Economic Evaluation of the Cotton Checkoff Program

an Executive Summary of a Report to the Cotton Board
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TABLE OF CONTENTS

INDEX OF EXHIBITS

I. PURPOSE

The purpose of this study is to determine the effectiveness of cotton checkoff assessments by attempting to quantify the relationship between research/promotion expenditures and cotton demand. Specifically, we attempt to provide answers to the following questions:

(1) What are the effects of research and promotion activities on domestic consumption of cotton, farm-level demand for cotton, and cotton imports?

(2) What is the rate of return associated with the program?

In other words:

(1) Do the program benefits outweigh the program costs?

(2) If so, how much?

In this analysis, we use the following definitions:

DOMESTIC CONSUMPTION = U.S. Mill Consumption of Cotton + Net Imports of Raw Fiber Equivalent Cotton Textile Products (yarn, thread, and fabric; apparel; and home furnishings)

FARM-LEVEL DEMAND FOR COTTON = U.S. Mill Consumption + U.S. Exports of Raw

COTTON IMPORTS = Imports of Raw Fiber Equivalent Cotton Textile Products

II. BACKGROUND SUMMARY

This study was prompted by the 1996 Federal Agricultural Improvement and Reform (FAIR) Act which calls for independent evaluations of grower-funded checkoff programs.

The legislative intent of the Cotton Research and Promotion Act of 1966 (PL89-502) and the Cotton Research and Promotion Amendments Act of 1990 was to authorize the establishment of an orderly procedure for the development of an effective and continuous coordinated program of research and promotion. The intent of both Acts was to strengthen the competitive position of cotton against primarily man-made fibers as well as expand domestic and foreign markets and uses for U.S. cotton.

The Cotton Research and Promotion Amendments Act of 1990 (enacted by Congress under Subtitle G of Title XIX of the Food, Agriculture, Conservation and Trade Act of 1990, and approved by producers and importers voting in a referendum held July 17-26, 1991) contains two provisions that authorized changes in funding procedures, thereby distinguishing it from the Act of 1966:

(1) All cotton marketed in the United States, whether from domestic or foreign production, was to share in the cost of the research and promotion program

(2) The right of cotton producers to demand a refund of assessments was terminated.

The checkoff program is financed through one-dollar-per-bale assessments, plus 1/2% of market value on domestically produced cotton, imported cotton, and the cotton content of imported products. First handlers collect the assessments and provide them to the Cotton Board. The Board contracts with Cotton, Inc., (referred to as "CI"), to carry out research and promotion activities authorized by the legislative Acts.

As exhibited in Table ES.1, the CI budget grew from $18.5 million to slightly more than $55 million over the ten-year period 1986 to 1995 without adjustments for inflation. Funding under the assessment rose from 18.5 million in 1986 to 28.5 million in 1991. These figures represent remaining funding after up to 35 percent of the assessment had been refunded. Funding from the assessment rose from $43 million in 1992 to $55 million in 1995. The difference in magnitude of the assessments for the period 1986 to 1991 versus the period 1992 to 1995 was due to the two changes in the checkoff program brought about by the Congressional Act of 1990.

Table ES.1 Cotton, Inc. Budget Allocations Dollars and Percentage Breakdown

From 1986 to 1995 on a Calendar Year Basis

	Promotion Activities		Textile Research Activities					
YEAR	U.S. Marketing	Int'l Marketing	Textile Research	Fiber Quality Research	Fiber Processing Research	Agri Research	Administration	TOTAL
1986	10.563[a] (56.96)[b]	1.427 (7.69)	2.962 (15.97)	1.044 (5.63)	0.000 (0.00)	0.856 (4.62)	1.693 (9.13)	18.545
1987	10.206 (55.43)	1.363 (7.40)	3.312 (17.99)	0.953 (5.18)	0.000 (0.00)	0.907 (4.93)	1.672 (9.08)	18.413
1988	13.104 (59.18)	1.450 (6.55)	3.719 (16.80)	0.892 (4.03)	0.000 (0.00)	1.121 (5.06)	1.855 (8.38)	22.141
1989	12.759 (56.94)	2.573 (11.61)	2.843 12.83)	0.732 (3.30)	0.552 (2.49)	1.044 (4.71)	1.904 (8.59)	22.407
1990	15.424 (58.09)	2.466 (9.29)	3.729 (14.05)	0.881 (3.32)	0.821 (3.09)	1.276 (4.81)	1.953 (7.36)	26.550
1991	15.569 (54.53)	3.041 (10.65)	4.395 (15.39)	1.120 (3.92)	1.087 (3.81)	1.299 (4.55)	2.042 (7.15)	28.553
1992	24.847 (57.64)	3.354 (7.78)	6.795 (15.76)	1.236 (2.87)	1.437 (3.33)	3.411 (7.91)	2.027 (4.70)	43.107
1993	25.552 (56.68)	3.801 (8.43)	6.407 (14.21)	1.651 (3.66)	1.555 (3.45)	3.957 (8.78)	2.156 (4.78)	45.079
1994	26.508 (55.93)	4.152 (8.76)	6.787 (14.32)	1.547 (3.26)	1.827 (3.85)	4.363 (9.21)	2.211 (4.67)	47.395
1995	29.891 (54.25)	6.037 (10.96)	7.496 (13.61)	1.754 (3.18)	1.965 (3.57)	5.652 (10.25)	2.301 (4.17)	55.096

[a] million $
[b] percent

Between 1986 and 1995, the Cotton Board budgeted approximately 66 percent of the assessment for promotion activities and 20 percent for textile research activities. The Board also allocated, on average, $2 million annually for administration and producer relations, with the remainder to be spent on agricultural research and administration.

III. PROMOTION AND RESEARCH ACTIVITIES

This analysis emphasizes the impact of promotion and research activities by CI on per capita consumption of cotton, farm-level demand for cotton and cotton imports. Marketing services are important to mills, manufacturers, and retailers in marketing new cotton products. CI attempts to improve the image of cotton with a multi-million-dollar television advertising campaign, special promotions and public relations efforts designed to stimulate consumer demand, as exhibited under the heading of promotion activities in Table ES.2:

Table ES.2. A Representation of Various Promotion, Textile Research, and Agricultural Research Activities

Promotion Activities:

(1) U.S. Marketing
  (a) Marketing Implementation
    (i) Apparel Mill Marketing
    (ii) Home Fabric Marketing
    (iii) Fashion Marketing
    (iv) Retail Implementation
  (b) Marketing Services
    (i) Advertising
    (ii) Public Relations
    (iii) Market Research
(2) International Marketing
  (a) Technical Services
  (b) Information Services
  (c) Fashion Services
  (d) Emerging Markets
  (e) Market Promotion Program
  (f) Importer Support Program

Agricultural Research Activities:

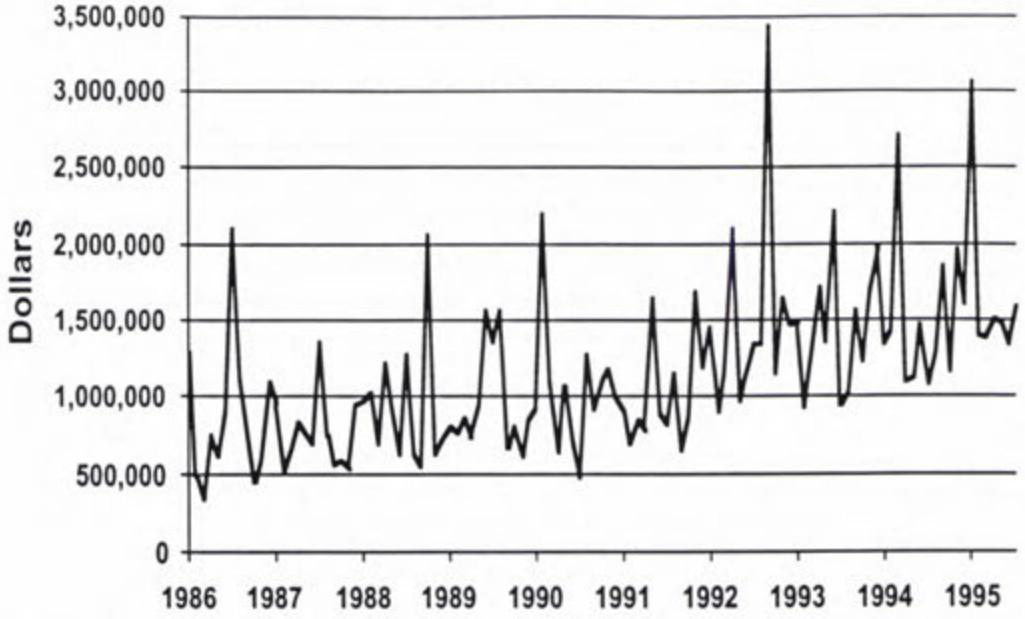
(1) Agricultural Research/State Support

Textile Research Activities:

