THE ECONOMIC EFFECTIVENESS OF THE COTTON CHECKOFF PROGRAM

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ABSTRACT:
This report is an empirical analysis of the effectiveness of the marketing/promotion, non-agricultural research, and agricultural research activities associated with the cotton checkoff program over the period of 1986/87 through 2004/05. The analysis is based on a multi-equation, econometric, non-spatial, price equilibrium simulation model of U.S. and foreign fiber markets using annual data. The key average annual impacts of the cotton checkoff program on U.S. and foreign cotton and man-made fiber markets and their associated textile markets are reported. The results show that the returns to cotton producers as well as to cotton importers from the cotton checkoff program are positive. The average discounted benefit-cost ratios (BCR) for the cotton checkoff program were found to be 5.7 for domestic cotton producers and 14.4 for importers. The higher BCR for importers reflects revenue gains not only from additional sales of cotton fiber textiles but also from additional "spillover" sales of man-made fiber textiles prompted by the cotton checkoff program. The results also show that U.S. taxpayers are better off because the cotton checkoff program has tended to reduce government outlays directed to cotton farmers. The analysis also finds that neither U.S. producers nor importers pay the full cost of the checkoff assessments. Finally, cotton checkoff expenditures on agricultural research were found to have positively and significantly affected U.S. cotton yields with no discernible effects on cotton harvested acreage.

The Texas Agribusiness Market Research Center (TAMRC) has been providing timely, unique, and professional research on a wide range of issues relating to agricultural and agribusiness markets and products of importance to Texas and the nation for thirty-five years. TAMRC is a market research service of the Texas Agricultural Extension Service. The main TAMRC objective is to conduct research leading to expanded and more efficient markets for Texas and U.S. agricultural and food products. Major TAMRC research divisions include International Market Research, Consumer and Product Market Research, Commodity Market Research, and Contemporary Market Issues Research.

THE ECONOMIC EFFECTIVENESS OF THE COTTON CHECKOFF PROGRAM

EXECUTIVE SUMMARY

The cotton and textile industries are particularly important components of the U.S. food and fiber system. As a percent of the gross domestic product, personal consumption expenditures on clothing and accessories are slightly more than three percent. The U.S. cotton industry accounts for more than $40 billion in products and services annually, generating over 440,000 jobs from the farm level to the textile mill level of the marketing chain. In global markets, cotton is a prominent textile fiber. Cotton accounts for over 40% of total world fiber production.

Commodity checkoff programs are primarily government-established efforts to expand demand through collective action by domestic producers. 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 United States. The introduction of polyester and nylon fibers led to a sustained decline in the demand for cotton for all uses beginning in 1960. By 1966, the decline in cotton demand had progressed to the point that Congress intervened, passing the Cotton Research and Promotion Act (CRPA) of 1966 (PL89-502) establishing the Cotton Board and the Cotton Checkoff Program in an effort to arrest the erosion of consumer demand for cotton. The legislative intent of the CRPA and of the Cotton Research and Promotion Amendments Act (CRPAA) of 1990 was to authorize and enable the establishment of an orderly procedure for the development of "an effective and coordinated program of research and promotion." The design of both Acts was to strengthen the competitive position of cotton vis-à-vis primarily man-made fibers and to expand domestic and foreign markets and uses for U.S. cotton.

From 1967 to 1991, all domestic producers were required to pay cotton checkoff assessments. However, the 1966 Act allowed producers to request a refund. Over the period 1967 to 1991, up to one-third of the assessments collected were refunded. The CRPAA, enacted by Congress in November 1990 under Subtitle G of Title XIX of the Food, Agriculture, Conservation and Trade Act of 1990, contained two provisions amending funding procedures of the CRPA: (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 and (2) the right of cotton producers to demand a refund of assessments was terminated. Since July 31, 1992, an assessment of one dollar per bale plus a fractional percentage of value (specifically five-tenths of one percent) is collected by first handlers on domestically produced (raw) cotton, imported (raw) cotton, and the cotton content of imported textile and apparel products.

Between 1986 and 1991, about 65% of the cotton assessments collected (from $18.3 million up to $28.6 million in nominal terms over that period) was available for funding cotton checkoff activities and the remaining 35% was refunded on average each year. By eliminating refunds, the 1990 amendments to the CRPA contributed to a substantial increase in annual cotton checkoff collections from $42 million in 1992 to $66 million in 2004.
Since the CRPAA was implemented in the early 1990s, contributions by importers have grown to $25 million while contributions by producers have grown from about $30 million to $41 million. Early on, importer assessments accounted for about 30% of total collections with

producers paying the other 70%. Over time, however, the producer share has dropped reaching about 62% of total collections in 2004 while the importer share has increased to about 38%.

Using the collected checkoff assessments, Cotton Incorporated (CI) finances a wide variety of research and promotion activities which can be grouped into four categories: (1) marketing and promotion, (2) agricultural research, (3) textile or non-agricultural research, and (4) administration. The Cotton Incorporated (CI) total annual budget grew from $18.4 million in 1986 to more than $66 million (unadjusted for inflation) in 2004. About 67% of the collected assessments were used to finance marketing and promotion activities in 2004 and 16% to finance non-agricultural textile research activities. Though a larger percentage of the budget goes to marketing/promotion than to textile research and development, that breakdown reflects both the cost of national advertising and program priorities. The remainder was spent on agricultural research activities (13%) and administration activities (5%). Marketing and promotion activities include television advertising campaigns, seasonal promotions, and special public relations programs. Textile research activities include technical processing and production support to mills (e.g., improvements in fiber quality and processing; fabric production; fabric development and ginning technology research) as well as product development and textile development (e.g., wrinkle-free cotton; stretch fabrics; and flame-resistant cotton).

This study is a retrospective economic analysis of the Cotton Checkoff Research and Promotion Program to determine the market results and returns achieved through the investment of the checkoff funds collected by the Cotton Board. Specifically, this study focuses on the answers to the following questions:

- What are the effects of the cotton checkoff program on the demand for raw cotton (mill level) and the demand for cotton fiber textile products (retail level)?
- What are the spillover effects of the cotton checkoff program on man-made fiber markets?
- What are the effects of the agricultural research programs funded by the cotton checkoff program?
- What is the incidence (that is, who pays the cost) of the cotton checkoff assessments on domestically produced cotton and on cotton fiber textile product imports?
- What is the overall return on investment associated with the cotton checkoff program to U.S. cotton producers and importers of cotton fiber textile products?
- What are the implications of cotton checkoff program activities for government cotton program costs?

This report is the third in the series of economic evaluations of the cotton checkoff program and focuses on the period of 1986/87-2004/05. The analysis in this report is an updated and revised version of a comprehensive study of the effects of the cotton checkoff program recently completed by the authors in connection with the legal defense of the program. The analysis is conducted using a multi-equation, econometric simulation model of U.S. and foreign fiber markets originally developed by the Cotton Economics Research Institute (CERI) at Texas Tech University. The model was modified by the authors to account for the programmatic activities of the Cotton Board and, hence, is referred to as the modified CERI model or the MCERI model.
Extensive and fundamentally important advances in the methodology for analyzing the cotton checkoff program were made in this analysis leading to the most accurate, reliable, and

defensible measurement of the impacts and returns from the cotton checkoff program to date. A few of the more salient advances made include the following:

- The MCERI model used in this study is a more formal and structurally comprehensive model than used in previous studies.
- The model also explicitly includes both the raw cotton and man-made fiber markets as well as cotton and man-made fiber textile markets and their extensive market linkages and interrelationships.
- The analysis explicitly measures the "spillover" effects of the cotton checkoff program, that is, the impacts of the program on not only the cotton industry but also the man-made fiber industry.
- The MCERI model also explicitly accounts for the incidence of the checkoff assessments allowing a detailed measurement of the share of the costs of the assessments borne by U.S. producers, importers, foreign producers, foreign mills, and consumers.
- The MCERI model includes detailed representations of the complicated government cotton policy over the years so that the savings to taxpayers in terms of reduced government outlays to cotton farmers over time that are directly attributable to the cotton checkoff program can be measured.
- This study provides the first ever measurement of the impacts of agricultural research funded by the cotton checkoff program on cotton harvested acreages and yields in four production regions across the United States.
- This study provides both discounted and undiscounted average benefit-cost ratios (BCR) for both domestic producers as well as for importers over the period of 1986/87 through 2004/05.
- Because the cotton checkoff program became mandatory in 1992, the BCR analysis is decomposed into two time periods: (1) the "voluntary contribution period" of 1986/87 through 1991/92 and (2) the "mandatory contribution period" of 1992/93 through 2004/05.

The MCERI model functions through the *simultaneous* interaction of supply, demand, trade, and price components across various commodities and regions of the world. The main components of the model include: (1) the U.S. and foreign cotton production; (2) U.S. and foreign man-made fiber production; (3) U.S. and foreign cotton and man-made fiber mill demands; (4) U.S. and foreign demands for cotton textiles and man-made fiber textiles; (5) world trade and price linkages for cotton, cotton textiles, man-made fiber, and man-made fiber textiles; and (6) international trade policy and U.S. government farm policy elements.

According to the simulation analysis conducted with the MCERI model, the key average annual impacts of the cotton checkoff program on world cotton and cotton fiber textile markets over the 1986/87 to 2004/05 period were the following:

- A 4% increase in U.S. cotton production, mostly in western and southeastern states;
- A 2% increase in foreign cotton production;
- A 16% increase in U.S. cotton mill use and a 1% increase in foreign cotton mill use;
- A 7% decline in U.S. cotton exports offset somewhat by a 2% increase in foreign cotton exports;

- A 13% increase in the average annual U.S. cotton farm price, a 14% increase in the U.S. cotton mill price, and a 2% increase in the world price of cotton (A-index);
- A 10 % increase in U.S. consumption of cotton fiber textiles along with a 5% increase in imports of cotton fiber textiles from foreign mills;
- A larger share of the U.S. consumption of cotton fiber textiles being supplied by foreign rather than domestic mills; and
- A 2% decline in the price of cotton fiber textiles.

In U.S. man-made fiber and man-made fiber textile markets, the key average annual impacts of the cotton checkoff program over the entire simulation period (the spillover effects) included:

- A small negative impact on U.S. production of synthetics and cellulosics;
- A 3% reduction in U.S. man-made fiber mill use;
- A 1% decline in the U.S. polyester price;
- A 22% increase in net imports of man-made fiber textiles;
- A 1% decline in U.S. consumption of man-made fiber textiles; and
- A 5 % increase in the price of man-made fiber textiles.

Over the voluntary period of the checkoff program (1986/87-1991/92), the simulation results indicate that the cumulative added net revenues to producers as a result of the cotton checkoff program were $220 million for all cotton producers, roughly $37 million per year and about 0.9% of the farm receipts received by cotton producers, excluding government payments, during that time period. Benefits in terms of added net revenues were positive to non-participants in farm programs and negative for farm program participants during this period. Because farm program participants during that period received deficiency and other government payments, their cotton farm revenues were relatively unaffected by any price increase achieved by the checkoff program. Non-participants in farm programs, however, benefited from the higher farm price of cotton induced by the checkoff program during that period.

During the mandatory period (1992/93-2004/05), in contrast, both participants and non-participants in farm programs benefited from the price increase and demand increase generated by the cotton checkoff program. Cumulative added net revenues for participants in the farm program during the mandatory period were close to $6.1 billion compared to $322 million for non-participants primarily due to the much larger number of participants than non-participants in cotton farm programs. Added net revenues to cotton producers per year were almost $493 million during the mandatory period representing about 10.4% of the farm receipts received by cotton producers during that period, excluding government payments. Over the entire simulation period, the added average annual net revenues to cotton producers were nearly $350 million, about 7.5% of the farm receipts received by cotton producers, excluding government payments.

The calculated undiscounted producer net benefit cost ratios (NBCR) during the voluntary and the mandatory periods of the cotton checkoff program were 0.6 and 9.2, respectively. The discounted NBCRs during those two periods are estimated at 0.5 and 7.5, respectively. Over the entire simulation period, the undiscounted and discounted producer NBCRs were 7.6 and 5.7, respectively. Clearly, cotton producers have benefited from the cotton checkoff program, particularly in the mandatory stage of the program.

During the voluntary period which roughly corresponded to the period when deficiency payments were a major component of government farm policy, the cumulative reduction in government farm program costs due to the cotton checkoff program amounted to slightly less than $1.3 billion. Thus, during the voluntary period, had it not been for the cotton checkoff program, government cotton program costs would have been higher by about $221 million per year, an annual savings of about 22%. In the mandatory period, the cumulative reduction in government expenditures due to the cotton checkoff program amounted to slightly more than $6.5 billion or about $502 million per year, an annual savings of approximately 28%. Over the entire period from 1986/87 to 2004/05, the cumulative savings in government cotton program outlays totaled about $7.8 billion, an annual savings of about $413 million or 27%.

Combining the benefits accruing to domestic producers with the reduction in government outlays associated with the cotton checkoff program gives a total undiscounted BCR of 17.8 over the entire period (13.4 on a discounted basis) at the farm level. Over the voluntary period of the program, the total undiscounted and discounted BCRs were 10.0 and 9.1, respectively. For the mandatory period, the total undiscounted and discounted BCRs were 19.5 and 16.0. respectively. Even after accounting for the sensitivity of the results to changes in key parameters in the model, the conclusion that both cotton producers and taxpayers (in the way of reductions in government outlays) are better off with the cotton checkoff program is still strongly supported by the empirical results.

