bullet T \qquad (19)$$

where a subscript of 0 denotes baseline conditions, E denotes a proportionate change in a variable, and T is the assessment collected from domestic producers.

Based on the expression in (18), our estimated parameters, and the average supply price and quantity from 1996 through 2000, a 1 percent increase in annual promotional expenditures would have resulted in an average price increase of 0.02 percent under free market conditions. A 1 percent increase in annual nonagricultural research expenditures, on the other hand, is estimated to raise cotton prices by 0.30 percent. Taken together, these results imply that a 1 percent increase in expenditures on both promotion and research would increase cotton prices by 0.32 percent. The increase in quantity given an estimated increase in price is calculated by multiplying the proportionate increase in price found using (18) by the estimated supply elasticity. The proportionate changes in quantity implied by a 1 percent increase in annual promotional expenditures, annual nonagricultural research expenditures, and total demand-side expenditures are 0.01 percent, 0.14 percent, and 0.15 percent, respectively.

Using the simulated changes in price and quantity resulting from CRPP activities, estimated parameters, and the average values of price and quantity from 1996 through 2000, we calculated net changes in producer surplus over that period using (19). This net change in producer surplus was then divided by the change in assessment paid by domestic producers for calculating the ROI.

In addition to calculating the ROI assuming a free market, we also examined the effects on the returns to the CRPP under several variations of government cotton support programs. Table 3 shows the estimated ROI under different government programs as well as a weighted ROI measure based on the number of months each was in effect during 1996 through 2000. These results show that when the Step 2 program is in effect, there is a significantly larger benefit of promotion and research to producers. This is because the effective price faced by consumers of raw cotton (primarily foreign and domestic textile

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Table 3. Effects of Interaction with Government Cotton Programs on Domestic Producer ROI, 1996-2000 (2000$)

Marginal Benefits, Costs[a]	Free Market	LDP	Step 2	LDP and Step 2	Weighted Average[b]
Net Producer Benefits, Promotion	$1,339,915	$1,065,155	$2,081,637	$1,473,021	$1,611,416
Net Producer Benefits, Non Ag Research	$18,871,694	$15,365,473	$28,341,000	$20,570,558	$22,337,780
Net Producer Benefits, Combined	$20,166,529	$16,384,866	$30,380,092	$21,998,879	$23,905,031
Domestic Producer Costs, Promotion	$290,084	$290,084	$290,084	$290,084	$290,084
Domestic Producer Costs, Non Ag Research	$67,334	$67,334	$67,334	$67,334	$67,334
Domestic Producer Assessment, Combined	$453,447	$453,447	$453,447	$453,447	$453,447
Producer Benefits/Producer Costs, Promotion	**4.6**	**3.7**	**7.2**	**5.1**	**5.6**
Producer Benefits/Producer Costs, Non Ag Research	**280.3**	**228.2**	**420.9**	**305.5**	**331.7**
Producer Benefits/Producer Assessments, Combined	**44.5**	**36.1**	**67.0**	**48.5**	**52.7**

[a]These values correspond to a 1 percent increase in expenditures and costs/assessments. For promotion and research the costs to domestic producers of a marginal increase in CRPP expenditures are calculated as 1 percent of the expenditures on those activities multiplied by the share of total assessments paid by domestic producers (about 67 percent). For the combined measure, the costs are calculated as a 1 percent increase in the total assessments paid by domestic producers.

[b]Weights for the four policy regimes are based on the number of months each was in effect during 1996-2000.

mills) does not increase as much as it would in a free market. When demand shifts out, the market price will rise. However, this will trigger larger government subsidies per pound of cotton. The net price after subsidy will rise much less than the price received by producers as a result of these payments. Thus, the quantity purchased and the price received by producers both increase more than they would under free market conditions. The LDP program, on the other hand, acts to reduce the ROI of promotion and nonagricultural research activities when binding. This is because part of the increase in market price is offset by reductions in government LDP payments. A weighted average of the returns under different government programs in existence from 1996 through 2000 yields a return that is about 18 percent higher than the estimated return in the absence of government programs.

6.   Summary and Conclusions

Using an econometrically estimated model of the U.S. cotton market, we find that interaction effects with existing government cotton programs have a large impact on checkoff program returns. Our simulation results show that the returns to the CRPP are reduced by about 20 percent when only the loan rate for the LDP is binding and increased by just over 50 percent when only the Step 2 program is in effect. The net effects of these programs when both are in effect at the same time may be either positive or negative depending on U.S. cotton prices, world cotton prices, the loan rate, and other variables that influence government subsidy payments and the cotton market.

One policy implication of these findings is that producers of commodities that receive statutorily required support (feed grains (corn, grain sorghum, barley, oats); cotton; rice; wheat; peanuts; sugar; tobacco; soybeans; minor oilseeds (sunflower seed, canola, rapeseed, safflower, mustard seed, flax seed); and dairy products) may have a reduced incentive to establish generic promotion and research programs if some of their support is in the form of nonrecourse loans and LDPs. In fact, relatively few of these commodities have established promotion and research programs. Only soybeans, cotton, peanuts, and dairy products have national checkoff programs and three of the four have unique features of their support programs in addition to LDPs that make checkoff programs that increase commodity demand more attractive (e.g., Step 2 demand subsidies for cotton, quotas on the quantity of peanuts that can be marketed for domestic edible use, and a system that offers premiums to dairy producers for shifting more production into Class I (fluid milk)).[26] To the extent that checkoff programs are more efficient than federal commodity support programs, there may be net benefits to altering the support system to encourage formation of generic promotion and research programs for additional commodities receiving the majority of Federal commodity support funds.

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[26]In addition, the loan rate for soybeans was very rarely binding prior to 1998, implying that nonrecourse loans and LDPs have had little effect on soybean producers' behavior until the last few years.

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