(1) Fiber Processing Research
(2) Textile Research and Implementation
  (a) Fabric Development
  (b) Product and Process Research
  (c) Technical Services
(3) Fiber Quality Research

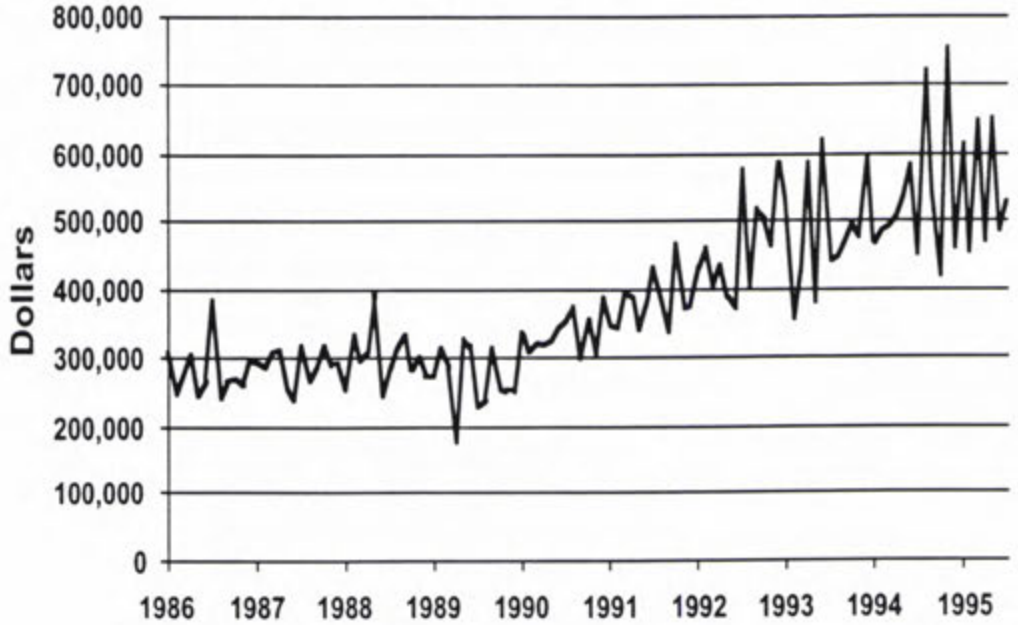
CI also assists U.S. manufacturers and retailers in merchandising cotton products and provides technical information to international users of American-grown cotton. A graphical representation of the real seasonally-adjusted promotional expenditures CI made between January 1986 to July 1995 is exhibited in figure ES.1:

Figure ES.1 Real Seasonally Adjusted Promotional Expenditures



Under the heading of research activities, technical support teams offer assistance to mills ranging from fiber processing education to problem-solving in yarn and fabric production. Product development is an important aspect of research activities (for example, textile research leading to the development of wrinkle-resistant apparel). Agricultural research activities also include contributions in crop management and biotechnology that lead to improvements in cotton production levels and cotton quality. CI also plays a role in the development of a data-management system to aid mills, merchants, gins, and growers. A graphical representation of the real seasonally-adjusted research expenditures CI made between January 1986 to July 1995 is exhibited in Figure ES.2:

Figure ES.2 Real Seasonally Adjusted Research Expenditures



IV. APPROACH

The empirical approach used to provide a quantitative assessment of the effectiveness of the Cotton Research and Promotion Program over the period 1986 to 1995 is based on the development and use of structural/econometric models and time-series models. The study identifies and assesses factors which affect, on a per capita basis, the domestic consumption of cotton (mill use plus net imports); farm-level demand for cotton (mill use plus U.S. exports of raw cotton); and cotton imports. In addition to promotion and research efforts, additional potentially important factors include:

- Raw fiber equivalent prices, notably cotton prices, SLM 1 1/16" at Group B mill points; rayon prices (class of cellulosic man-made fibers), 1.5 and 3.0 denier, regular staple at f.o.b. producing plants; and polyester prices (class of non-cellulosic man-made fibers), 1.5 denier, stable at f.o.b. producing plants
- User certificates
- The A index, a measure of the world price of cotton
- Support levels (loan rate and target price) and season-average prices received by farmers for upland cotton
- U.S. and rest-of-world beginning stocks of cotton
- U.S. population
- The U.S. inflation rate
- U.S. and rest-of-world income
- Prices of inputs (materials, energy, and labor) used in the production of textiles at the mill level

Figures ES.3-ES.6 reflect the real price of cotton at the mill level, nominal prices received by farmers for cotton, and the loan rates and target prices for cotton over the period January 1986 to July 1995:

Figure ES.3 Real Effective Price of Cotton at the Mill Level

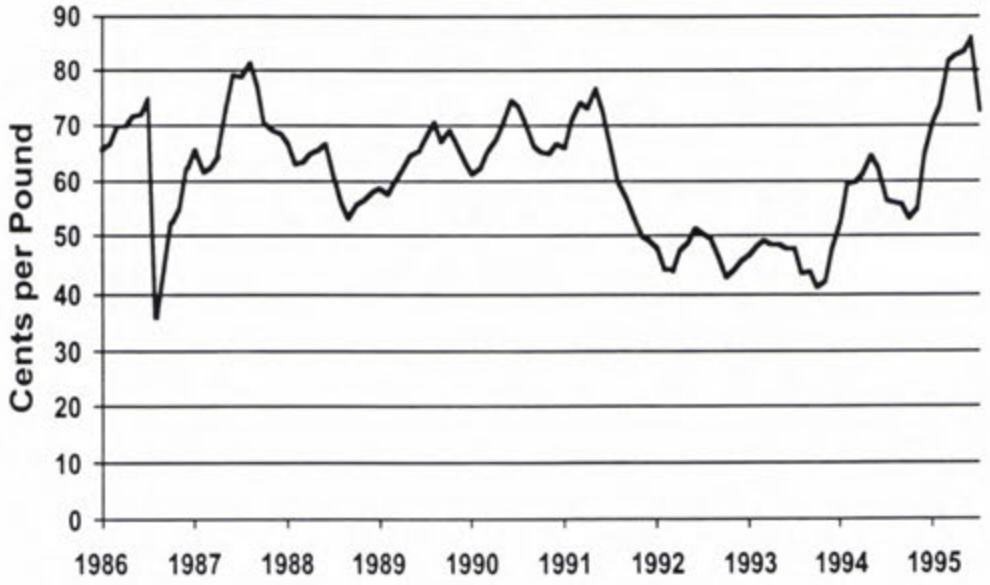


Figure ES.4. Prices Received by Farmers

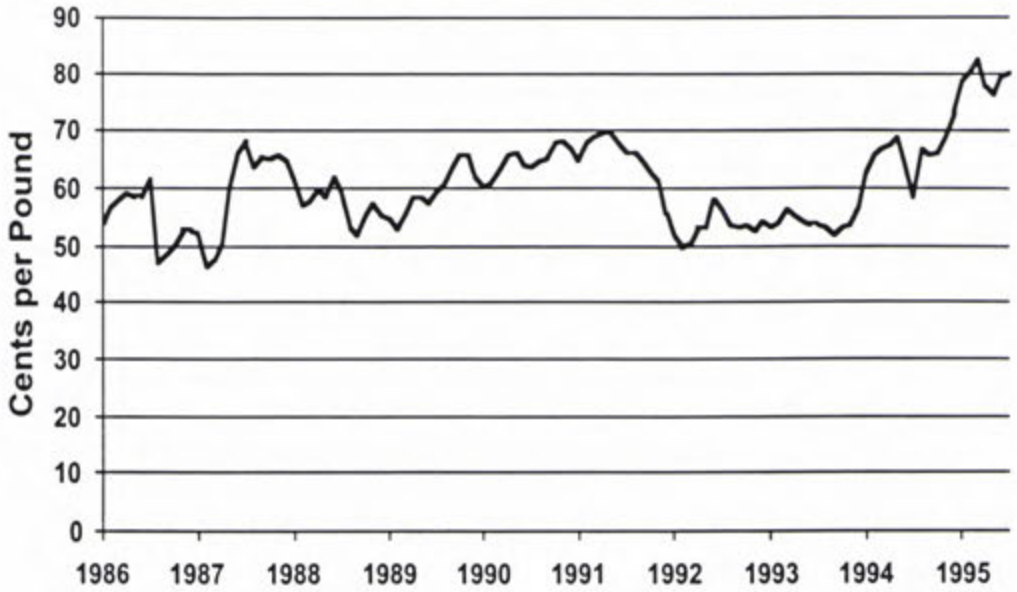


Figure ES.5. Loan Rate for Cotton

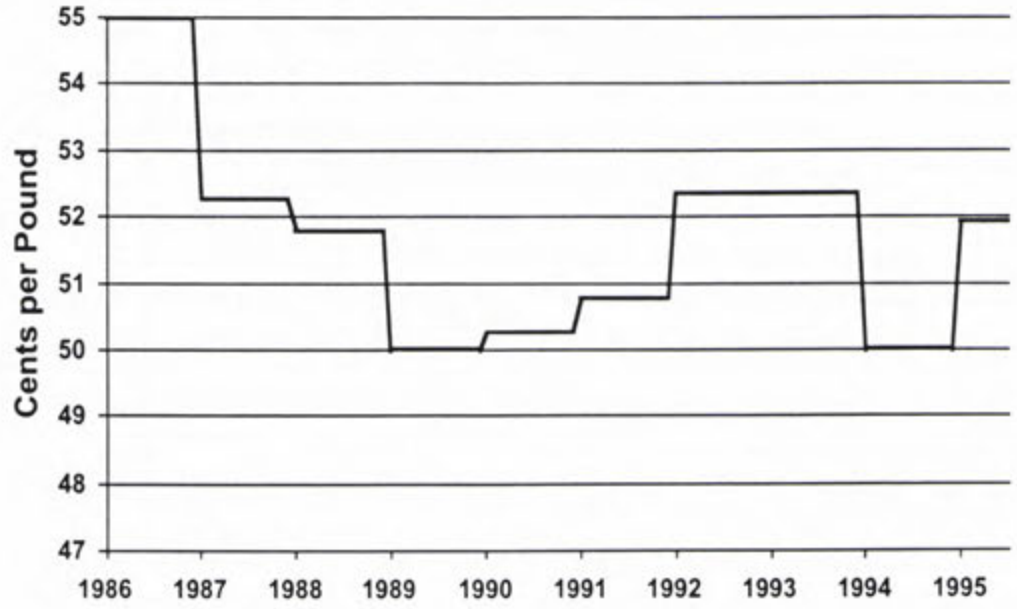
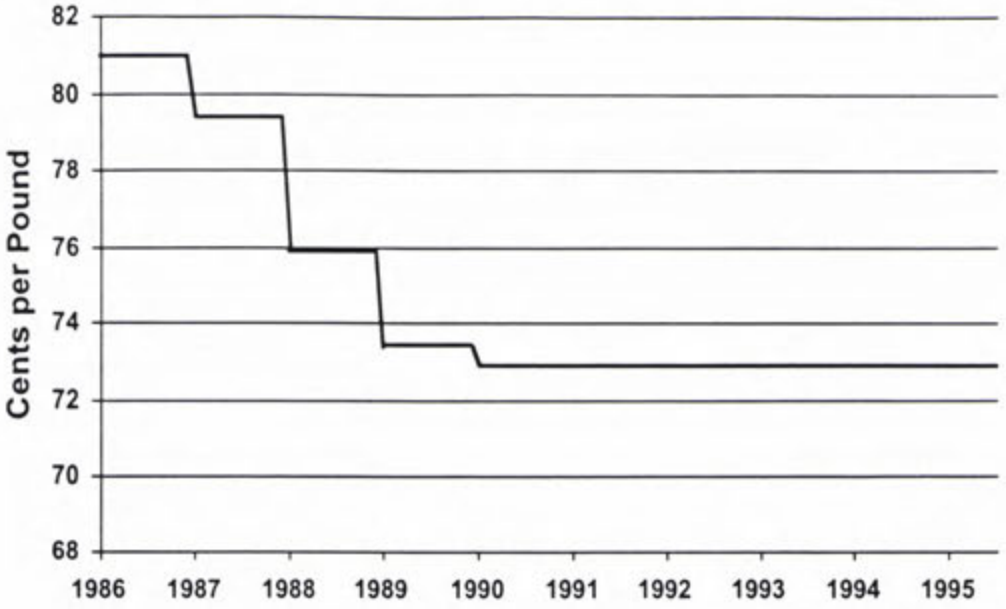


Figure ES.6. Target Price for Cotton



The structural/econometric model approach emphasizes the theoretical description of behavioral relations that impose identifying restrictions on model specification. The time-series approach focuses on reduced-form estimation with few parameter restrictions and does not attempt structural interpretation of data. This two-track approach is especially innovative in terms of project design. Results based on the same data set generated from two distinctly different modeling procedures validates the modeling approach and findings.

Because the Cotton Research and Promotion Program has several dimensions, it is necessary to analyze them as separate components. To account for carryover effects, indigenous to any evaluation of the promotion and research program, we rely on the use of a polynomial inverse lag (PIL) procedure in the econometric/structural model. The attractive features of the PIL include:

- A flexible representation of the lag structure allowing both humped and monotonically declining lag weight distributions
- A parsimonious representation of the lag structure
- No requirement of a fixed lag length
- No imposition of endpoint restrictions

The estimation of the PIL involves a search for the polynomial degree using a series of nested OLS regressions. Based on Monte Carlo work, the PIL outperforms other popular distributed lag models (e.g., the Almon lag). To complement the structural/econometric approach, we use a time-series model to assess the direction of causality and timing of response. The focus of the time-series approach is the dynamic or lagged response nature of such relationships.

V. DATA

Monthly data from January 1986 to July 1995 is used in the study. Attention is centered on this period for the following reasons:

(1) **Empirical analysis rests on the use of monthly data** to provide a sufficiently large sample size to carry out statistical analyses; while data on most variables indigenous to the analysis were available on a monthly basis prior to 1986, monthly data pertaining to promotion and research expenditures, considered as key variables in this study, were only available back to 1986.

(2) **A dramatic shift in agricultural policy occurred** with the introduction of the marketing loan provisions of the 1985 Food Security Act. The Act was geared to provide greater market orientation and more international competition. The legislation intended to transfer the domestic price support from a rigid loan rate to a formula-based competitive adjusted world price. Prior to the 1985 Food Security Act, the non-recourse loan rate had set the officially-recognized price floor for the U.S. market, which at times was substantially higher than the world market price. The marketing loan program was implemented in August 1986 with the 1986 cotton crop. With a focus on the period 1986 to 1995, we subsequently eliminate concerns about structural shifts in agricultural policy. As a result, this ten-year interval constitutes a relatively homogeneous period for empirical analysis in terms of the absence of salient structural shifts.

Over the period 1986 to 1995, growth was evident in exports, imports, mill consumption, farm-level demand and domestic consumption of cotton (see Figures ES.7 - ES.12):