The cumulative retail sales revenues for cotton fiber textiles attributed to the checkoff program over the period 1992/2004 were nearly $140 billion, about $11 billion per year. The cumulative retail sales revenues for man-made fiber textiles attributed to the checkoff program over the same period were $118 billion, about $9 billion per year. The sum of the cumulative total revenue from retail sales of both cotton and man-made fiber textiles over the simulation period, then, was $258 billion, or nearly $20 billion per year. According to financial data of 18 major apparel and home furnishings retailers, the average pre-tax profits to sales ratio ranged from 4.2% to 6.5% from 1994 to 2003 with a median of roughly 5% over this period. Consequently, the additional profit to the retail textile industry per dollar spent by the Cotton Board was $19.5 undiscounted or $14.4 on a discounted basis. Again, even after accounting for the sensitivity of the results to key model parameters, the analysis clearly demonstrates that importers, like domestic producers, are better of with the cotton checkoff program.

The BCRs for importers are found to be higher than those for producers indicating that importers have benefited more from the cotton checkoff program than have domestic producers on a per dollar invested basis. The higher return to importers is due largely to the spillover effects of cotton checkoff programs at retail to man-made fiber textile markets. That is, importers gained from the cotton checkoff program not only from additional sales of cotton fiber textiles but also from additional related sales of man-made fiber textiles. To put these importer BCR calculations into perspective with the extant literature, Capps et al. (1997) and Murray et al. (2001) found the undiscounted importer BCR to be in the interval of 3.63 to 5.59 and 1.90 to 3.40, respectively. The lower BCRs for importers in these earlier studies are largely explained by the fact that they did not account for the spillover benefits to the retail textile industry in additional man-made fiber textile sales that are captured in this study.

In considering the effects of the cotton checkoff program, the incidence of the assessment, that is, the share of the cost of the assessment paid by the various contributors, must be taken into account. For producers, their assessment is tantamount to an added cost. For importers, their assessment is akin to a tariff. The annual average assessment paid by producers in each year was usually less than 1% of the farm price. The annual average assessment paid by importers was equivalent to about 0.03% to 0.05% of the price received by importers. A comparison of the producer and importer assessments demonstrates that they have not been equal over time. On a per pound of fiber basis, the importer assessment exceeded the producer assessment in every year from 1992 to 2000 except for 1994 and 1995. Since 2001, however, the annual per pound producer assessment has been greater than the importer assessment. On average, the analysis shows that 58% of the producer assessment was borne by U.S. cotton producers with about 42% borne by domestic buyers (mills) and foreign cotton buyers (mills). With respect to the importer assessment, an average of 49% was borne by U.S. cotton fiber textile consumers and roughly 51% by foreign cotton fiber textile sellers.

While this study focuses primarily on cotton checkoff expenditures intended to shift out the mill demand for cotton and the retail demand for cotton fiber textiles, the study also analyzes the cotton production effects of the 13% of cotton checkoff dollars that are spent on agricultural research. The results indicate that over the period of crop years 1977/78-2004/05, cotton checkoff funded agricultural research activities positively and significantly affected yields with no statistically discernible effect on harvested acreage. Over the long-run, percentage changes in yields due to a 1% change in inflation-adjusted agricultural research expenditures were calculated to have varied among U.S. cotton-producing regions from 0.04 in the Dryland Southwest to 0.18 in the Irrigated Southwest. The length of time required for such expenditures to achieve their maximum cumulative effect varied from 6 to 10 years, depending upon the production region.

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This study is a retrospective economic analysis of the Cotton Checkoff Program to determine the market effects and returns achieved through the investment of the checkoff funds collected by the Cotton Board over the years 1986 through 2004. Emphasis is placed on cotton checkoff investments in marketing and promotion activities and textile research (otherwise known as non-agricultural research) activities although investments in agricultural research are also considered.

Specifically, this study focuses on the answers to the following key questions:

- What are the effects of the cotton checkoff program on the demand for raw cotton (mill level) and the demand for cotton fiber textile products (retail level)?
- What are the spillover effects of the cotton checkoff program on man-made fiber markets?
- What are the effects of the agricultural research programs funded by the cotton checkoff program?
- What is the incidence (that is, who pays the cost) of the cotton checkoff assessments on domestically produced cotton and on cotton fiber textile product imports?
- What is the overall return on investment associated with the cotton checkoff program to U.S. cotton producers and importers of cotton fiber textile products?
- What are the implications of cotton checkoff program activities for government cotton program costs?

Before analyzing the answers to these questions, however, this report begins with a brief discussion of the economic structure and government policy interventions in the U.S. cotton and cotton fiber textile industry as background to later discussions of the domestic and world market effects of the cotton checkoff program.

THE U.S. COTTON AND COTTON FIBER TEXTILE INDUSTRY

The U.S. food and fiber system – from the farmer to the consumer – is one of the largest sectors of the U.S. economy, producing output valued at $1,241.7 billion or 11.3% of the gross domestic product (GDP) and employing 23.2 million full-time workers or 16.0% of the total U.S. civilian employment in 2002 (Table 1). The share of the GDP contributed by the food and fiber industry, however, has steadily declined from a high 14.4% in 1993 (Table 1). Similarly, the share of U.S. civilian employment contributed by the agricultural sector has declined from 18.6% to 16.0% over that same period.

The cotton and textile industries are key components of the U.S. food and fiber system. The U.S. cotton industry accounts for more than $40 billion in products and services annually, generating over 440,000 jobs from the farm level to the textile mill level of the marketing chain. From 2002 to 2004, personal consumption expenditures on clothing and accessories accounted for an average of 4.2% of all personal consumption expenditures in the United States (BLS 2006). As a percent of GDP, personal consumption expenditures on clothing and accessories were 3.2% over the same period (BLS 2006). Cotton production alone added $3.1 billion to $5.5 billion annually to the U.S. economy between 2001 and 2004, accounting for 4% to 5% of the total value added to the U.S. economy from all crop production (Census Bureau 2006).

Economic Structure of the U.S. Cotton Industry

The U.S. cotton industry is composed of two interdependent sectors: (1) the cotton sector and (2) the cotton fiber textile sector. The cotton sector includes the supply (production and ginning) and demand (milling and exporting) of cotton, represented by the top portion of the cotton-textile supply chain illustrated in Figure 1. The cotton fiber textile sector includes the supply (milling, manufacturing, and importing) and demand (consumers) for cotton textiles, represented by the lower portion of Figure 1. Note that the milling industry represents the demand side of the cotton sector but the supply side of the cotton fiber textile sector.

U.S. Cotton Production

Since 1965, the U.S. cotton area planted and harvested has ranged from a low of 7-8 million acres to and high of 16-17 million acres and averaged 12.7 million acres and 11.7 million acres, respectively (Table 2). Over the same period, cotton yields ranged from a low of 404 lb/acre in 1980 to 855 lb/acre in 2004 with an average of 574 lb/acre. U.S. cotton production ranged over that period from 3.6 billion lb to 11.2 billion lb and averaged 6.8 billion lb. Farm prices for cotton also varied widely between 1965 and 2004 from 21.8¢/lb to 76.5¢/lb and averaged 51.4¢/lb. Cotton farm receipts ranged from roughly $954 million to $6.8 billion and averaged $3.6 billion.

Although roughly 80 countries produce cotton, India and China are currently the major competitors for the U.S. in the production of cotton (Table 3). Together the three countries produce over half the cotton in the world. The U.S. ranks second to China in production but is the largest exporter, accounting for over 40% of global trade in raw cotton in 2004 which was more the double the share the U.S. had just a few years earlier (Table 4). The four other major foreign producers of cotton include: (1) the Former Soviet Union, (2) Brazil, (3) Turkey, and (4) Pakistan (see Table 3). Between 1970 and 2004, these four countries plus China and India accounted for 75% of both total foreign cotton acreage harvested and total foreign cotton production (Table 5). Over the past five years (2000 to 2004), India accounted for the largest share (30%) of total foreign cotton area harvested followed by China, (17%), Pakistan (11%), and the former Soviet Union (9%). Nevertheless, over the same time period China was the largest foreign cotton producer (30% of total foreign production) followed by India (17%), Pakistan (11%), and the former Soviet Union (9%). Cotton yields in Turkey, China, and Brazil were all about double the average yield in non-U.S. cotton producing countries and about 40% to 50% higher than U.S. average yields over the same recent five year period. Cotton yields in India were about half the average of non-U.S. countries and about 40% of U.S. yields. Cotton yields in the Former Soviet Union and Pakistan were only about 75% of average U.S. yields.
Annual harvested area of cotton outside the U.S. since 1965 has ranged from a low of 62.8 million acres in 2002 to a high of 75.6 million acres in 2004 (Table 5). At the same time, cotton yields in foreign countries ranged from a low of 294 lb/acre in 1965 to a high of 617 lb/acre in 2004. Over the same time period, foreign cotton production ranged from 20.2 billion lb to 46.6 billion lb. Since 1965, the United States has accounted for an average of nearly 15% of the harvested acres of cotton in the world and nearly 20% of the world cotton production. U.S. cotton yields were 36% higher on average than foreign yields between 1965 and 2004.

U.S. cotton production competes not only with cotton production in other countries but also with the production of synthetic (man-made) fibers around the world. Between 1980 to 2003, cotton accounted for over 40% of total world fiber production (Table 6). However, cotton has lost global market share to synthetic fibers every year for nearly a decade. Since 1996, the synthetic fiber (principally polyester) share of world fiber production has been larger than the share accounted for by cotton.

The U.S. cotton planting season typically occurs from February to June, depending on the region. U.S. cotton production regions include the Delta (Arkansas, Louisiana, Mississippi, Missouri, and Tennessee); the Southeast (Alabama, Florida, Georgia, North Carolina, South Carolina, and Virginia); the Southwest (Kansas, Oklahoma, and Texas); and the West (Arizona, California, and New Mexico). The aggregate of these regions represent the so-called "Cotton Belt." Of the 17 Cotton Belt states, the major cotton producing state is Texas. About 98% of the cotton produced in the U.S. is upland cotton. The remainder is extra-long staple (ELS) cotton or American Pima cotton, generally grown in the western part of the Cotton Belt.

U.S. Cotton Trade

Since 1995, the U.S. has exported nearly half of its domestic production (Table 7) and is the leading world exporter of raw cotton. Except for 1995, 1996, and 1998, U.S. imports of raw cotton were almost nonexistent. Even in those three years, U.S. imports of raw cotton were only a fraction of the level of exports and an even smaller fraction of the level of domestic cotton supply. Between 1965 and 1984, Pakistan, China, Turkey, Brazil, Sudan, and Egypt were the major non-U.S. exporters of cotton (see Table 4). Since the mid-1980s, however, Uzbekistan and other African countries have emerged as the leading foreign cotton export competitors for the United States. At times over the last 20 years, Pakistan, India, China, and most recently Brazil have played major roles in world cotton export markets. The most consistent foreign cotton importing nations since at least the mid-1980s have been the EU-25, Russia, Japan, Indonesia, South Korea, Thailand, Taiwan, and China (Table 8). Imports of raw cotton by the EU-25, Russia, and Japan have declined steadily over time while imports of raw cotton by Indonesia, Thailand, Pakistan, and China have risen dramatically.

Cotton Milling and Textile Manufacturing

Cotton bales are shipped from gins and warehouses located throughout the U.S. Cotton Belt to both foreign and domestic mills. Cotton merchants, located across the Cotton Belt, arrange the transfer of bales between these parties. Cotton is harvested throughout the Cotton Belt in a six-month time period, beginning in south Texas in mid-July and ending in North Carolina and West Texas in December. Mills, however, use cotton on a continual basis.

Domestic cotton textile mills are concentrated in four states: (1) Alabama; (2) Georgia; (3) North Carolina; and (4) South Carolina. U.S. cotton mills generally have become vertically integrated with the largest companies combining spinning, weaving, and finishing (Glade, Meyer, and Stults 1996). The National Cotton Council has identified 92 major product classifications as end uses for milled cotton grouped into three broad categories: (1) home furnishings; (2) apparel; and

(3) industrial products. Apparel is the predominant category, followed by home furnishings, and industrial products (Figure 2).

U.S. mill use of cotton increased slowly from about 3.0 billion lb in the early 1980s to a little over 5.0 billion lb in the late 1990s and then declined rapidly ever since, dropping back to just 3.1 billion lb in 2004 (Table 9). Rapidly growing U.S. imports of cotton fiber textile (processed cotton) products from foreign mills drastically reduced the domestic (mill) share of total U.S. cotton consumption (expressed in raw cotton fiber equivalents) from a high of 70% in 1990 to just 30% in 2004.

Cotton Fiber Textile Trade

U.S. trade in processed cotton (cotton textiles and apparel) has followed quite a different pattern from that of U.S. trade in raw cotton. Beginning in the late 1980s, U.S. cotton textile exports began to increase rapidly reaching a peak at 2.4 billion lb in 2000 and then stabilized at 2.1 billion lb to 2.3 billion lb since that time (Table 9). The growth of U.S. cotton textile exports, however, has not kept pace with the influx of cotton textile imports. Imports have captured a large and growing share of U.S. cotton consumption, from 30%-35% in the 1960s to 70% in 2004.

The growth in net imports is due largely to strong growth in the U.S. demand for processed cotton products and the reduction in U.S. and world trade barriers primarily as a result of the Agreement on Textiles and Clothing (ATC) signed in 1994 as part of the Uruguay Round of the General Agreements on Tariffs and Trade (GATT) negotiations. U.S. consumption of processed cotton products has more than doubled since the mid-1980s (Table 9). Almost 75% of the imports consist of apparel while less than 20% are fabric and other textile products (USDAb).

As barriers to world cotton and textile trade have declined, developing countries, where wages are much lower than those in the U.S., have gained a competitive edge in global cotton fiber product markets since apparel manufacturing is more labor intensive than textile processing. This growing competitive advantage has determined, in large part, the changing global pattern of cotton and textile production and manufacturing. In recent years, that pattern has included U.S. raw cotton production and exports to developing countries, milling and manufacturing in foreign countries, and then importation of the cotton textile goods back into the domestic U.S. market. The global pattern of trade has also included fabric construction in the U.S., cutting and assembling in other countries, and then U.S. importation of the final cotton textile products. Unfortunately, reliable public and private estimates of how much apparel made of U.S.-produced cotton is imported back into the U.S. are not available.

U.S. Processed Cotton and Man-Made Fiber Demand[1]

As indicated earlier, total domestic processed cotton fiber product consumption, defined as U.S. cotton mill use plus net imports of processed cotton (expressed on a raw cotton fiber equivalent basis), realized a dramatic increase from nearly 5.0 billion lb in 1986 to 10.3 billion lb in 2004 (Table 9). On a per capita basis, total domestic consumption of processed cotton rose from 20.7

[1] Because wool accounted for only 1% to 2% of total fiber consumption during this period, the focus of this analysis centers on man-made fiber and cotton fiber.

lb to 35.1 lb between 1986 to 2004. Per capita consumption of U.S. mill output of processed cotton, on the other hand, rose from 13.9 lb to 19.9 lb between 1986 and 1997 and then afterwards declined precipitously to 10.7 lb in 2004 primarily due to the surge in processed cotton imports in recent years. Between 1986 and 1996, per capita consumption of imported processed cotton products increased by 47% from 6.8 lb to 10.0 lb and then jumped by over 140% between 1996 and 2004 to 24.4 lb.

The U.S. per capita consumption of man-made fibers, including rayon (cellulosic fiber) and polyester (non-cellulosic fiber), has averaged 1.5 to 2 times higher than that of cotton since at least the mid-1980s (Table 10). Since the mid-1980s, the annual U.S. per capita consumption of man-made fibers increased has increased somewhat from around 40-42 lb to near 50 lb. Polyester is the dominant man-made fiber in terms of domestic consumption.

Like U.S. mill use of cotton, mill use of man-made fibers also has dropped in recent years while imports have risen. Mill use of man-made fibers rose from 8.7 billion lb in 1986 to 11.1 billion lb in 1997 and then dropped to 10.2 billion lb by 2004 (Table 10). Imports of man-made fibers, on the other hand, increased dramatically between 1986 and 2004. The domestic (mill) share of total U.S. man-made fiber consumption declined from nearly 90% in the mid-1980s to about 70% in 2004 while the import share jumped from 10% to nearly 30% over the same period.

In terms of total fibers (cotton, man-made, wool, flax, and silk), annual per capita domestic consumption increased from 61.6 lb to 88.7 lb between 1986 and 2004 (Table 11). U.S. per capita total fiber mill use peaked at 60.2 lb in 1997 and then dropped steadily to 45.7 lb in 2004. In contrast, per capita net imports of total fibers rose rapidly after 1996 from 16.1 lb to 43.0 lb in 2004. The growth in the absolute volume of total fiber consumption was accompanied by an increase in the cotton share from almost 34% in 1986 to nearly 40% in 2004 and a decline in the share accounted for by man-made fiber over that same period from 66% to 55%.

Cotton and Man-Made Fiber Prices[2]

Among the various potential determinants of the demand for any commodity, price is usually one of the most important. Although consumption of all fibers is measured in pounds, a pound of cotton does not provide the same amount of textiles as a pound of other fibers, such as celluslosic or non-cellulosic man-made fibers. Consequently, comparing the per pound prices of various fibers can provide a misleading view of their relative market values. Thus, the U.S. Department of Agriculture (USDA) developed a method for adjusting the pounds of fiber used in manufacturing textiles so that the quantity of cotton needed to provide the same quantity of textiles could be estimated (Donald, Lowenstein, and Simon 1963). This adjustment of fiber consumption, known as "cotton equivalent" pounds, represents the quantity of cotton that would be needed to replace a pound of other fibers as raw material for textile production. USDA publishes estimates of domestic fiber consumption in cotton equivalent pounds. The prices of fibers are correspondingly converted to raw fiber equivalent prices. The cotton price is divided by 0.90 and the rayon and polyester prices are divided by 0.96. Rayon represents the class of

[2] In this section, the prices of reference for the various fibers are in raw fiber equivalents. The reference prices are: cotton - Strict Low Middling (SLM) 1 1/16" at Group B mill points, net weight; rayon - 1.5 and 3.0 denier, regular staple at f.o.b. producing plants; polyester - 1.5 denier, regular staple at f.o.b. producing plants.

cellulosic man-made fibers (rayon and acetate) while polyester represents the class of non-cellulosic man-made fibers (polyester; acrylic; polypropylene; and nylon).

To calculate the appropriate mill price for cotton to compare with those of competing fibers between 1991 and 2006, an adjustment must be made to account for user marketing certificates. The Upland Cotton User Marketing Certificate program, also known as "Step 2," began in the fall of 1991 as an incentive for American produced cotton to be domestically consumed or exported (USDAc). Payments under the program were made in cash or certificates to domestic users on documented raw cotton consumption and to exporters on documented export shipments at a payment rate equal to the difference between the U.S.-Northern Europe price and the Northern Europe price during the fourth week of the period, minus 1.25¢/lb (the threshold) (USDAd). Available on a weekly basis, the payment was based on a comparison of the Northern Europe (Liverpool) current price (NE) to the five-day average of the lowest U.S. current quote (USNE). Initially, the user certificate value (CV) was calculated as: CV = (USNE – NE) – 1.25.

The 2002 Farm Act suspended the application of the 1.25¢/lb threshold until August 1, 2006. Consequently, Step 2 payment calculations for the 2002-05 marketing years were based on the difference between the USNE and the NE prices. If CV was less than zero in any week, then the certificate value for that week was zero. Also, the subsidy was paid as long as the adjusted world price (AWP) was less than 130% of the cotton loan rate. So, for a payment to occur, the certificate value (CV) had to be positive and the AWP also had to be less than 130% of the loan rate. On February 8, 2006, the President signed legislation repealing the Step 2 Program as of August 1, 2006. The repeal terminated export subsidies and import substitution subsidies cited by the World Trade Organization (WTO) in the findings of a dispute settlement panel. Thus, to calculate the "effective mill price" of cotton after 1991 until the termination of the Step 2 program, the certificate value (CV) must be subtracted from the nominal mill price of cotton[3].

The nominal mill price of cotton (raw fiber-equivalent basis) generally increased from the 1960s through the 1990s, hitting an average annual all-time high of 100.8¢/lb in 1995 (Figure 3). The record high price was short lived, however, as the cotton mill price raced downwards to an average annual low of 45.6¢/lb in 2002 and then recovered somewhat to 60.4¢/lb in 2004. The nominal raw fiber-equivalent mill prices of rayon and polyester followed a similar pattern over the years, generally increasing from just over 50¢/lb in 1975 to highs in the early to mid-1990s. The rayon price increased more rapidly, however, hitting a high of 127¢/lb in 1991 when the polyester price was only near 80¢/lb (Figure 3). Both prices have tended to decline since the mid-1990s but the rayon price has shown more resistance to downward pressures. Consequently, the price of rayon was still nearly 60% above the price of polyester in 2004.

The nominal farm price of cotton followed a much slower but still generally upward trend until the mid-1990s, hitting an all-time high of 76.5¢/lb in 1995. By 2001, however, the farm price of cotton had dropped nearly 60% to 32¢/lb, the lowest level since the early 1970s (Figure 3). Over the same period, the nominal A index followed a similar pattern, reaching a near record high of 93¢/lb in 1994 and then dropping to a low of 42¢/lb in 2001 before recovering somewhat (Figure 3). The U.S. government loan rate over the same period dropped from 55.0¢/lb to 50.0¢/lb and then rose slightly to 52¢/lb.

[3] In 1997/98, the Step 2 program ran out of money and was not operative.

Adjusting the nominal prices for inflation, however, reveals that in relative terms, the prices of cotton and competing fibers all followed a clear downward since at least the mid-1970s (Figure 4). Figures 3 and 4 show clearly that cotton and competing fiber prices have been highly correlated over time with correlations ranging from 0.899 to 0.961. The real prices of rayon and polyester were less collinear than was the case for the set of real cotton prices with a correlation of 0.841. Also, the correlations of the real prices of polyester and rayon with real cotton prices were on the order of 0.8 and 0.7, respectively.

Government Intervention in U.S. Cotton Markets

Government intervention in U.S. cotton and textile markets has been the norm rather than the exception since at least the 1930s. The primary objective of the intervention over the years has been to support cotton producer income through the use of a variety of policy tools, primarily cotton price and income support programs and demand enhancement programs.

U.S. Cotton Price and Income Support Policy

Beginning with the Agricultural Adjustment Act of 1933, the government has attempted to support cotton farm income by restricting output, supporting domestic market prices, and making payments of various types to cotton producers. Supply reduction has been achieved through various programs designed to reduce acreage in production, such as acreage allotments, set-asides, and acreage reduction programs, as well as long-term land retirement programs like the Soil Bank in the 1950s and the Conservation Reserve Program (CRP) created in 1985. The combined effect of these programs has been to support farm prices over the years, including the price of cotton.

The principal price support feature of U.S. farm policy has been the nonrecourse (NR) marketing assistance loan program operated by the Commodity Credit Corporation (CCC) since 1938. Through the CCC, cotton farmers can request loans on the bales of cotton they have harvested and ginned at the announced loan rate. Until passage of the 1985 farm bill, when market prices rose sufficiently above the loan rate during the term of the loan, cotton farmers could sell their crop and repay their loans plus any fees and charges. If market prices dropped below the loan rate, however, producers defaulted on their loans and transfered ownership of their cotton (pledged as collateral) to the CCC as full settlement of their loans, without penalty. The commodity loan program acted to support price at the established loan rate by removing supply from the market and into government inventories until the market price rose to the level of the loan rate. The NR loan rate for cotton rose from 38.9¢/lb in the mid-1970s to a high of 57.3¢/lb in 1985. Since that time, however, the cotton NR loan rate has varied only slightly from a high of 55.0¢/lb in 1985 to a low of 50.0¢/lb in 1994. The current cotton NR loan rate is 52.0¢/lb.

Beginning with direct payments under the Food and Agriculture Act of 1965 and then deficiency payments under the Agriculture and Consumer Protection Act of 1973, income support to U.S. producers of many commodities, including cotton, became a central feature of U.S. farm policy. Until the passage of the Federal Agricultural Improvement and Reform (FAIR) Act of 1996, producers received deficiency payments equal to the difference between a set target price and the existing national average market price or the non-recourse loan rate, whichever was higher (the payment rate). The total payment to each farmer was calculated as the product of the payment rate, the farm's eligible payment acreage, and the farm's established program payment yield. Producers could only take part in the non-recourse loan program or receive deficiency payments if they set aside a portion of their acreage to reduce production.

The Food Security Act (FSA) of 1985 added marketing loan provisions to the income support features of U.S. farm policy for cotton and a few other commodities. The marketing loan program allows cotton producers to sell their crop in the market and repay their loans at less than the loan rate and receive a marketing loan gain (or loan deficiency payment, as applicable) equal to the difference between the loan rate and the "adjusted world price" (AWP) (the marketing loan repayment rate) whenever the AWP was below the loan rate. The AWP is the prevailing world price for upland cotton, adjusted to account for U.S. quality and location. In most years during that period, however, cotton prices stayed above the loan rate (see Table 2).

To mitigate potential negative impacts of the price support programs on exports and the domestic textile industry and to further support cotton farm income, the Food, Agriculture, Conservation, and Trade Act (FACTA) of 1990 implemented a three-step "competitiveness" program for cotton. Step 1 of the program allows the Secretary of Agriculture to lower the cotton loan repayment rate when the AWP falls below 115% of the upland cotton loan rate and the weekly average U.S.-Northern Europe price quotation exceeds the Northern Europe price quotation. Step 2 provided for payments to U.S. mills and exporters in user marketing certificates or cash when the A index exceeded the Northern European cotton price by more than 1.25¢/lb for four consecutive weeks. As indicated earlier, the Step 2 provision underwent several modifications through the years and was ultimately repealed effective August 1, 2006. Step 3 permits special import quotas for upland cotton to enable domestic mills to import foreign cotton when the weekly average U.S.-Northern Europe price quotation (adjusted for any certificate value in effect, unless U.S. supplies are extremely tight) exceeds the Northern Europe price quotation by more than 1.25¢/lb for four consecutive weeks.

Recent Changes in U.S. Cotton Policy

With the passage of the FAIR Act in 1996, acreage reduction programs were eliminated and a schedule of agricultural marketing transition assistance (AMTA) payments was established. Cotton farmers were offered declining payments, known as production flexibility contract (PFC) payments, based on historical acreage and yields. Total planting flexibility enabled cotton producers who had participated in previous commodity programs to shift production to other crops such as corn or soybeans without sacrificing program benefits. Total planting flexibility also permitted farmers to shift production to cotton from other crops. The FAIR Act also continued the three-step "competitiveness" program that was initiated under the 1990 farm bill. In 1998, Congress added *ad hoc* marketing loss assistance (MLA) payments to the PFCs. Continuation of the CRP allowed the Cotton Belt to continue active participation in acreage reduction to control soil erosion.

The Farm Security and Rural Investment Act of 2002 replaced PFC payments with direct payments (DPs) and added new counter-cyclical payments (CCPs) for cotton and other covered crops for 2002 through 2007 (Westcott, Young, and Price 2002). Like PFC payments, DPs are decoupled (not tied to current production or price). CCPs, on the other hand, are only partially decoupled payments. Farmers have nearly complete flexibility in what to plant to their base so that CCPs are essentially decoupled from production decisions. However, the actual payment received can be affected by the current market price so that the CCPs are not decoupled from prices. Owners of farms were given a one-time opportunity to select a method for determining base acreage for both DPs and CCPs based on historic production. The payment acreage was set at 85% of base acreage. Payment yields for DPs remained at the levels specified by the 1996 Farm Act. For CCPs, farmers could update their payment yields at the time they initially enrolled. To receive payments, owners have to enroll annually.