Figure ES.7 U.S. Exports of Raw Cotton

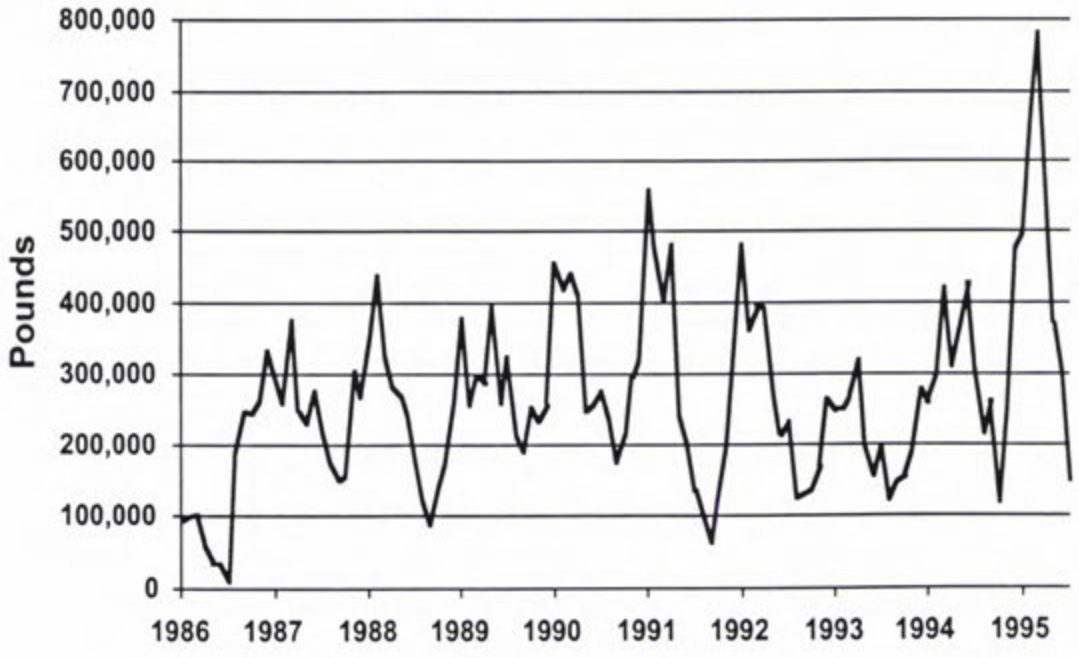


Figure ES.8. U.S. Imports of Raw Fiber Equivalent of Cotton

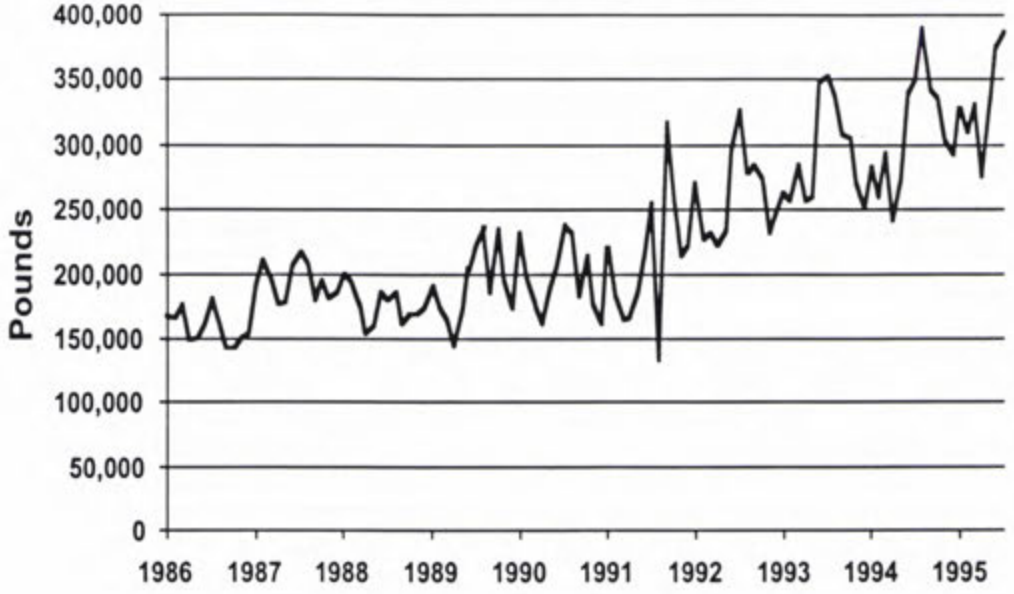


Figure ES.9. Monthly Mill Use of Cotton

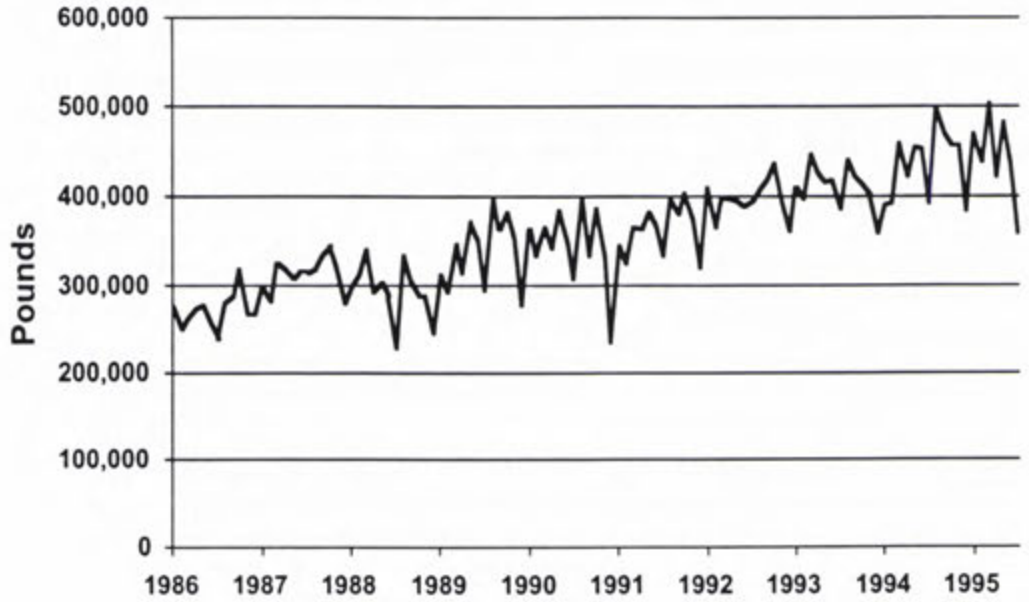


Figure ES.10. U.S. Net Imports of Raw Fiber Equivalent of Cotton

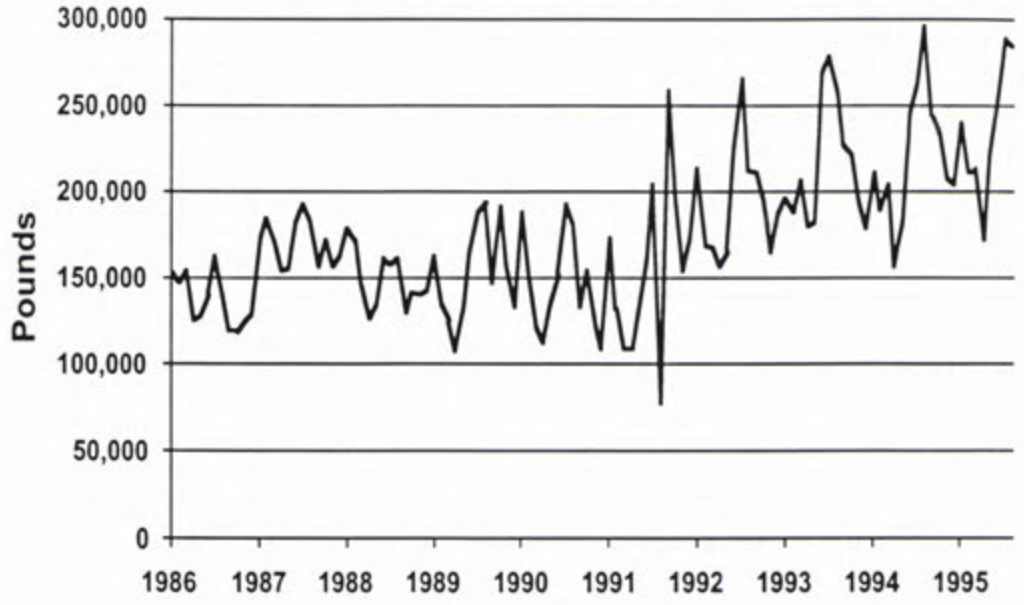


Figure ES.11. Farm-Level Demand for U.S. Cotton

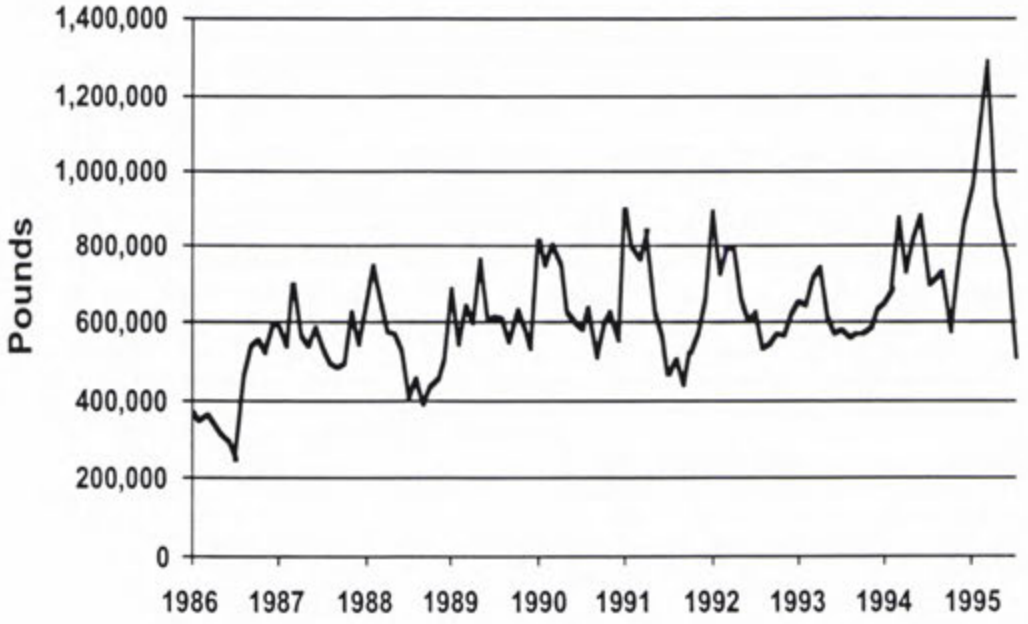
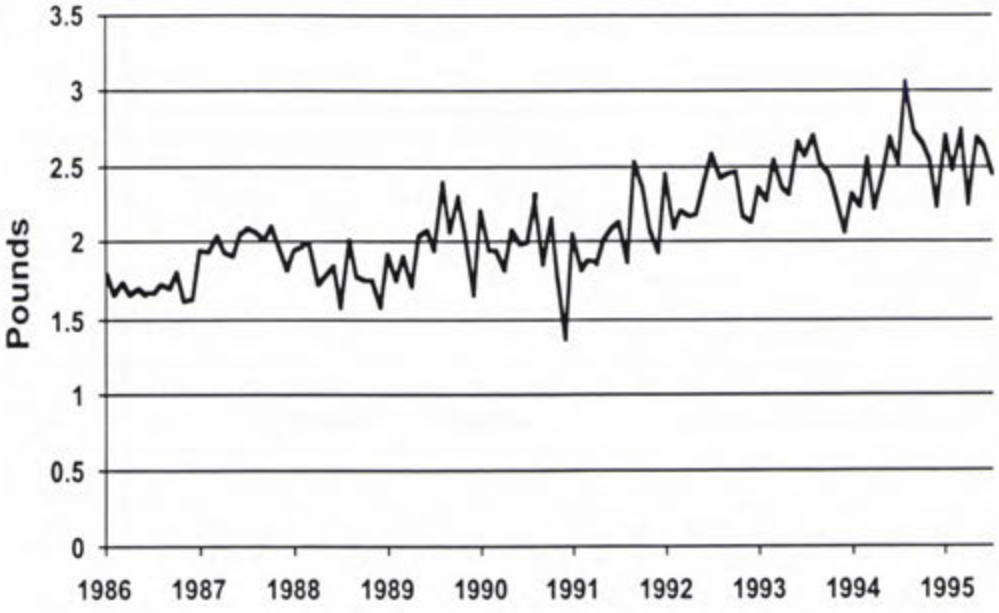


Figure ES.12. Domestic Consumption Per Capita of Cotton



In terms of market share, the 1986 to 1995 period was favorable to cotton but not for man-made fibers or for wool, as exhibited in Table ES.3:

Table ES.3 U.S. Fiber Consumption: Total & Per Capita, by Type of Fiber

Year and Fiber	U.S. Mill Use	Percent of Fibers	Textile Trade (a) Exports	Textile Trade (a) Imports	Total Domestic (b) Consumption	Percent of Fibers	Per Capita Mill Use	Per Capita Domestic Consumption	Per Capita Net Imports
	Million Pounds	Percent	Million Pounds			Percent	Pounds		
COTTON									
1986	3254.6	26.6	274.8	1910.5	4890.3	31.0	13.5	20.3	6.8
1987	3753.2	29.0	298.0	2335.7	5790.9	33.7	15.4	23.9	8.5
1988	3482.3	27.1	325.3	2118.8	5275.8	32.0	14.2	21.5	7.3
1989	4046.0	30.2	467.2	2304.8	5883.6	34.7	16.3	23.8	7.5
1990	4115.3	31.0	624.8	2370.2	5860.7	35.4	16.3	23.5	7.2
1991	4347.5	32.0	669.4	2556.6	6234.7	37.3	17.2	24.6	7.4
1992	4761.6	32.5	793.7	3145.7	7113.4	38.1	18.6	27.8	9.2
1993	4937.7	32.3	915.5	3523.8	7546.0	38.5	19.1	29.3	10.2
1994	5230.6	32.5	1069.0	3737.6	7899.2	38.0	20.1	30.4	10.3
1995*	2750.9	33.3	658.9	1998.0	4090.0	38.8	---	---	---
	* data for the first 6 months								
WOOL									
1986	136.7	1.1	16.0	275.6	396.3	2.5	0.6	1.6	1.0
1987	142.8	1.1	23.5	276.1	395.4	2.3	0.6	1.6	1.0
1988	144.2	1.0	30.7	248.7	350.7	2.1	0.5	1.4	0.9
1989	134.7	1.0	66.3	222.3	290.7	1.7	0.5	1.2	0.7
1990	132.7	1.0	59.6	205.8	278.9	1.7	0.5	1.1	0.6
1991	151.5	1.1	63.3	210.9	299.1	1.8	0.6	1.2	0.6
1992	150.8	1.0	72.2	237.4	316.0	1.7	0.6	1.2	0.6
1993	156.8	1.0	77.6	260.5	339.7	1.7	0.6	1.2	0.6
1994	153.3	0.9	91.6	309.6	371.3	1.8	0.6	1.4	0.8
1995	80.0	1.0	53.3	146.0	172.7	1.6	---	---	---
	* data for the first 6 months								
MAN-MADE FIBERS									
1986	8852.0	72.3	519.3	1703.0	9835.7	62.4	35.8	40.7	4.9
1987	9047.9	69.7	591.9	1805.4	10261.4	59.7	37.1	42.1	5.0
1988	9217.3	71.6	681.6	1758.9	10285.2	62.1	37.4	41.8	4.4
1989	9217.6	68.0	1060.5	1715.7	9872.8	58.7	37.3	39.9	2.6
1990	9047.0	67.3	1339.3	1750.4	9458.1	57.9	36.2	37.8	1.6
1991	9092.2	66.3	1400.1	1769.0	9461.1	56.8	36.0	37.5	1.5
1992	9730.9	66.0	1418.8	2126.5	10438.6	56.3	38.1	40.9	2.8
1993	10160.6	66.1	1388.1	2221.2	10993.7	56.1	39.4	42.6	3.2
1994	10732.3	66.1	1448.1	2530.0	11814.2	56.6	41.2	45.3	4.1
1995*	5371.9	65.0	753.7	1279.4	5897.6	55.9	---	---	---