DPs were made available to eligible landowners and producers of upland cotton who enter into an annual agreement. The amount of the DP is equal to the product of the payment rate, payment acres, and payment yield. The payment rate for upland cotton is set at 6.67¢/lb for crop years 2002 through 2007. CCPs are available to contract holders when a program crop's target price is greater than the effective price. The target price for upland cotton for the crop years 2002 through 2007 specified in the 2002 Farm Act is 72.4¢/lb. Consequently, the effective price of upland cotton received by producers is the sum of the DP (6.67¢/lb) and the higher of the national average farm price for the marketing year or the national loan rate (52.0¢/lb). The minimum effective upland cotton price is 58.67¢/lb, calculated as the sum of the direct payment (6.67¢/lb) and the loan rate (52.0¢/lb). The maximum payment rate for upland cotton is 13.73¢/lb, calculated as the target price (72.4¢/lb) minus the minimum effective price (58.67¢/lb). The payment amount equals the product of the payment rate, payment acres, and the counter-cyclical payment yield.

The 2002 Farm Bill extends nonrecourse commodity loans with marketing loan provisions but eliminates the requirement that producers must enter into an agreement for DPs in order to be eligible for loan program benefits. All current upland cotton production is eligible. Farmers can receive government marketing loan assistance payments either through marketing loan gains (MLG) for those producers who receive CCC nonrecourse loans or loan deficiency payments (LDP). Cotton producers with CCC loans can receive an MLG because the marketing loan provisions allow them to repay their loans at a rate less than the loan rate. The difference between the loan rate and the repayment rate is the MLG. Alternatively, producers who do not place their cotton crop under loan can receive an LDP when the AWP is below the national loan rate of 52¢/lb. The difference between the AWP and the loan rate is the LDP.
In addition to the price and income support provisions of the 2002 Farm Act, cotton producers can also benefit from crop and revenue insurance programs to guard against diverse weather, insect manifestations, and other natural perils. Payments from the USDA to cotton farmers have covered a portion of the contract premiums for the insurance policies.

Clearly, U.S. farm policy has been an important driver in U.S. cotton markets. Government outlays to U.S. cotton farmers totaled roughly $29.6 billion between 1986/87 and 2004/05, averaging about $1.6 billion per year (Table 12). Payments to cotton farmers hit a low of $217 million in 1995/96 just before the 1996 Farm Bill was passed and then hit an all-time high of $3.9 billion just before the 2002 Farm Bill was passed. At $2.2 billion, payments to cotton farmers in 2004/05 were nearly 50% above the annual average since 1986/87.

U.S. Cotton Policy and the WTO Cotton Decision

In March 2005, a WTO appellate panel ruled against the U.S. in a dispute settlement case brought by Brazil against certain aspects of the U.S. cotton program (Schnepf 2006). In compliance with the "prohibited subsidy" portion of the WTO ruling, the Bush Administration proposed statutory changes to Congress in July of 2005, including elimination of the Step 2 cotton program, removal of a 1% cap on fees charged under the GSM-102 export credit guarantee program, and termination of the GSM-103 export credit guarantee program. Congress complied with a portion of the Administration's proposal by including a provision in the Deficit Reduction Act of 2005 (February 2006) that called for the elimination of Step 2 on August 1, 2006. Schnepf (2006) indicates that with this action and the expectation that the rest of the WTO ruling will be fully implemented quickly, Brazil has temporarily suspended its pursuit of WTO-sanctioned retaliatory trade measures against U.S. agricultural products. He argues that "additional permanent modifications to U.S. farm programs may still be needed to fully comply with the 'actionable subsidies' portion of the WTO ruling."

Textile and Apparel Trade Agreements

The government also has intervened in U.S. textile markets by restricting imports of textiles and apparel in an effort to protect the U.S. cotton industry. The intervention has historically taken the form of textile and apparel trade agreements to limit imports through tariffs and quotas. Prior to the 1970s, a trade agreement, referred to as the Long Term Agreement Regarding International Trade in Cotton Textiles (LTA), was in effect. This agreement specifically allowed the U.S. to limit the growth of cotton textile imports to 5% per year (Dickerson 1999). No restrictions on man-made fiber trade were imposed during the years 1964 to 1971. Following an influx of man-made fiber textile imports in the early 1970s, however, the U.S. joined the Multi-Fiber Arrangement (MFA) in 1973. Under the MFA, import quotas were established by participating countries and implemented on a country- and product-specific basis when textile and clothing exports posed a threat of "market disruption" (MacDonald and Vollrath 2005). The MFA was renewed in 1977, 1981, and 1986 with minimal changes in provisions.

The MFA and its predecessor agreements influenced world textile and clothing trade patterns for nearly 50 years (MacDonald and Vollrath 2005). The Agreement on Textiles and Clothing (ATC) negotiated as part of the Uruguay Round of the General Agreements on Tariffs and Trade (GATT) negotiations and signed in 1994 specified that the MFA was to be phased out by the end of 2004. The ATC established a schedule for eliminating quotas initially established under the MFA and for accelerating the annual growth rates in import quantities under the quota system. Under the ATC, textile and clothing tariffs also were lowered, highlighting the need to bring all trade policies applied to the sector into alignment with World Trade Organization (WTO) rules.

U.S. Cotton Demand Enhancement Policy

In addition to price support policy, the government has also attempted to raise the level of cotton farm income through domestic demand enhancement programs, that is, shifting the demand curve for cotton to the right. The basic cotton demand enhancement policies implemented by the government over time fall into three categories: (1) foreign demand expansion through policies that promote exports; (2) subsidies for the development of new uses for cotton; and (3) domestic demand enhancement through checkoff-funded advertising and promotional programs.

The particular policy interest in demand enhancement programs of any type stems from the fact that "farmers as a group are better off at a given increase in the price of a product, if the increase comes about through an increase in demand rather than a decrease in supply" (Gardner 1981). In other words, if a program to expand demand for a commodity through advertising or promotion efforts, for example, effectively shifts the demand curve outward and boosts the price of the commodity, domestic producers, from a welfare viewpoint, are better off than if the price increase were to come about from an inward shift of the supply curve due to a particular production control program.

As illustrated in Figure 5, an increase in the demand for a commodity from advertising, for example, from D_0 to D_1 also raises the price from P_0 to P_1, and increases producer surplus (producer welfare) from area i to area f+g+h+i resulting in a net increase in producer surplus of area f+g+h. At the same time, consumer surplus changes from area a+c+f to area a+b+c+d+e. But note that area a+b = area a+c+f so that the new consumer surplus area is equal to (a+c+f)+c+d+e. Subtracting the original consumer surplus area from the new area gives a positive increase in consumer surplus of area c+d+e. Thus, a demand expansion program unequivocally improves producer welfare and consumer welfare. The net benefit to society from a rightward shift in demand unequivocally is positive and equal to the sum of area c+d+e (the gain in consumer welfare) and area f+g+h (the gain in producer surplus).

On the other hand, as illustrated in Figure 6, a reduction in supply from S_0 to S_1 under some government supply reduction program, which also increases price from P_0 to P_1, changes producer welfare from area c+f+g to area b+c giving a net increase in producer surplus of b-f-g. Unless the gain of area b is greater than the loss of area f+g, producers will lose from this government effort to enhance the price of the commodity to producers. Worse yet, the loss in producer welfare comes at a cost to taxpayers if any government payments or subsidies were involved to achieve the supply reduction. At the same time, a supply reduction program leads to an unequivocal loss in welfare to consumers since they lose area b+d+e and remain only with area a after the supply reduction occurs. The net benefit to society from a leftward shift in supply unequivocally is negative and equal to the sum of areas d, e, f, and g.

U.S. Cotton Advertising and Promotion Programs

Like most other major U.S. agricultural commodity industries, the U.S. cotton industry operates a government established program to expand demand through collective action by cotton farmers. The term "checkoff" refers to the collection of assessments and comes from the concept of checking off the appropriate box on a form, like a tax return, to authorize a contribution for a specific purpose, such as the public financing of election campaigns, or, such as in this case, the financing of demand expansion programs. As with many other commodity checkoff programs, the cotton checkoff funds collected are used to expand demand by financing both generic advertising efforts and the development of new uses of the associated commodities.

Historical Foundation of the Cotton Checkoff Program

The legal groundwork for checkoff programs was laid in the early 1900s when farmers were granted greater control over the production and marketing of their goods. First, the Clayton Act of 1914 exempted non-stock agricultural associations from antitrust laws. Then, the Capper-Volstead Act of 1922 extended the Clayton Act's antitrust exemptions to all producer cooperatives but still prevented cooperatives from engaging in predatory market conduct to exclude competition. Although the Capper-Volstead Act was initially praised as providing some solution to the farm problem, the limitations of cooperatives in (legally) alleviating over-production remained as long as cooperatives were prevented from exercising near monopoly control over production marketing.

In the early 1930s, some farm groups and cooperatives instituted commodity marketing programs using *voluntarily* collected producer funds. For homogeneous commodities, however, cooperatives, just like individual producers, have little incentive to engage in marketing activities if they lack any real market power. Producers not associated with a particular cooperative, for example, can take advantage of any price increase resulting from the cooperative's marketing activity without incurring any of the cost involved. As a general rule, voluntary programs fail because producers who choose to remain outside the programs "free ride" on the efforts of those producers adhering to the voluntary marketing programs. Unless universal participation is mandated and the free-rider problem is eliminated, efforts by groups of producers to collectively affect market prices and income will be largely ineffective (Crespi 2001).

In order to provide farmers greater control over the marketing of their goods, the Agricultural Adjustment Act of 1933 gave the Secretary of Agriculture the power to enter into marketing agreements with producers and to issue licenses granting the licensee permission to handle agricultural commodities. The Act also granted the Secretary the authority to impose production restraints to reduce commodity surpluses in order to increase purchasing power to that which farmers had enjoyed in the more prosperous years of 1909 to 1914 ("purchasing power parity"). The period from 1909 to 1914 often is labeled as the golden period of agriculture.

Marketing orders, established under the 1937 Agricultural Marketing and Agreement Act, provide farmers of particular commodities with a method of regulating the marketing of their products under the auspices of the U.S. Secretary of Agriculture (for a federal order) or the State Secretary of Agriculture (for a state order). Under the orders, producers in an industry are compelled to participate jointly in certain aspects of the marketing of a commodity. A marketing order for generic advertising compels all producers under the order to jointly contribute funds for industry advertising. The generic advertising component of marketing orders is one of the regulatory attempts to alleviate the "farm problem". The Agricultural Marketing Agreement Act of 1937, like its precursors, the Agricultural Adjustment Acts of 1933 and 1935 (amended), are extensions of earlier *voluntary* attempts by producers to control the farm problem.

In 1954, Congress amended the 1937 Act to authorize the Secretary to establish "marketing development projects," including advertising and promotion for a broad range of commodities, that would further the goals of the original act. With the exception of some minor provisions for milk promotion, generic advertising had been left out of the original 1937 Act because the

USDA had concerns that advertising just changed market share from one commodity to another. By the 1950s, however, the government was purchasing a great deal of excess supply to maintain parity prices. Stimulating demand through advertising, it was hoped, would increase farm prices while relieving pressure for government purchases of excess stocks. Thus, generic advertising just added a demand instrument to the government's toolbox of supply controls (Crespi 2001).

Like any effort by groups of farmers to collectively enhance market prices and incomes, generic commodity advertising is likely to be ineffective if free riding by other producers is allowed. Typically, when free riding is allowed, a sub-optimal level of funds for advertising is expended in the industry. Consequently, even though every producer would benefit from advertising if all producers participated, no individual producer or group of producers wants to undertake the expense of benefiting all producers, particularly if the group is small relative to the total number of producers. A marketing order for generic advertising solves this problem by compelling every producer in an industry to support the program. The stipulations of marketing orders for generic advertising generally are that advertising must truly be of a generic nature so as not to benefit some producers over others, and that the assessed money may not be used to promote political or ideological viewpoints (Crespi 2001).

The Cotton Research and Promotion Act

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 United States. The introduction of polyester and nylon fibers led to a sustained decline in the demand for cotton for all uses beginning in 1960. By 1966, the decline in cotton demand had progressed to the point that Congress intervened, passing the Cotton Research and Promotion Act (CRPA) of 1966 (PL89-502) (Murray et al. 2001), in an effort to arrest the erosion of consumer demand for cotton.

In passing the CRPA, Congress reasoned that the inroads into the textile fiber market made by synthetic fibers were due, for the most part, to research and promotion conducted by primarily large chemical firms. Because 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 (Murray et al. 2001).

The legislative intent of the CRPA and of the Cotton Research and Promotion Amendments Act (CRPAA) of 1990 was to authorize and enable the establishment of an orderly procedure for the development of "an effective and coordinated program of research and promotion." The 1966 Act specifically authorized the creation of the Cotton Board to "establish and carry out research and development projects and studies with respect to the production, ginning, processing, distribution or utilization of cotton and its products." The design of both Acts was to strengthen the competitive position of cotton vis-à-vis primarily man-made fibers and to expand domestic and foreign markets and uses for U.S. cotton. Clearly, the Acts are about more than increasing consumer demand through advertising and promotion. Rather, advertising was intended to be one of several elements in a coordinated campaign to improve the use and quality of cotton products and lower the costs of cotton production.

From 1967 to 1991, all domestic producers were required to pay cotton assessments. However, the 1966 Act allowed producers who were not in favor of supporting the program to request a refund. Over the period 1967 to 1991, up to one-third of the assessments collected were refunded. The CRPAA, enacted by Congress in November 1990 under Subtitle G of Title XIX of the Food, Agriculture, Conservation and Trade Act of 1990, contained two provisions amending funding procedures of the CRPA: (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 and (2) the right of cotton producers to demand a refund of assessments was terminated. The CRPAA was approved by producers and importers voting in a referendum held July 17-26, 1991. Consequently, since July 31, 1992, all imported cotton, and not just the cotton produced in the U.S., has been subject to the assessment of a fee as set out in the CRPAA. The assessment on imports is collected by the U.S. Customs Service and remitted to the Cotton Board through the Agricultural Marketing Service (AMS) on a monthly basis.

The CRPA, as amended by the CRPAA, requires an assessment of one dollar per bale plus a fractional percentage of value (specifically five-tenths of one percent), collected by first handlers, on domestically produced (raw) cotton, imported (raw) cotton, and the cotton content of imported textile and apparel products. Almost all U.S. cotton imports are textile and apparel cotton products rather than raw cotton. The AMS adopted the use of the calendar year average price received by U.S. farmers for upland cotton as a benchmark for the value of domestically produced cotton. Use of the average price figure in the calculation of supplemental assessments on imported cotton and the cotton content of imported products yields a value that approximates assessments paid on domestically produced cotton.

Cotton Checkoff Assessments

Since 1976, the assessment on U.S. cotton producers has ranged from a low of 0.460¢/lb in 1999 through 2002 to a high of 0.644¢/lb in 1980 (Table 13). The assessment is a fraction of the higher of the average price received by producers or the U.S. government loan rate for upland cotton and has generally declined since 1976. The importer assessment began in August of 1992 and has since varied from a low of 0.383¢/lb in 2003 and 2004 to a high of 0.581¢/lb in 1997 (Table 14). The importer assessment is a fraction of the effective price used in the calculation of the assessment and has also tended to decline over time, at least since 1997.

A comparison of the producer and importer assessments demonstrates that they are not equal. The importer assessment exceeded the producer assessment on a per pound basis in every year from 1992 through 2000 except for 1994 and 1995. Since 2001, however, the annual producer assessment has been greater than the importer assessment by as much as 0.115¢/lb and as little as 0.014¢/lb. In 2004, the producer assessment exceeded the importer assessment by 0.077¢/lb.

The Cotton Board collects all assessments and then contracts with producer-controlled organizations to carry out the research and promotion activities as authorized by the legislative Acts. Initially, the producer-controlled organization was the Cotton Producer Institute. Beginning in 1970, however, Cotton Incorporated (CI) was charged with the task of carrying out all research and promotion activities except export promotion under contract with the Cotton Board. Cotton Council International is responsible for cotton export promotion activities.

Because the checkoff program is federally authorized, the Secretary of Agriculture and the AMS have oversight responsibilities. Recommended program plans and budgets of the Cotton Board must be approved by the Secretary before they become operational. The responsibilities of AMS include: (1) developing regulations to implement the checkoff program, in consultation with the cotton industry and (2) ensuring compliance with the authorizing legislation. AMS regulations specify allowable activities, such as the type of promotion or research activities, the level and collection of assessments, the composition of the Cotton Board, and the types of allowable expenditures. AMS reviews the budgets and projects of the Cotton Board to prevent any prohibited activities such as lobbying. Although not responsible for conducting evaluations of the program, the AMS reviews the independent evaluation of the effectiveness of the program required at least once every 5 years by the 1996 Farm Bill. The Cotton Board reimburses AMS for its oversight costs.

Between 1986 and 1991, about 65% of the cotton assessments collected (from $18.3 million up to $28.6 million in nominal terms over that period) was available for funding cotton checkoff activities and the remaining 35% was refunded on average each year. By eliminating refunds, the 1990 amendments to the CRPA contributed to a substantial increase in annual cotton checkoff collections from $42 million in 1992 to $66 million in 2004 (Table 15).

Since the implementation of the CRPAA in the early 1990s, contributions by importers have grown to $24.7 million. Over that same period, producer contributions have varied considerably along with cash receipts from cotton sales from as low as $30.5 million in 1993 to as high as 42.1 million in 1996 (Table 15). Total producer assessments were $41.3 in 2004. In the early 1990s, importer assessments accounted for about 30% of total collections annually with producers paying the other 70%. Over time, however, the producer share has dropped to just over 60% of total collections in 2004 while the importer share has increased to just under 40%.

Cotton Checkoff Expenditures

Cotton Incorporated (CI) uses the checkoff assessments collected to finance a wide variety of research and promotion activities which can be grouped into four categories: (1) marketing and promotion, (2) agricultural research, (3) textile or non-agricultural research, and (4) administration. The CI total annual budget grew from $18.4 million in 1986 to over $60 million (unadjusted for inflation) in recent years (Table 15). In 2004, about 67% of the collected assessments were used to finance marketing and promotion activities and 16% to finance textile research activities. Though a larger percentage of the budget goes to marketing/promotion than to textile research and development, that breakdown reflects the cost of national advertising more than program priorities. The remainder was spent on agricultural research activities (13%) and administration (5%) (Table 15).

Marketing and promotion activities include media advertising, public relations, fashion marketing, retail promotion, and global product marketing. The most salient element in the consumer marketing effort revolves around the image represented by the “Cotton Seal”. This image is maintained and enhanced through media promotion, merchandising events, primary data collection, and strategic partnerships (for example, tie-ins with apparel retailers like J.C.

Penney and manufacturers like Proctor and Gamble). The CI global product marketing effort involves communications with textile mills and clothing retailers worldwide about the various products and services available. CI makes presentations at trade shows and distributes various publications to customers both in the United States and abroad.

Checkoff funds allocated for textile research (non-agricultural research) finance technical support to mills, apparel manufacturers, and retailers to find ways of reducing their costs and increasing their operating efficiencies (such as improvements in fiber quality and processing, fabric production, fabric development, and ginning technology) as well as new product development research (such as wrinkle-free cotton, stretch fabrics, and flame-resistant cotton). Textile research activities focus on fiber quality and fiber management. CI provides measurement, data analysis services, and technical support related to fiber quality characteristics such as color, staple length, micronaire, and stickiness. Also, fiber performance in finished textiles, including shrinkage, fading, and smoothness is monitored. CI's High Volume Instrument/Engineered Fiber Selection (HVI/EFS) system is the standard for measuring fiber quality. This system is used by merchants and mills to track the performance of each year's crop and to select the optimal mix of cotton bales for specific needs. Textile research activities also include research and development in conjunction with U.S. as well as foreign textile mills in both processing and fashion fabrics to: (1) improve their ability to process cotton and cotton-containing blends (the processing component) and (2) increase the desirability of cotton apparel to the final consumer (the fashion fabric component). From 1986 through 2004, 15% to 20% of CI budget allocations have been directed to textile or non-agricultural research (Table 15).

Agricultural research activities focus on reducing the costs or increasing the efficiency of growing and ginning cotton. Agricultural research expenditures rose from just over $800,000 in 1986 (4% of expenditures) to $8.4 million in 2004 (12.7% of expenditures) (Table 15). While administrative expenditures rose over the same period from $1.5 million to $3.2 million, the share of total expenditures accounted for by administrative costs dropped from 8% to about 5%.

Despite the rather strong upward trend of nominal expenditures of cotton checkoff funds (Figure 7), inflation has eroded the purchasing power of those funds. In terms of 1982-84 inflation adjusted dollars, cotton checkoff expenditures by Cotton Incorporated declined to a low in the mid-1970s and then increased to a high in 1996 before declining somewhat over the next several years (Figure 8).

ECONOMIC ANALYSIS OF THE COTTON CHECKOFF PROGRAM

Before attempting to empirically estimate the effects of the cotton checkoff program on U.S. and world fiber and textile markets and to calculate the cotton producer and importer average benefit-cost ratios associated with the program, this section of the report first examines the program and its market effects graphically to determine what economic theory can tell us about how the checkoff program affects world fiber and textile markets. Following the graphical analysis, the methodology used in the analysis is presented, including a detailed review of the econometric simulation model and data used. The results of the simulation analysis then are presented followed by the conclusions and implications of the analytical results.

Graphical Analysis of the Cotton Checkoff Program

After developing a simplified graphical representation or model of U.S. and world cotton and cotton textile markets, the model is used first to examine the economic incidence of the checkoff assessments paid by U.S. cotton producers and by U.S. cotton textile importers. Then the graphical model is used to consider the likely effects of the cotton checkoff program on U.S. and world cotton and cotton fiber textile markets with a focus on the impacts of the retail marketing/promotion expenditures and the non-agricultural research expenditures associated with the checkoff program. Next, the likely effects of cotton checkoff expenditures on U.S. and world man-made fiber and man-made fiber textile markets are analyzed. Finally, based on the results of the graphical analysis, the likely returns to both producers and importers from the cotton checkoff expenditures are considered.

Graphical Representation of World Cotton and Cotton Fiber Textile Markets

A simplified graphical representation of world cotton and cotton textile markets is provided in Figure 9. The top row of graphs represents raw cotton markets while the bottom row represents cotton fiber textile markets. Cotton fiber textiles are the cotton products produced by mills for retail consumption, primarily cotton apparel but also cotton floor coverings and various cotton textile home furnishings. Also, the first column of graphs represents U.S. markets while the last column represents all other countries. The middle column represents world markets.

In raw cotton markets, the supply of cotton in each country is upward sloping indicating that an increase in cotton price leads to an increase in the quantity of cotton supplied to the market. The supply of cotton in each country also is a function of other variables such as costs of production, the prices of competing crops, weather, and domestic agricultural policies. The demand for raw cotton in each country is the demand by mills for processing cotton into cotton fiber textiles and is downward sloping because an increase in cotton price reduces the quantity of raw cotton demanded by mills for processing. Mill demand for cotton in each country also is affected by other variables such as the price of cotton fiber textiles and processing capacity in the corresponding country. While the price of raw cotton represents the cost of the cotton input to cotton mills, the cotton fiber textile price represents the price of mill output. Consequently, while an increase in the raw cotton price reduces the quantity of cotton demanded by mills, represented by a movement along the mill demand curve up and to the left, an increase in the cotton fiber textile price is an incentive to mills to process more cotton and hence shifts the mill demand curve to the right.

The U.S. is depicted in Figure 9 as an exporter of raw cotton because the U.S. supply of cotton is greater than U.S. mill demand for cotton at most prices. In other words, at most prices, the U.S. can produce more cotton than is demanded by domestic mills. The excess supply of cotton not demanded by domestic mills is available for export and is graphed as the upward sloping export supply curve in the middle graph on the top row of graphs in Figure 9. The U.S. cotton export supply is the horizontal difference between the U.S. cotton supply and demand curves and is upward sloping because the higher the price, the greater the gap between the U.S. domestic supply and mill demand for cotton making more available for export at higher prices. In contrast, the “rest-of-the-world” (ROW) is depicted as a net cotton importing region. The ROW supply and demand curves are the horizontal sums of the respective cotton supply and demand curves in all non-U.S. cotton producing and consuming countries. Because what the ROW produces is less than what is demanded in those countries at most prices, the ROW is depicted as a net importing region. The ROW import demand curve in the middle graph on the top row of graphs in Figure 9 is drawn as the difference between the ROW mill demand and supply of cotton and is downward sloping because the lower the price, the greater the gap between ROW cotton mill demand and supply. The interaction of the U.S. export supply and ROW import demand in world markets determines the world price (P_c^w) and quantity traded (Q_c^w) of raw cotton. In turn, the world price level determines the quantities of cotton demanded and supplied in all countries, including the United States.

In cotton fiber textile (CFT) markets, the demand for CFTs is downward sloping because an increase in the price of CFTs reduces the quantity demanded. Other variables that affect CFT demand in each country include the prices of non-cotton textile products (primarily those made from man-made fibers like polyester and rayon) and consumer disposable personal income. The vertical supply curves for CFT products reflect the fact that the mill demand for raw cotton in each country is actually the supply of cotton fiber textiles. Given the cotton milling technology, therefore, the CFT yield per unit of cotton as determined by the installed capacity multiplied by the quantity of cotton processed at a given price for cotton (QD_c^{us} at price P_c^w in the United States, for example) gives the quantity of CFT products produced at that price of cotton (QS_{cft}^{us}).

Besides being linked through processing technology, the markets for raw cotton and CFTs also are linked through prices. For the cotton miller, the price of cotton represents the price of the input while the CFT price represents the price of the output. If the price of cotton (P_c^w in Figure 9) increases, then the quantity of cotton demanded for processing and, consequently, the volume of CFT products produced, both decline. On the other hand, if the CFT price (P_{cft}^w in Figure 9) increases, the volume of cotton demanded at a given price for cotton increases which would be depicted as a rightward shift in the cotton mill demand curve. A CFT price increase results in not only a greater volume of cotton milled but also as greater volume of CFTs supplied to the market which would be shown as a rightward shift of the vertical CFT supply curve.
The United States is depicted as a CFT importing country because at most prices the U.S. demand for CFT products is greater than the supply of those products available from U.S. mills. Consequently, the U.S. imports CFT products as depicted by the downward sloping U.S. CFT import demand curve in Figure 9 which is drawn as the difference between the domestic U.S. CFT supply and demand curves. In contrast, the ROW exports CFT products to the United States so that the CFT supply is greater than the CFT demand in that region at most prices. The ROW export supply curve for CFT products is, therefore, upward sloping and drawn as the horizontal difference between the ROW supply and demand for CFT products. The interaction of the U.S. CFT import demand and the ROW CFT export supply determines both the world price (P_{cft}^w) and quantity traded (Q_{cft}^w) of CFTs in the world market.