	* data for the first 6 months								

(a) Raw fiber - equivalent of imports and exports of textile products. (yarn, thread, and fabric; apparel; house furnishings)
(b) U.S. Mill Consumption plus net textile products trade balance

Cotton
(on a per capita basis)

- Domestic consumption rose from 20 to 30 pounds over the 1986 to 1995 period.
- U.S. mill consumption rose from 13.5 to 20 pounds.
- Net imports rose from 6.8 to 10.3 pounds.
- The share of total fiber consumption went from 31 percent in 1986 to about 39 percent in 1995 (counting both U.S. mill use and net imports).
- The share of retail apparel and home furnishings attributable to cotton rose from 41 percent in 1986 to 62 percent in 1995.

Man-Made Fibers
(on a per capita basis)

- Domestic Consumption of man-made fibers ranged from 37.5 pounds to 45.3 pounds.
- U.S. mill consumption ranged from 35.8 pounds to 41.2 pounds.
- Net imports ranged from 1.5 pounds to 5.0 pounds (all on a per capita basis).
- The share of fiber consumption for man-made products fell from 62 percent to 56 percent over the 1986 to 1995 period (counting U.S. mill use and net imports).
- The market share for wool over this period fell from 2.5 percent to 1.6 percent.

VI. IMPACTS ON DOMESTIC CONSUMPTION

Research and Promotion significantly and positively impact cotton consumption after a delay of 8 to 9 months, and after accounting for other factors. The short-run elasticity due to promotion efforts is 0.0367, and the short-run elasticity due to research efforts is 0.0771. These elasticities, calculated at the sample means of the data, are consistent with those from similar studies, as exhibited in Table ES.4:

Table ES.4. Studies That Discuss Effects of Generic Advertising on Commodity Sales/Consumption

COMMODITY/STUDY	PROMOTION PERIOD	GENERIC ADVERTISING ELASTICITIES
Fluid milk		
USDA	1984-86	0.010
Ward and McDonald	1976-83	0.009
Warmen and Stief	1978-89	0.018 to 0.046
Beef		
Kinnucan, et al	1976-91	0.003
Brester and Schroeder	1970-93	0.006
Cranfield and Goddard	1971-91	0.011
Fats and Oils		
Butter: Chang and Kinnucan	1973-76	0.023
Margarine: Chang and Kinnucan	1973-76	0.006
Shortening: Chang and Kinnucan	1973-76	0.006
Miscellaneous		
Orange Juice: Ward	1978-88	0.027
Eggs: Chyc and Goddard	1974-88	0.007
Avocados: Carman and Green	1961-90	0.150
Wool: Dewbre, *et al*	1974-85	0.070

The impact of research efforts is twice that of promotion efforts. The respective patterns resemble a geometric lag process, where the impacts are greatest early on and subsequently diminish monotonically over time. The mean lag, or the average amount of time necessary to bring about changes in cotton consumption due to promotion and research efforts, is about two months after the initial 8 to 9 month delay.