Note that this graphical model of U.S. and world cotton and cotton fiber textile markets does not include the effects of U.S. domestic cotton policy or textile import policies in order to focus on the basic underlying economic relationships in the U.S. and world cotton and cotton textile markets without the distortions implied by domestic and trade policy. These effects are incorporated into the graphical analysis later as part of the discussion of the effects of the cotton checkoff program expenditures.

Incidence of the U.S. Cotton Producer and Cotton Textile Importer Assessments

As indicated earlier in this report, the costs of cotton promotion and research activities until the early 1990s were financed through an assessment on each unit of domestic cotton sold. With the passage of the CRPAA of 1990, an additional assessment was levied on imported cotton and cotton-containing products in addition to domestically produced cotton. Thus, before addressing the question of the effects of the expenditure of the checkoff funds collected on cotton and cotton fiber markets, we first consider the incidence of the two assessments (producer assessment and importer assessment), or, in other words, the effects of the collection of the assessments on the markets. The key question is "Who pays the assessments?" The answer to that question is not straight forward and requires an understanding of the economics of tax incidence.

<u>A Brief Review of Tax Incidence</u>

The study of tax incidence in economics essentially is the study of who bears the burden of the tax, or in other words, who pays for the tax. The basic economic principles apply to the payment of any type of fee whether a sales tax, an import tariff, or a fee like the checkoff assessment. The *seemingly* obvious answer to the question of who pays for a tax or any other type of assessment is that the one from whom the tax or assessment is collected pays the tax or assessment. In the case of the cotton checkoff program, it is commonly assumed that producers pay the assessment on raw cotton and that importers pay the assessment on imported cotton since the producer assessment appears to be deducted from the price they receive for the cotton they sell while the importer assessment is collected by the U.S. Customs Service from importers in much the same way as a tariff is collected. The actual answer to the question of tax incidence, however, is more complicated and involves the economic structure of the particular industry being studied. A couple of simple examples serve to illustrate the point.

In the case of an assessment on a domestically produced commodity, the assessment represents an increase in the costs to producers. In Figure 10, the increase in producer cost represented by the assessment is shown as an upward shift in the domestic supply curve (to "supply with assessment" in Figure 10) since the supply curve is the marginal cost curve of the industry. In other words, for every quantity of the commodity supplied by the producer, the price required to cover the cost of the assessment is higher. The shift of the supply curve increases the market price at which producers sell their output along the demand curve (from "market price before assessment" to "market price after assessment" in Figure 10) and reduces the quantity available for consumption (from "market quantity before assessment" to "market quantity after assessment" in Figure 10). Subtracting the assessment from the higher market price received by producers for each unit of the commodity sold gives the net price received by producers per unit sold. Note that the assessment is the difference between the market price after assessment and the net price received by producers. Note that as a result of the assessment the net price received by producers is not only lower than the price received before the assessment but also the reduction in the price is less than the assessment. At the same time, the market price is higher as a result of the assessment but the increase in the market price also is less than the assessment. Consequently, the assessment is paid in part by producers in terms of a lower net price received for their output and in part by buyers of the commodity in terms of a higher price paid for the commodity. In other words, *producers and buyers share the cost of the assessment.*

The share of the cost of the assessment paid for by producers and the share paid by buyers depends on the particular characteristics of the commodity market. For example, Figure 11 illustrates a market structure in which market demand is price-inelastic (relatively unresponsive to changes in market price) and supply is price-elastic (relatively responsive to changes in market price). Given the same pre-assessment market supply and price, charging the same per unit assessment results in a higher market price as well as a higher net price received by producers. In this case, the largest proportion of the assessment is paid for by buyers in terms of a higher price with little of the cost falling on producers in terms of a lower net price received for their output. If the situation were reversed (that is, a more price-elastic demand and a more price-inelastic supply), then a larger portion of the assessment would be paid by producers with buyers paying a smaller share. Thus, who actually pays an assessment on a domestically-produced commodity, or how the cost of the assessment is shared by producers and buyers, has nothing to do with how or from whom the assessment is collected but rather on the price elasticities of supply and demand of the commodity.

In the case of an assessment on an imported product, who actually pays the assessment also is independent of how or from whom the assessment is collected. In this case, as in the case of a domestically produced commodity, who actually pays the cost of the assessment is determined by the own-price elasticities of supply and demand. An assessment on imports is collected by the U.S. Customs Service as the product enters the country just as tariffs and other import duties are collected. The U.S. Customs Service then remits the amount collected to the appropriate commodity organization. Thus, the assessment operates much like a tariff in its effects on the market. In Figure 12, the import demand curve represents the quantities of the product that the importing country is willing to import at various prices and the export supply curve represents the quantities that the exporting country is willing to export at various prices. Before imposition of the import assessment, market equilibrium occurs at the “market price before assessment” with market demand at the “quantity demanded before assessment,” market supply at the “quantity supplied before assessment,” and imports at “imports before assessment.”

When the assessment is imposed, the price received by the sellers of the product in the exporting country is less than the price paid by the buyers in the importing country by the amount of the assessment. In other words, the net price that sellers in the exporting country receive is the price paid by the buyers in the importing country (“market price charged to consumers after assessment”) minus the assessment. This situation is illustrated in Figure 12 with an import demand curve that is lower by the amount of the assessment at every level of imports (“import demand with assessment”).

Given the lower import demand curve, the quantity imported is now lower (“imports after assessment’) as well as the price received by sellers in the exporting country from retailers or others who import the product for sale in the importing country (“net price received by foreign sellers”). Adding the assessment to the price paid to (and received by) foreign sellers at the lower level of imports gives the market price charged to consumers by retailers or others who import the product for domestic sale.

The result of the assessment on the imported product, therefore, is a higher price charged to consumers and a lower net price received by foreign sellers. The difference between those two prices is the amount of the assessment. Thus, in this case, the assessment is paid by sellers in the exporting countries in terms of a lower price and by consumers in the importing country in terms of a higher price. As in the case of an assessment on a domestically-produced commodity, the share of the cost of the assessment paid for by domestic consumers and by foreign sellers depends on the price elasticities (that is, the relative price responsiveness) of supply and demand. Note that, in this case, the share of the cost paid by the two groups depends on the supply and demand elasticities in both the importing and the exporting countries. Consequently, the more price-elastic the supply and demand for the product in the exporting countries (and, therefore, the more elastic the export supply) and the less price-elastic the demand and supply of the product in the importing country (and, therefore, the more price-inelastic the import demand), the greater the share of the cost of the assessment that is paid by consumers in the importing country. Conversely, the more price inelastic is export supply and the more price elastic is import demand, the greater the share of the assessment that is paid by foreign sellers.

Finally, note that intermediaries involved in the buying, selling, transporting, or other services do not pay any of the cost of the assessment. For example, a domestic firm that buys the product from foreign sellers for sale in the domestic market pays the lower net price to the foreign sellers and charges the higher market price to consumers. So even if the assessment is collected from an intermediary firm such as a retailer, that firm does not actually pay the cost since the firm recovers that cost by being able to pay a lower price to foreign sellers and to charge a higher price to consumers than would have been the case without the assessment.

Incidence of the U.S. Cotton Producer Checkoff Assessment

Using the graphical model of U.S. and world cotton and cotton fiber textile markets developed earlier and based on the previous discussion of the incidence of a tax, Figure 13 provides a graphical analysis of the incidence of the U.S. cotton producer checkoff assessment. As explained earlier, the assessment acts as an increase in the cost of producing cotton and shifts the market supply of cotton up and, therefore, the U.S. export supply of cotton as well (the darker, higher U.S. export supply curve in Figure 13). The consequences are a higher world market price for cotton and a lower net price received by U.S. cotton producers. Again, whether the market price of raw cotton increases by more or less than the net price received by producers declines depends on the elasticities of supply and demand. In other words, the share of the assessment paid for by U.S. cotton producers and the share paid by buyers (cotton mills) depends on the responsiveness of cotton supply and demand to prices in the U.S. and foreign countries. An empirical investigation is necessary to determine the actual share of the assessment paid by the two groups.

The higher price of cotton reduces the quantity of cotton milled in the United States along with the volume of U.S. cotton exports since the decline in the U.S. cotton supply is greater than the decline in the U.S. quantity of cotton milled. The higher market price for cotton also reduces the quantity of cotton milled by foreign mills and increases the quantity of foreign cotton produced resulting in a lower volume of cotton imports by foreign countries. The quantity of cotton milled in the United States and in foreign countries reduces the U.S. and foreign CFT supplies. Even though the reduction in U.S. CFT production increases the U.S. demand for imported CFT (the rightward shift in the U.S. CFT import demand to the darker import demand curve in the bottom middle graph of Figure 13), the reduction in foreign CFT production restricts the availability of world CFT supplies (a leftward shift of the ROW CFT export supply to the darker export supply curve in the bottom middle graph of Figure 13), and pushes up the world CFT price (the higher, darker price line in the bottom row of graphs in Figure 13). Whether the U.S. imports more or less CFT as a consequence depends on whether or not the increase in U.S. import demand outweighs the reduction in the ROW export supply. If the ROW export supply declines by more than the U.S. import demand increases, the U.S. could import less CFT as a result of the U.S. cotton producer checkoff assessment. On the other hand, the assessment could lead to greater U.S. CFT imports if the increase in the U.S. demand for such imports outweighs the reduction in the ROW export supply. Either of the two cases is plausible but which actually occurs depends on myriad factors that affect the demand for and supply of cotton and cotton fiber textiles around the world. An empirical analysis is required to determine the net effect of the cotton producer checkoff assessment on world CFT trade.

Of course, the higher CFT price as a result of the assessment would tend to increase cotton mill demand in all countries leading to higher supplies of CFT in all countries, offsetting to some extent the positive effect of the producer assessment on the CFT price. Under typical conditions, however, the net effect of the producer assessment on prices and quantities in both the cotton and CFT markets would be those represented in Figure 13.

Incidence of the U.S. Cotton Textile Importer Checkoff Assessment

The graphical analysis of the U.S. cotton textile importer checkoff assessment also follows closely from the earlier discussion of tax incidence. In the middle bottom graph in Figure 14, the imposition of the importer assessment raises the CFT price charged to consumers and reduces the CFT price paid by importers (and received by foreign CFT suppliers) and, as a consequence, U.S. CFT imports decline. Whether or not the CFT price charged to consumers increases by more than the CFT price paid by importers declines again depends on the price responsiveness of domestic and foreign CFT supplies and demands. Under different plausible scenarios for the price elasticities of CFT supply and demand in the United States and in foreign countries, the share of the importer assessment paid for by U.S. consumers in the form of a higher price could be larger or smaller than the share of the importer assessment paid for by foreign CFT producers in the form of a lower CFT price. An empirical investigation is necessary to determine the U.S. CFT consumer and the foreign CFT producer incidence (or share) of the assessment.

The higher U.S. CFT price, however, signals an increase in U.S. mill demand (the rightward shift in U.S. mill demand to the darker curve in the top left graph in Figure 14) while the lower CFT price in foreign countries signals a decline in foreign cotton mill demand (the leftward shift in foreign mill demand to the darker curve in the top left graph of Figure 14). Because the United States mills more cotton leaving less for export (the leftward shift of the U.S. cotton export supply curve in the top middle graph of Figure 14) while foreign countries mill less cotton requiring less imports of U.S. cotton (the leftward shift of the ROW import demand curve in the top middle graph of Figure 14), the importer assessment not only leads to lower U.S. CFT imports but also to lower U.S. exports of raw cotton. The implications concerning U.S. cotton prices, however, depend on the relative shift of the U.S cotton export supply curve and the ROW import demand curve. If the reduction in ROW demand for U.S. cotton is greater than the U.S. reduction in the availability of cotton export supplies, the world price of cotton will be lower as a result of the importer assessment. If, on the other hand, U.S. export supplies decline by more than the foreign demand for U.S. cotton, the importer assessment could lead to a higher market price of cotton. Again, either case is quite plausible. Consequently, an empirical investigation is necessary to determine which case actually occurs.

Of course, the increased U.S. cotton mill demand results in increased domestic supplies of CFT which tends to moderate the increase in the U.S. CFT price caused by the importer assessment to some extent. At the same time, the lower foreign cotton mill demand results in lower foreign CFT supplies and tends to provide some price support in the ROW CFT market. Under typical conditions, however, the net CFT price and quantity effects are those shown in Figure 14 (that is, a higher CFT price in the United States and a lower CFT price in the rest of the world).

Effects of Cotton Checkoff Expenditures

The preceding analysis of the *incidence* of the cotton checkoff assessments considers the market effects of imposing the producer and importer checkoff assessments. Once the assessments are collected, they are then remitted to the Cotton Board and spent for various purposes, primarily for promoting the consumption of cotton textile products (retail marketing and promotion expenditures) and for research at the mill level mainly to develop new ways to use additional cotton in the production of cotton fiber textiles (non-agricultural research expenditures). This section considers the market effects of the marketing/promotion expenditures and the non-agricultural research expenditures made by the Cotton Board. The graphical analysis in this section does not consider the effects of the assessments themselves (that is, the incidence of the assessments), only the effects of spending the assessments for marketing/promotion and non-agricultural research. Nevertheless, in the empirical analysis of the cotton checkoff program, we account for both the assessments and the expenditures associated with the assessments.

Effects of the Cotton Checkoff Retail Marketing/Promotion Expenditures

As indicated earlier, the largest portion of cotton checkoff funds are spent on promoting the retail consumption of cotton fiber textiles (marketing/promotion expenditures). If marketing and promotion expenditures effectively shift out the U.S. demand for cotton fiber textiles as intended, then Figure 15 illustrates the likely effects of such expenditures on world cotton and cotton fiber markets using the graphical model developed previously.

An increase in the U.S. demand for cotton fiber textiles as a result of checkoff program expenditures (represented by the rightward shift of the CFT retail demand curve in the bottom left graph of Figure 15) results in a rightward shift of the U.S. CFT import demand (middle bottom graph in Figure 15) and a consequent increase in the CFT market price (the higher, darker horizontal line in the bottom row of graphs in Figure 15). The increase in the CFT price, however, signals an increase in cotton mill demand in all countries (top left graph and the top right graph of Figure 15) resulting in less U.S. cotton available for export at the same time that the foreign import demand for cotton increases. As a result, the world price of cotton also increases, limiting the expansion of cotton mill demand in all countries. The effect on U.S. cotton exports, however, is unclear. If the reduction in the U.S. cotton export supply is greater than the increase in the foreign import demand for cotton, U.S. cotton exports decline as a result of the marketing/promotion expenditures financed by the checkoff assessments.

On the other hand, if U.S. cotton export supplies decline less than the increase in the import demand for cotton, then the marketing/promotion expenditures result in an expansion of U.S. cotton exports. In either case, however, the marketing/promotion expenditures clearly increase the price of cotton as well as the price and imports of cotton fiber textiles. Because the increase in U.S. cotton mill demand also increases the supply of domestically-produced cotton fiber textiles, not all of the additional consumption of cotton fiber textiles comes from imports. The shares of the increased U.S. CFT consumption accounted for by increased imports and by increased domestic CFT supplies depend on the relative price elasticities of U.S. and foreign CFT and cotton supplies and demands. If, for example, the U.S. mill demand for cotton is relatively sensitive to an increase in the CFT output price compared to foreign mill demand and foreign CFT demand is highly price inelastic, then a relatively larger share of the increased U.S. CFT demand from the marketing/promotion expenditures is likely to come from domestic supplies than from imports. If not, then the increase in demand for CFT prompted by the retail CFT marketing promotion expenditures could come primarily from imports.

Effects of the Cotton Checkoff Non-Agricultural Research Expenditures

As discussed in an earlier section of this report, some of the cotton checkoff funds are spent to develop new means of using additional cotton to produce additional cotton fiber textiles. Such "non-agricultural" or textile research expenditures represent mill-level cotton demand promotion. If such expenditures are effective, then they result in a rightward shift in the mill demand for raw cotton. Because these research activities are directed at foreign as well as U.S. textile mills, expenditures of this type tend to shift out the foreign as well as the U.S. mill demand for cotton (the rightward shifts in the U.S. and foreign mill demands to the darker mill demand curves in the top left and top right graphs of Figure 16).

In the U.S., greater domestic use of domestically produced cotton as a result of the non-agricultural research expenditures results in less U.S. cotton available for export as depicted by the leftward shift of the U.S. cotton export supply in the top middle graph of Figure 16. At the same time, greater foreign mill use of cotton induced by the research expenditures shifts out the foreign or rest-of-the-world (ROW) import demand for U.S. cotton as also shown in the top middle graph of Figure 16. Together, the reduced availability of U.S. cotton for export and the increased ROW mill demand for cotton boosts the price of cotton in both the U.S. and ROW markets. The implications for U.S. exports of cotton, however, are unclear. If the increase in U.S. mill demand for cotton induced by the non-agricultural cotton research expenditures is greater than the corresponding shift in the ROW cotton mill demand, then U.S. cotton exports would tend to decline. If the reverse is the case, then U.S. cotton exports would tend to drop as a result of the non-agricultural research expenditures.

In the U.S., the increased processing of cotton results in an increase in the supply of domestically-produced cotton fiber textiles (the rightward shift of the CFT supply curve in the bottom left graph of Figure 16) and, therefore, a reduced U.S. demand for imported cotton fiber textiles (the leftward shift of the U.S. CFT import demand curve in the bottom middle graph of Figure 16). At the same time, however, the ROW mill demand for cotton increases the ROW production of cotton fiber textiles (the rightward shift of the ROW CFT supply curve in the bottom right graph of Figure 16) as well as the ROW supply of cotton fiber textiles available for export (the rightward shift in the ROW export supply curve in the bottom middle graph of Figure 16). Together, the leftward shift of the U.S. demand for CFT imports and the greater ROW supply of CFT exports results in a lower CFT price in the CFT markets in both the U.S. and the ROW markets. Again, however, the implications for U.S. imports of CFT are ambiguous. U.S. CFT imports would tend to decline if the increase in the U.S. supply of cotton fiber textiles was larger than the corresponding increase in the ROW supply of cotton fiber textiles. U.S. CFT imports would tend to rise if the opposite was the case.

<u>The Complications of U.S. Cotton Farm Policy</u>

The effects of the cotton checkoff program expenditures on the U.S. cotton market over the years have been complicated by U.S. farm policy. In the decade preceding the 1996 Farm Bill, the central feature of U.S. farm policy for many commodities, including cotton, was the deficiency payment scheme. As discussed earlier, under U.S. farm policy during that period, U.S. cotton farmers received deficiency payments in each year equal to the difference between the established target price and the existing national average market price for cotton. During that period, a NR loan program with a marketing loan feature was also in place for cotton although the cotton market price was generally above the loan rate in most years as illustrated in Panel A of Figure 17.

The policy worked to make the farm supply of cotton generally unresponsive to changes in the market price of cotton at levels below the target price for those producers that participated in farm programs as illustrated also in Figure 17 with the vertical supply curve for cotton below the target price. With the market price between the target price and the NR loan rate, producers would sell their cotton output at the market price, repay their production loan from the government at the established loan rate, and receive a payment from the government in the amount of the difference between the target price and the market price multiplied by their output (the shaded area in Panel A of Figure 17). The effective price received by the producer, therefore, was the market price plus the per unit deficiency payment. Consequently, changes in the market price had little effect on the market supply and mainly affected the level of the deficiency payment (that is, the cost of the cotton program to taxpayers) and the shares of producer cotton revenues that came from market sales and from government payments.

With the marketing loan feature, the NR loan rate for cotton did not operate as a floor to government payments to cotton farmers as was the case for most other program crops during that period. When the cotton market price (as represented by the AWP) dropped below the loan rate, which only happened in one year during that period (1986), cotton producers did not default on their loans and transfer ownership of their cotton to the CCC but rather sold their cotton and repaid their loans at less than the loan rate. As a consequence, the cotton market price was not supported at the loan rate in low price years by government takeovers of cotton pledged as collateral on defaulted loans but, rather, was free to drop in response to negative market forces. Producers would keep the loan from the government in the amount of the difference between the target price and the loan rate and also receive a marketing loan gain equal to the difference between the NR loan and the AWP. Consequently, the effective price per unit to producers was still the target price even in low market price years.

Because the pre-1996 cotton farm program effectively rotated the domestic supply curve of cotton below the target price to a vertical position (so that supply was unresponsive to changes in the market price), the farm program also rotated the U.S. cotton export supply curve to the right below the target price level since export supply is simply the horizontal difference between domestic supply and demand. Given the ROW import demand for cotton, the cotton market price then is set at the level shown in Panel A of Figure 17. Thus, with the market price between the target price and the NR loan rate as was the case in most years during that period, the total payment to cotton farmers subsequently was the difference between the target price and the market price multiplied by the quantity of cotton produced (the shaded area in Panel A in Figure 17 as indicated earlier).

From an examination of Figures 15 and 16, note that checkoff expenditures for both retail marketing/promotion activities and non-agricultural research activities result in a rightward shift of the U.S. mill demand for cotton, a leftward shift of the U.S. export supply of cotton, and a consequent increase in the cotton market price. This scenario is reproduced in panel B of Figure 17. In this case, any increase in the cotton market price as a result of cotton checkoff expenditures during that pre-1996 Farm Bill period simply reduced the amount of government deficiency payments to cotton producers (the smaller shaded area in Panel B of Figure 17). While a larger share of producer revenues consequently came from the market and less from the government, the effective price and total revenues received by cotton producers were relatively unaffected by cotton checkoff expenditures. In other words, under the pre-1996 farm policy, the cotton checkoff program primarily worked to limit government payments to farmers rather than to increase cotton producer revenues. Because not all cotton producers participated in farm programs, the cotton checkoff program likely had a small positive effect on the aggregate revenues of U.S. cotton producers during that period.

As discussed earlier, the 1996 Farm Bill (the FAIR Act) eliminated target prices and the deficiency payment program in favor of decoupled direct payments to farmers so that the cotton checkoff program worked essentially as depicted earlier in Figures 15 and 16. The 1996 Farm Bill continued the marketing loan program for cotton but market prices continued to stay above the loan rate until the 1999/2000 crop year (see Table 13).

An increase in world commodity supplies and a drop in world commodity prices along with weakened global demand in the late 1990s set the stage for a return to target prices and a form of deficiency payments referred to as counter cyclical payments (CCPs) in the 2002 Farm Bill. In addition, the loan deficiency provisions were continued providing an additional payment to farmers in years when the market price drops below the loan rate which has occurred frequently in recent years (see Table 13). The effects of the essential features of the 2002 Farm Bill on cotton markets are depicted in Panel A of Figure 18. With a market price below the loan rate, cotton producers receive a per unit CCP equal to the target price minus the loan rate minus the direct payment rate as well as an LDP/MLG payment calculated as the difference between the loan rate and the AWP.

Under the 2002 Farm Bill, therefore, given a market price below the loan rate, which has been the case frequently in recent years, a rightward shift of the U.S. cotton mill demand as a result of cotton checkoff program expenditures would increase the market price as depicted in Panel B of Figure 18 and reduce government payments to farmers by eliminating some or all of the LDP/MLG and CCP payments. Consequently, the checkoff program currently works to reduce the costs of the cotton program to taxpayers as was the case before the implementation of the 1996 Farm Bill. The primary effect of the cotton checkoff program on producers is again to reduce the share of producer revenues paid for by the government and to increase the share coming from private market sales.

Spillover Effects of Cotton Checkoff Expenditures

The cotton checkoff program can have unintended effects on other related fiber and fiber textile markets – the so-called spillover effects of checkoff promotion. To the extent that checkoff program expenditures have an effect on cotton and cotton fiber markets, those expenditures might be expected also to have effects on related fiber and fiber textile markets. These effects can be illustrated for man-made fiber (MMF) and man-made fiber textile (MMFT) markets in a graphical analysis similar to the one used for the analysis of cotton and cotton fiber markets. In Figure 19, the United States is depicted as a net importer of raw man-made fibers rather than a net exporter as in the case for raw cotton. The same is the case for man-made fiber textiles consistent with the market situation for cotton fiber textiles. In other words, in the U.S. markets for both man-made fibers and man-made fiber textiles, the U.S. demand is greater than the U.S. supply at most prices. Thus, at most prices, the U.S. tends to import both man-made fibers and man-made fiber textiles.

Given the graphical representation of the MMF and MMFT markets as discussed above and depicted in Figure 19, then the use of checkoff funds to promote the retail demand for cotton fiber textiles might be expected to result in some shift of total textile consumption away from man-made fiber textiles toward cotton fiber textiles to some extent (shown as a leftward shift of the MMFT retail demand curve in the lower left graph in Figure 19). The result in the MMFT market would be a reduction in U.S. MMFT import demand (the leftward shift in the U.S. import demand curve in the bottom middle graph of Figure 19), a consequent drop in the MMFT market price (the lower, darker horizontal line in the bottom row of graphs in Figure 19), and lower U.S. MMFT imports. The drop in the MMFT price, in turn, reduces the MMF mill demand in both the United States and foreign markets (the leftward shifts of the mill demand curves in both the top left and top right graphs in Figure 19).

With a lower U.S. MMF mill demand, the U.S. MMF import demand curve shifts to the left (top middle graph of Figure 19). At the same time, given a lower MMF mill demand in foreign countries, the quantity of MMF available for export increases (top middle graph in Figure 19). Thus, with a lower U.S. MMF import demand and a greater availability of MMF from the ROW, the market price of MMF unambiguously declines. The implication for world MMF trade, however, is not so clear. Whether MMF trade increases or decreases depends on the relative shifts of the MMF mill demands in both regions. If the drop in the MMFT price reduces the MMF mill demand in the U.S. by more than in the ROW, then MMF trade declines. If not, then MMF trade increases. Which case actually holds is an empirical question that can only be determined through a statistical examination of the data.

The effect of the cotton checkoff program on MMF and MMFT markets is somewhat different if the funds are used to promote the mill level demand for cotton through expenditures on non-agricultural research. At the mill level, cotton is more likely to be a complement to man-made fibers than a substitute since the production of cotton textile products often involves the use of fiber blends. Thus, an increase in the use of cotton to produce new textile products through cotton checkoff-financed non-agricultural research often results in an increase in the demand for raw man made fibers as well. This non-agricultural-research-induced increase in the mill demand for man made fibers is depicted as a rightward shift in the MMF mill demand curve in the top left graph in Figure 20 and a corresponding rightward shift in the U.S. MMF import demand curve in the top middle graph. The greater U.S. MMF import demand leads to an increase in the MMF market price (the higher, darker horizontal line in the top row of graphs in Figure 20), a reduction in the quantity of MMF demanded by the rest of the world, and an increase in the quantity of MMF supplied to the market by the ROW.

The increase in the U.S. MMF mill demand results in an increase in the domestic quantity demanded of MMF (top left graph of Figure 20) and a corresponding increase in the supply of MMFT (the rightward shift in the MMFT supply curve in the bottom left graph of Figure 20) and along with a leftward shift in the U.S. MMFT import demand curve (bottom middle graph of Figure 20). At the same time, the decline in the quantity demanded of MMF by mills in foreign countries reduces the production of MMFT in those countries (a leftward shift in the MMFT supply curve in the bottom right graph of Figure 20) as well as the supply of MMFT available for export (a leftward shift in the ROW export supply curve in the bottom middle graph of Figure 20). The result is an unambiguous decline in U.S. imports of man made fiber textiles as a result of the non-agricultural research expenditures funded by the cotton checkoff program. The result for the price of man-made fiber textiles is ambiguous and depends on the relative shifts in the ROW MMFT export supply and the U.S. MMFT import demand.