Promotion and Research Expenditures also influence cotton prices at the mill level. This influence approximates two to two and a half cents per pound prior to 1992 and from three to five cents per pound from 1992 to 1995. Promotion and research expenditures result in an approximate .10 pound per capita per month increase in consumption prior to 1992 while in the post 1992 period, the increase approximates .20 pounds per capita per month.

A ten percent change in promotion expenditures, after a delay of eight months, results in a 0.36 percent change in domestic per capita cotton consumption. To put this result in perspective, the average level of real seasonally-adjusted promotion expenditures per

month is $1.15 million, over the period 1986 to 1995. A ten percent change of $115,000 translates to a 2 million pound change in cotton consumption in the short-run.

A ten percent change in research expenditures, after a delay of nine months, leads to a 0.77 percent change in domestic per capita cotton consumption. Given that the average level of real seasonally-adjusted research expenditures is $382,000 per month, a ten percent change in this figure is $38,200. This ten percent change of $38,200 in research expenditures translates to a 4 million pound change in cotton consumption in the short-run.

OTHER INFLUENCES

- **Seasonality** is a key determinant of cotton consumption. Cotton consumption is higher in all months relative to the December base or reference month. For example, consumption is highest in January, June, August and October and is 20 to 25 percent higher, relative to December. Consumption is higher by 7 to 18 percent relative to December in all other months.

  The own-price elasticity at the mill level is estimated to be -.1655, statistically different from zero. Previous studies have estimated the price elasticity of demand for cotton between -0.1 and -0.3. Holding all other factors constant, a 10 percent change in mill price leads to a 1.6 percent change in domestic consumption per capita in the opposite direction. This price effect occurs after a lag of 13 months. This lag is consistent with previous studies and is essentially attributable to forward contracting in which distributors and retailers contract for cotton fiber twelve months or more prior to delivery.

- **Rayon and Polyester Prices**, after a lag of 13 months, exert a statistically significant influence on cotton consumption. The cross-price elasticity of cotton with respect to rayon is 2600, indicating that rayon is a substitute for cotton. On the other hand, the cross-price elasticity of cotton with respect to polyester is -.5479, indicating that polyester and cotton are complements. This situation perhaps reflects the blending of cotton and polyester in textiles.

- **Wages** are a significant factor of the domestic consumption of cotton after a lag of 13 months. A one percent change in real wages leads to a three percent change in cotton consumption in the opposite direction. Neither the price of energy nor the price of material inputs has a statistically discernible effect on cotton consumption.

- **U.S. and Rest-of-World Beginning Stocks of Cotton** are determinants of domestic consumption of cotton. A ten percent change in U.S. beginning stocks leads to a 0.70 percent change in domestic cotton consumption, whereas a ten percent change in rest-of-world beginning stocks, after a lag of two months, results in a 2.1 percent change in domestic cotton consumption.

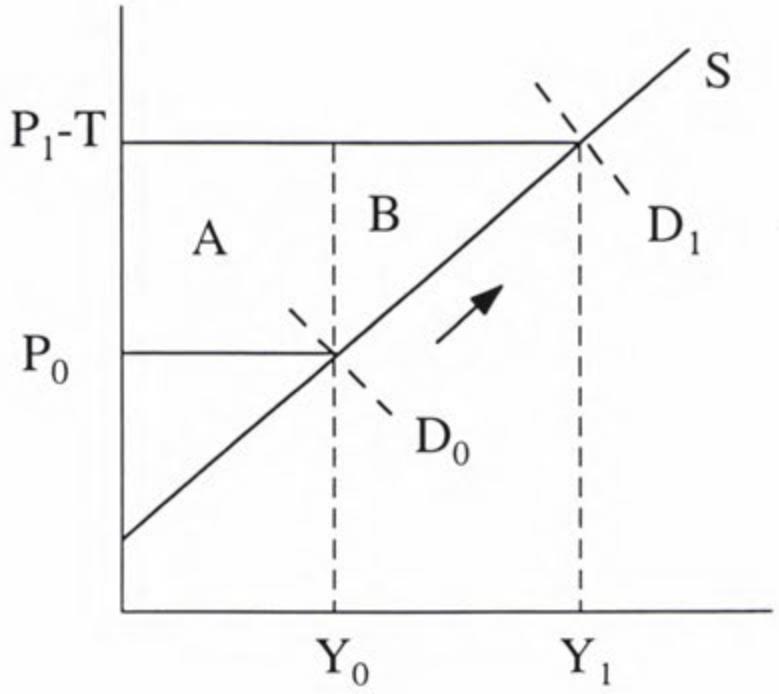
- **The A Index** (a measure of the world price of cotton) also is a determinant of domestic cotton consumption after a lag of two months. A ten percent change in this world price measure leads to a 4.0 percent change in U.S. per capita cotton consumption, holding all other factors constant. This positive relationship is presumably due to the substitutability of U.S. cotton with foreign cotton. Neither U.S. income nor rest-of-world income is a statistically important factor in domestic cotton consumption.

VII. RATE OF RETURN BASED ON DOMESTIC CONSUMPTION

While our analysis shows that promotion and research expenditures significantly affect cotton consumption and cotton price at the mill level, the major issue is the level of returns. The return to the cotton checkoff program is calculated through the ratio of cumulative net returns to cumulative assessments. Separate calculations are presented using the structural/ econometric modeling approach and the time-series modeling approach.

Derivation of the expression to represent the gain in net returns associated with a rightward shift in the demand curve for cotton, induced by the promotion/research program, can be facilitated by the use of Figure ES.3.:

Figure ES.13 Diagram to Facilitate Rate of Return Calculations



The gain in net returns is represented by the sum of the areas of rectangle A and triangle B. In Figure ES.13:

- Y_0 corresponds to domestic consumption of cotton per capita at the base level of real promotion and research expenditures
- Y_1 corresponds to domestic consumption of cotton per capita at the actual level of real promotion and research expenditures
- P_1 - T corresponds to a real price on a raw fiber equivalent basis of cotton at the actual level of real promotion and research expenditures, after allowance for assessment
- P_0 corresponds to the real price on a raw fiber equivalent basis of cotton at the base level of real promotion and research expenditures.

Due to the use of lagged variables in both approaches, it is only possible to calculate rates of return from January 1988 to July 1995. In addition, two different kinds of checkoff programs were in place during this period. For the January 1988 to July 1991 period, domestic producers could ask for a refund on assessments, and importers were free riders. For the August 1991 to July 1995 period, refunds were discontinued and importers could no longer be free riders. Consequently, we report rates of return for the entire period from January 1998 to July 1995 as well as for the periods January 1988 to July 1991 and August 1991 to July 1995. A summary of the rate of return calculations based on domestic consumption of cotton is given in Table ES.5:

Table ES.5. Summary of Rate of Return Calculations Based on Domestic Consumption of Cotton

	Structural Model	Time-Series Model
With Actual Expenditures versus Without Any Expenditures		
Scenario 1:		
1/88 to 7/91	2.24	2.44
8/91 to 7/95	8.14	7.12
1/88 to 7/95	5.95	5.38
With Actual Expenditures versus Projected Expenditures from Initial Period		
Scenario 2:		
8/91 to 7/95	2.50	2.19
With Projected Expenditures from Initial Period versus Without Any Expenditures		
Scenario 3:		
8/91 to 7/95	4.46	5.29
1/88 to 7/95	3.64	4.22

The change in cotton consumption with and without the checkoff program must be considered as well as the change in mill price with and without the checkoff program. So, we consider actual promotion and research expenditures made by Cotton, Inc., as compared with the absence of any promotion and research expenditures. The checkoff program over the period January 1988 to July 1995 yields a rate of return between 5.38 (from the time-series model) and 5.95 (from the structural/econometric model). Over the period January 1988 to July 1991, the rate of return is lower, in a bracket from 2.24 to 2.44. During the period August 1991 to July 1995, the rate of return is in a bracket from 7.12 to 8.14. The results, therefore, indicate that both checkoff programs were effective in the stimulation of mill use and net imports; however, the latter program, as part of the Cotton Research and Promotion Amendments Act of 1990, was even more effective than the earlier program.

We wish now to consider the following two scenarios, with a focus only on the August 1991 to July 1995 period:

(1) **The First Scenario** deals with the rate of return to the checkoff program if actual promotion and research expenditures are compared over this period to the promotion and research expenditures that would have existed without modification in the program. Accordingly, it is necessary to make projections of the promotion and research expenditures from the January 1988 to July 1991 period to the August 1991 to July 1995 period, through the use of a trend extrapolation model. The dependent variable in the model corresponds to the logarithm of the sum of real seasonally-adjusted promotion and research expenditures. The regressors correspond to a twelfth-order autoregression of the dependent variable plus linear and quadratic trend terms. On the basis of this specification, data are used from the period January 1986 to July 1991 to make projections of the total promotion and research expenditures for the period August 1991 to July 1995. Forecasts of promotion and research expenditures from this total are obtained by multiplying the total by .73491 and .26509, respectively. These factors correspond to the share of total expenditures for promotion and research over the period January 1986 to July 1991.

    On average, the projected expenditures correspond to roughly 40 percent of the actual expenditures. This projection is reasonable, given that the Cotton Research and Promotion Amendments Act of 1990 led to a change in the CI budget from $18 to $22 million to $43 to $55 million. We calculate a rate of return of current expenditures versus projected expenditures over the period August 1991 to July 1995 to range from 2.19 (from the time-series model) to 2.50 (from the structural/econometric model).

(2) **The Second Scenario** considers the rate of return for the period August 1991 to July 1995 for the case of projected expenditures from the initial period versus no program expenditures at all. The rate of return for this period falls in a bracket of 4.46 (structural/econometric model) to 5.29 (time-series model). During the entire period January 1988 to July 1995, the rate of return ranges from to 3.64 (structural/econometric model) to 4.22 (time-series model).

    Based on the elimination of free riders (importers and nonparticipant domestic farmers), the rate of return is greater than without the elimination of free riders. As exhibited in Table ES.6, the rates of return for the checkoff program are in the interval established by studies done for other commodities. For example, Ward and Lambert found that in the beef industry, checkoff program yielded a return of about 5.7 to 1. Based on this conclusion, our estimates of rates of return are not unreasonable. Our estimates are deemed to be robust because only negligible differences exist between the structural/econometric model and the time-series model. In addition, the estimated rates of return are upper bounds due to the fact that they are based on short-run (monthly) responses to promotion and research.

Table ES.6. Returns to Generic Commodity Promotion in the United States

COMMODITY/STUDY	REVENUE PER $ INVESTED
Milk Fluid Only	
Liu, *et al*	7.04
Ward and McDonald	1.85
Milk Fluid and Manufactured	
Liu, *et al*	4.77
Kaiser, *et al*	2.04
Milk and Cheese	
Kinnucan and Forker	11.29
Meat	
Beef (U.S.) — Ward	5.74
Catfish	
Kinnucan	0.57-1.30 (short run) 0.17-0.57 (long run)
Soybeans and Products	(export)
Williams	14.00
Orange Juice	
Lee and Fairchild	2.28
Grapefruit Juice	
Lee	10.44
Apples	
Ward and Forker	6.74
Australian Wool	
Dewbre, *et al*	1.94

CI conducted a rate-of-return analysis of the checkoff program over the time period 1975 to 1992. Their study also defined cotton consumption as the sum of mill consumption plus net imports of yarns, fabrics, and finished goods. No formal econometric or time-series models were used. CI simply calculated the cumulative difference between the actual level of consumption for cotton and a hypothetical level arrived at under the assumption that the market share for cotton would have continued to decline until 1985, and it would have stabilized thereafter at a 25-percent share after 1985. Under this scenario, the rate of return calculated by CI was estimated to be 3 to 1. The key assumptions in the analysis conducted by CI were:

(1) The market share for cotton would have continued to decline after 1975 if research and promotion activities had not been initiated.

(2) The efforts of CI were totally responsible in affecting cotton's market share of total fiber consumption. Our analysis does not hinge on these assumptions.

Up to this point, neither the structural/econometric model nor the time-series model provides sufficient detail to investigate the distribution of the benefits of the checkoff program. By definition, domestic consumption of cotton lumps net imports with domestic mill use. Although we show that there exists a positive link between promotion/research and consumption, it is not possible to say whether the increase in consumption comes in the form of increases in net imports, mill use, or both. Without this information, it is impossible to determine the degree to which domestic producers or importers benefit from the promotion/research effort. To this end, we investigate the impacts of promotion and research expenditures on domestic producers and importers.

VIII. IMPACTS ON DOMESTIC PRODUCERS

Research and Promotion have significant impacts on the farm-level demand for cotton after a 12 to 14 month delay, accounting for other factors. The impact of research efforts is almost twice that of promotion efforts. The respective patterns resemble a geometric lag process, where the impacts are greatest early on and subsequently diminish monotonically over time. The mean lag, or the average amount of time necessary to effect changes in cotton consumption, due to promotion and research efforts, is about two months after an initial 12 to 14 month delay.

Promotion and Research Expenditures exert positive influences on farm price and farm-level demand.

- The average impact on farm price is about 0.30 cents per pound prior to 1992, but 1.30 cents per pound from 1992 to 1995.
- The average impact on farm-level demand is about 2.4 million pounds per month higher prior to 1992, but 9.8 million pounds per month higher from 1992 to 1995.

Promotion Programs significantly affect the farm-level demand for cotton after a twelve-month delay. The short-run elasticity due to promotion efforts is 0.0631. A ten percent change in promotion expenditures results in a 0.63 percent change in farm-level demand for cotton. The average level of real seasonally-adjusted promotion expenditures per month is $1.15 million, over the period 1986 to 1995. A ten percent change of $115,000 in the measure of promotion expenditures translates to a 4 million pound change in cotton consumption in the short-run.

Research Programs significantly influence farm-level demand for cotton after a fourteen-month delay. The short-run elasticity due to research efforts is 0.1034. A ten percent change in research expenditures leads to a 1.03 percent change in farm-level demand for cotton. Given that the average level of real seasonally-adjusted research expenditures is $382,000 per month, a ten percent change in this figure is $38,200, which translates to a 6 million pound change in farm-level demand in the short-run.

OTHER INFLUENCES

- **Wages and the Price of Energy**, after a lag of 13 months, exert a positive influence on the farm-level demand for cotton. The price of materials is not a statistically significant factor of cotton demand at the farm level.
- **Both U.S. and Rest-of-World Beginning Stocks of Cotton** are determinants of farm-level demand for cotton. A ten percent change in U.S. beginning stocks leads to a 1.3 percent change in farm-level demand; a ten percent change in rest-of-world beginning stocks after a lag of two months, gives rise to a 2.2 percent change in farm-level demand.
- **The A index**, (a measure of the world price of cotton), is also a key factor of farm-level demand for cotton, after a lag of two months. A ten percent change in the A index leads to a 7.6 percent change in cotton demand at the farm level. In addition, rest-of-world income, but not U.S. income, is a statistically important factor in farm-level demand. A one percent increase in rest-of-world income gives rise to a three percent increase in cotton demand at the farm level. This result is presumably due to U.S. exports of raw cotton.

- **Seasonality** is a key factor of farm-level demand for cotton. Farm-level demand for cotton is highest (20 to 33 percent higher) in the first four months of the year; relative to December. Farm-level demand for cotton is lowest (12 to 17 percent lower) from July to October, relative to December.

Neither the mill price of cotton nor the price of polyester are significant determinants of farm-level demand. However, the price of rayon, after a lag of 13 months, is a key determinant of the demand for cotton at the farm level. Assuming rayon prices rise by 1 percent, farm-level cotton demand also rises by 1 percent, all other factors held constant.

IX. IMPACTS ON IMPORTERS

Research and Promotion have significant impacts on cotton imports after a delay of 8 to 9 months, and after accounting for other factors. The impact of research efforts is three times that of promotion efforts. The respective patterns resemble a geometric lag process, where the impacts are greatest in early stages and subsequently diminish monotonically over time. The mean lag due to promotion and research efforts is about two months after the initial 8 to 9 month delay.

Promotion and Research Expenditures exert positive influences on cotton imports and the A index:

- Cotton imports, on average, are roughly 120,000 pounds higher per month prior to 1992, but about 640,000 pounds higher per month after 1992.
- The impact on the A index is roughly 0.38 cents per pound prior to 1992, but about 1.70 cents per pound higher after 1992.

Promotion Programs significantly affect cotton imports after an eight-month delay. The short-run elasticity due to promotion efforts is 0.0472. Accordingly, a ten percent change in promotion expenditures, after a delay of eight months, gives rise to a 0.47 percent change in cotton imports. The average level of real seasonally-adjusted promotion expenditures per month is $1.15 million, over the period 1986 to 1995. A ten percent change of $115,000 in this measure of promotion expenditures translates to a 1 million pound change in cotton imports in the short-run.

Research Programs significantly influence cotton imports after a nine-month delay, holding all other factors constant. The short-run elasticity due to research efforts is 0.1275. A ten percent change in research expenditures, after a delay of nine months, leads to a 1.27 percent change in cotton imports. Given the average level of real seasonally-adjusted research expenditures is $382,000 per month, a ten percent change of $38,200 translates to a 3 million pound change in short-term cotton imports.

OTHER INFLUENCES

- **U.S. Income** exerts a positive influence on the level of cotton imports after a lag of 14 months. The income elasticity is .139; as a result, a 10 percent increase in real U.S. income leads to a 1.4 percent increase in the volume of imports of cotton.
- **Seasonality** is a key factor of imports of raw fiber equivalent cotton products. Imports are highest in January, June, July, August, September and October and are 14 to 27 percent higher relative to December. Imports of cotton are lowest in April and are 6 percent lower relative to December.

X. RATE OF RETURN CALCULATIONS FOR DOMESTIC PRODUCERS AND IMPORTERS

Earlier we estimated rates of return for the cotton checkoff program based upon the domestic consumption. Cotton consumption, in this regard, is defined as the sum of mill consumption plus net imports of yarns, fabrics, and finished goods. As such, the rate of return calculations were at the mill level. However, mills do not fund the checkoff program, domestic producers and importers (retailers) do. Therefore, to bring our analysis to closure, it is worthwhile to estimate a farm-level rate of return as well as a rate of return to importers. We calculate the return to the cotton checkoff program through the ratio of cumulative net returns to cumulative assessments. Up to August 1992, domestic producers were the sole contributors to the checkoff program. After July 1992, both domestic producers and importers were participants in the checkoff program. On average, the share of assessments was 75 percent for domestic producers and 25 percent for importers. We also present separate calculations using the structural/econometric modeling approach and the time-series modeling approach. Because of the use of lagged variables in both approaches, it is only possible to calculate rates of return from January 1988 to July 1995.

XI. RATE OF RETURN TO DOMESTIC PRODUCERS

When computing a farm-level rate of return, agricultural policy interventions (marketing loan and target price programs) must be considered. Assuming the promotion/research effort does not push the market price above the target price, benefits to program producers are zero. Under this set of conditions, the primary beneficiaries of the checkoff program with a binding support price are non-program producers and taxpayers. However, with the 1996 FAIR Act, the target price program has been eliminated.

As a result, the change in farm-level demand with and without the checkoff program must be considered, as well as the change in prices received by farmers with and without the checkoff program. Accordingly, actual promotion and research expenditures made by Cotton, Inc., are considered against the absence of any promotion and research expenditures.

Results indicate that domestic producers clearly benefit from the current program, under the auspices of the Cotton Research and Promotion Amendments Act of 1990. The checkoff program over the period January 1988 to July 1995 yields a rate of return between 1.70 (structural/econometric model) and 1.57 (time-series model) for domestic producers, as exhibited in Table ES.7:

Table ES.7. Rate of Return Calculations for Domestic Producers

	STRUCTURAL MODEL	TIME-SERIES MODEL
	with actual expenditures versus without any expenditures	
1/88 to 7/91	-0.73	-0.69
8/91 to 7/95	3.49	3.23
1/88 to 7/95	1.57	1.70

A return of between $1.57 and $1.70 is evident for each $1 of assessments. During the period January 1988 to July 1991, the rate of return is negative, in a bracket from 0.69 to -0.73. This result is due to the fact that, on average, the change in prices received by farmers is only 0.28 cents per pound; this increment in price is not sufficient to cover the assessment, which on average amounts to almost 0.50 cents per pound. However, over the period August 1991 to July 1995, the rate of return is in a bracket from 3.23 to 3.49.

XII. RATE OF RETURN TO IMPORTERS

The change in imports with and without the checkoff program as well as the change in prices received by importers with and without the checkoff program must be considered. Since importers were not part of the checkoff program until the passage of the Cotton Research and Promotion Amendments Act of 1990, the only time period germane to this analysis is August 1991 to July 1995. In addition, assessments were not collected from importers until August 1992, and, as a result, the relevant time period for which to calculate a rate of return to importers is August 1992 to July 1995.

The difficulty in estimating a rate of return for imports is the absence of secondary data pertaining to prices received by importers. A viable proxy for the prices received by importers is found in the CPI Index for Apparel and Upkeep. However, because this variable is an index, this measure cannot be converted in terms of cents per pound. Thus, we cannot directly calculate the change in prices received by importers with and without the checkoff program. Therefore, in this analysis, we make two assumptions about this unobservable price change:

(1) We calculate a rate of return under the assumption that the change in prices received by importers is the same as the change in prices at the mill level, with and without the checkoff program. Relative to July 1991, the average change in price at the mill level over the period of August 1991 to July 1995 is 0.80 cents per pound.

(2) We calculate a rate of return under the assumption that the change in prices received by importers is the same as the change in the A index. The average change in the A index, relative to July 1991, over the period August 1991 to July 1995 is 1.21 cents per pound.

Importers clearly benefit from the Cotton Research and Promotions Amendment Act of 1990. A return of between $3.63 and $5.59 is evident for each $1 of assessments. Based on alternative scenarios of the change in prices received by importers, the checkoff program yields a rate of return between 3.63 and 4.94 according to the structural/econometric model and between 4.33 to 5.59 according to the time-series model, as exhibited in Table ES.8:

Table ES.8. Rate of Return Calculations for Importers for the Time Period 8/92 to 7/95

SCENARIO	STRUCTURAL/ ECONOMETRIC MODEL	TIME-SERIES MODEL
(1) Change in prices received by importers equal to change in prices at mill level	3.63	4.33
(2) Change in prices received by importers equal to change in prices	4.94	5.59

Importers and domestic producers benefit from the Act of 1990. However, the rate of return from the checkoff program is greater for importers than for domestic producers; over the period August 1992 to July 1995, the rate of return to importers is 3.63 to 5.59. Over the period August 1991 to July 1995, the rate of return to domestic producers is 3.23 to 3.49. However, the estimated rates of return for both groups are upper bounds due to the fact that they are based on short-run (monthly) responses to promotion and research.

XIII. CONCLUDING REMARKS

The econometric models capture appropriately the structural behavioral relationships pertaining to domestic consumption; farm-level demand and imports of cotton. The goodness-of-fit of the structural/econometric models for domestic consumption, farm-level demand, and imports is 86 percent, 80 percent, and 87 percent, respectively. The models also show no evidence of specification bias or structural change. Consequently, the omission of branded advertising and cross-promotional effects does not lead to bias in the estimated coefficients of the structural/econometric models. The time-series model captures the essential dynamics present in the data. The structural/econometric models and the time-series models used in this analysis offer reasonable explanations of domestic consumption of cotton, farm-level demand for cotton, and imports of cotton.

Study results show that promotion and research expenditures, adjusted for inflation and seasonality, stimulate domestic consumption, farm-level demand, and imports of cotton.

Three possible choices can be made in regard to the checkoff program:

(1) Eliminate the program

(2) Return to the original program under the auspices of the Cotton Research and Promotion Act of 1966

(3) Maintain the current program under the auspices of the Cotton Research and Promotion Amendment Act of 1990

According to study results, the most desirable alternative is to maintain the current program.

XIV. LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

While the analysis provides useful information about the cotton checkoff program, inherent limitations may prompt further research, as follows:

(1) Incorporate branded advertising directly into the structural/econometric and time-series models. Rely on the use of Leading National Advertisers (LNA) data in this regard, which summarizes advertising expenditures in the following media:

- Consumer magazines
- Sunday magazines
- Newspapers
- Network, spot, syndication and cable television
- Billboards
- Network and spot radio

While these LNA data are a great source for identifying media occurrences, the information is not without limitations:

- Spot TV monitoring is limited to 80% of the population
- Newspapers and magazines are measured from a limited list
- Trade publications are not measured
- all rate card prices are provided by media sellers so expenditures are often inflated
- All TV rates are based on monthly averages instead of specific telecasts
- Magazine expenditures are based on onetime open rates and do not take into account frequency or negotiation discounts
- There is no independent check on the accuracy of the information

(2) Take into account cross-promotional/research efforts, employing a demand systems approach in lieu of a single-equation approach. However, relevant data for these efforts are not available, as was the case in our study.

(3) Investigate the optimal way to allocate expenditures of the checkoff program, addressing the following: is the current allocation of promotion and research expenditures optimal in the sense of maximizing net returns?

(4) Generic promotion seems to work best in industries where supply is controlled. Existing studies reveal that the more responsive supply is to rising prices, the more likely that the potential returns from generic promotion are at least partially if not totally reduced from increases in supply. Since relatively few studies of the effects of advertising have considered the possibility of a supply response, future research efforts in this area are likely to pay dividends.