Empirical Analysis of the Cotton Checkoff Program

The preceding graphical analysis provides a basic understanding of what economic theory can tell us about the potential effects of the cotton checkoff program on cotton and cotton textile markets as well as on competing man-made fiber and man-made fiber textile markets. Although the graphical analysis is a powerful tool for analyzing the expected *direction* of the effects of the program, the analysis provides little insight into the likely *magnitude* of effects. Consequently, in this section we present an empirical analysis of the cotton checkoff program both as a test of the hypotheses relating to the direction of the impacts of the cotton checkoff program as represented by the preceding graphical analysis as well as a measurement of the magnitude of the effects of the program. After presenting the model and data used in the empirical analysis, we present the results of econometrically estimating the parameters of the model, focusing on several key equations in the model. The results of validating the model for use in analyzing the effects of the cotton checkoff program then are discussed. Subsequently, we present the results of using the validated model to conduct an historical simulation analysis of the cotton checkoff program in which we examine several scenarios of changes in the level of checkoff funding to measure the market effects. The results of the simulation analysis are used in the subsequent benefit-cost analysis in which we calculate the returns to both producers and importers. Finally, the simulation results also are used as the basis for an analysis of the incidence of the checkoff assessment (that is, an analysis of who actually pays the cost of the assessments).

The MCERI Model

The empirical analysis of the cotton checkoff program is conducted with the use of a multi-equation, econometric, simulation model of U.S. and foreign fiber markets. The model originally was developed by the Cotton Economics Research Institute (CERI) at Texas Tech University but was modified for this project to account for the programmatic activities of the Cotton Board and, hence, is referred to in this report as the modified CERI model or the MCERI model. The CERI model has been used for a wide range of analyses and has received extensive peer review associated with academic journal articles, including most recently Pan et al. (2006a); Pan et al. (2006b); Pan et al. (2005); Chaudhary et al. (2006); Li, Mohanty, and Pan (2005); and Ramirez et al. (2004). An extensive technical description and documentation of the extensive CERI model is available in Pan and Mohanty (2005).

A frequently used market analysis tool is the equilibrium displacement model (EDM) which originated with Muth (1964). The EDM has been used extensively in evaluating the effects of promotion on markets and producer and consumer surplus (see, for example Alston, Chalfant, and Piggot (1995); Piggot, Piggot, and Wright (1995); Kinnucan (1996); Kinnucan and Christian (1997)). The EDM framework is appealing for three reasons: (1) it is flexible in modeling diverse economic phenomena; (2) it is easy to implement; and (3) the results are robust to econometric misspecifications. However, EDMs still are grossly inadequate when subjected to the scientific standards of confirmation and falsification because they presently are not testable as to their empirical validity. Consequently, their empirical claims are highly questionable. Without confirmation and falsification, theoretical speculations remain just that – speculation (Davis (2001); and Davis and Espinoza (1998, 2000)).

In an EDM, the values of reduced-form parameters are determined by substituting values for the structural parameters. The values of the structural parameters, usually elasticities, are obtained in one of three ways: (1) arbitrarily assumed; (2) borrowed from other studies; or (3) estimated empirically. The obvious shortcoming in this type of analysis is the assumption that the structural elasticities are assumed to be known with certainty (Davis and Espinoza (1998, 2000); Griffiths and Zhao (2000)).

Though the general procedure is couched within the same framework as a structural econometric model, an EDM is fundamentally different from an econometric model. In an econometric model, the unrestricted estimation process forces the parameter estimates and the data set under consideration to be compatible. Hopefully, the parameter estimates then also are compatible with theory. Alternatively in an EDM, the researcher forces the parameter estimates and the theory to be compatible. As a result, the parameters in an EDM may not be compatible with any single data set. Hence, the results are difficult to validate based on actual observations.

The only previous studies of the cotton checkoff program were done by Capps et al. (1997) and Murray et al. (2001). Both studies relied on the development of econometric models (technically quasi-reduced form specifications) to quantify the effects of the cotton checkoff program not only on the demand for cotton but also on the welfare of cotton producers and cotton importers. The 1997 Capps et al. investigation also used a time-series (vector autoregression) approach to serve as a check of the robustness of the econometric model results. Their study focused on the performance of the Cotton Research and Promotion Program primarily during the period of 1991 through 1995 while the 2001 study by Murray et al. focused on the period of 1996 through 2000.

The analysis presented in this report is the third in the series of economic evaluations of the cotton checkoff program. The analysis focuses on the period of 1986/87-2004/05 and is an updated and revised version of a comprehensive analysis of the effects of the cotton checkoff program recently completed by the authors in connection with the recent legal defense of the program. That analysis and this updated version make extensive and fundamentally important advances in the methodology for analyzing the cotton checkoff program leading to the most accurate, reliable, and defensible measurement of the impacts and returns from the cotton checkoff program to date. A few of the more salient advances in this analysis include the following:

- The model used in this study is a more formal and structurally comprehensive model than used by either Capps et al. (1997) or Murray et al. (2001). The model includes many key economic and market relationships and linkages not accounted for in the models used in those two studies while avoiding the pitfalls of the EDM and similar analytical methods.
- The model used in this study also explicitly includes both the raw cotton and man-made fiber markets as well as cotton and man-made fiber textile markets and their extensive market linkages and interrelationships. Cotton checkoff expenditures on marketing and promotion are linked in the model directly to retail level demand for cotton and man-made fiber textiles while expenditures for non-agricultural research expenditures are linked directly to mill level demands for cotton and man-made fiber.
- Because the model includes both cotton and man-made fiber and textile markets, the analysis explicitly measures the "spillover" effects of the cotton checkoff program, that is, the impacts of the program on not only the cotton industry but also the man-made fiber industry.
- The model also explicitly accounts for the incidence of the checkoff assessments allowing a detailed measurement of the share of the costs of the assessments borne by U.S. producers, importers, foreign producers, foreign mills, and consumers.
- The model used includes detailed representations of the complicated government cotton policy over the years so that the savings to taxpayers in terms of reduced government outlays to cotton farmers over time that are directly attributable to the cotton checkoff program can be measured.
- This study provides the first ever measurement of the impacts of agricultural research funded by the cotton checkoff program on cotton harvested acreages and yields in four production regions across the United States.

- This study provides both discounted and undiscounted average benefit-cost ratios (BCR) for both domestic producers as well as for importers over the period of 1986/87 through 2004/05. Because the original Cotton Research and Promotion Act of 1966 was amended to make contributions to the checkoff program mandatory and to require contributions by importers, the BCR analysis is also decomposed into two time periods: (1) the "voluntary contribution period" of 1986/87 through 1991/92 and (2) the "mandatory contribution period" of 1992/93 through 2004/05.

In essence, the MCERI model used in this analysis functions through the *simultaneous* interaction of various supply, demand, trade, and price components across various commodities and regions of the world (Labys (1972)). The main components of the model include: (1) the U.S. and foreign cotton production; (2) U.S. and foreign man-made fiber production; (3) U.S. and foreign cotton and man-made fiber mill demands; (4) U.S. and foreign demands for cotton textiles and man-made fiber textiles; (5) world trade and price linkages for cotton, cotton textiles, man-made fiber, and man-made fiber textiles; and (6) international trade policy and U.S. government farm policy elements.

The U.S. cotton supply sector in the model is divided into four production regions: (1) Delta; (2) Southeast; (3) Southwest; and (4) West (Figure 21). The Southwest is further subdivided into irrigated and dry land areas of production. Cotton producers located in the irrigated areas of the Southwest may make considerably different acreage response decisions than cotton producers located in dry land regions of the Southwest. Cotton competes for acreage with other commodities, primarily soybeans in the Delta and Southeast regions, sorghum and wheat in the Southwest, and corn and wheat in the West.

The model also includes representations of 24 foreign cotton regions as well, including: (1) China (divided into three production sub-regions: the Xinjiang valley, the Yellow River valley, and the Yangtze River valley); (2) India (divided into three production sub-regions: Northern—Haryana, Punjab, and Rajasthan; Western--Maharastra, Gujarat, and Madhya Pradesh; and Southern—Karnataka, Tami Nadu, and Andhra Pradesh); (3) Pakistan; (4) South Korea; (5) Taiwan, (6) Japan; (7) Other Asia; (8) Egypt; (9) Other Africa; (10) Mexico; (11) Canada; (12) Brazil; (13) Argentina; (14) Other Latin America; (15) Australia; (16) Turkey; (17) Other Middle East; (18) Uzbekistan; (19) Russia; (20) Other Former Soviet Union; (21) the European Union (EU-15); (22) Other Western Europe; (23) Eastern and Central Europe; and (24) a rest-of-the-world (ROW) region.

Cotton production in the U.S. and foreign cotton producing regions is derived in the MCERI model from behavioral (structural) stochastic equations related to acreage and yield. Figure 21 represents these relationships for the U.S. region. Generally, acreage is specified as a function of the expected net returns for cotton and competing crops. For the U.S., expected net returns for cotton and competing crops include both market returns and all government program payments such as direct payments, marketing assistance, loan deficiency payments, and counter cyclical payments. Producer cotton assessments associated with the checkoff program are treated as a cost and subtracted from the expected net returns. Yield is a function of expected cotton prices and technological development. National cotton production in each case is the sum of production in the corresponding regions.

Unlike previous studies of the cotton checkoff program reported in the literature, the MCERI model used in this analysis takes into account the markets and prices of not only cotton (top half of Figure 22) but also wool and man-made fibers (synthetics, primarily polyester, and cellulosics, primarily rayon) (bottom half of Figure 22) and their interactions. Man-made fiber production for both synthetics and cellulosics is derived through the estimation of capacity and utilization behavioral equations for each country (Figure 23). Emphasis in the model is placed on cotton and man-made fibers (primarily synthetics). As indicated earlier in this report, these fibers collectively account for more than 95% of total world fiber utilization. Synthetic fiber accounts for roughly 88% of the man-made fiber production in the world. Importantly, then, the MCERI model is capable of capturing *spillover effects*, that is, the impacts on the man-made fiber industry induced by the promotion and marketing activities as well as the non-agricultural research activities of the Cotton Board.

For each region as appropriate, the MCERI model also includes behavioral equations representing raw cotton and raw man-made fiber demand (mill demands and ending stocks) as indicated in Figure 22. Mill use, both for cotton and man-made fiber, is a function of the textile price in the downstream retail market, prices of raw cotton and man-made fiber from the upstream market (mills), and the non-agricultural research expenditures of the Cotton Board in each region as appropriate to the extent that the data are available. This structural representation of world fiber markets takes into account inter-fiber competition or complementary relationships between natural fibers and man made fibers in textile mill use as well as the important linkages between the raw fiber production segments of the marketing chain and the processing segments (mills) of the marketing chain in each region.

The U.S. model also includes representations of the cotton fiber textile market and the man-made fiber textile market (Figure 24). The U.S. demand for cotton and man-made fiber textiles is calculated as the sum of the net imports of cotton and man-made fiber textiles plus mill use of cotton and man-made fiber and is specified in the model to be a function of the textile price in the retail market, disposable personal income, and the marketing and promotion activities of the Cotton Board. These components of the model solve for retail level cotton textile and man-made fiber textile prices which enter the respective U.S. mill demand equations as the output price.

Finally, the MCERI model includes a series of international price and trade linkages for cotton, man-made fiber, cotton fiber textiles, and man-made fiber textiles to close the model (Figure 25). The price and trade linkages account for appropriate tariffs, quotas, and qualitative trade-related elements (such as the implementation of the new GATT agreement under the World Trade Organization). In essence, the model solves for world synthetic prices as well as the world price of cotton (the A index) which are linked to the respective domestic prices of cotton and man-made fibers in each region.

Data

Two general types of data were required for the analysis undertaken in this study: (1) data pertaining to supply, demand, trade, prices, etc and (2) marketing and promotion expenditures and non-agricultural research expenditures by the Cotton Board. The data sources are compiled from the St. Louis Federal Reserve Bank, the Food and Agricultural Policy Institute (FAPRI), the Foreign Agricultural Service (FAS), the FAO World Fiber Consumption Survey, *Fiber Organon* (published by the American Fiber Manufacturers Association), the Cotton Board, Cotton Incorporated, the National Cotton Council, the U.S. Department of Agriculture, and direct contact with various research organizations and institutes in various countries. In general, the structural parameters of this multi-equation model are estimated using 29 annual data observations covering 1976 through 2004, the common time period and frequency across all endogenous and predetermined variables.

Model Parameter Estimation

This section reports the empirical results of the econometric estimation of the parameters of the MCERI model with an emphasis on four key U.S. demand equations which are the focus of the marketing and promotion activities as well as the non-agricultural research activities of the Cotton Board. The parameters of the MCERI model were estimated using Ordinary Least Squares (OLS) with annual data for 1976 to 2004. Two (2SLS) or three-stage least squares (3SLS) procedures sometimes are used in the estimation of simultaneous systems. In this case, however, the large size of the model and the availability of limited annual observations resulted in a greater number of predetermined variables than the number of observations. Also, given that the efficiency gained in parameter estimation with the use of 2SLS and 3SLS is actually consistent with a large number of data points, OLS was the estimator of choice in this analysis. Additionally, data for some years of the 1976 to 2004 time period were not available for some behavioral equations, further necessitating the use of OLS to estimate the parameters of the behavioral equations in the model.

The four key demand equations (discussed in more detail below) account for more than 96% of the variability in the corresponding endogenous variables indicating that these representations provide excellent fits of the data. Also, the signs and magnitudes of the estimated parameters in each demand equation are consistent with *a priori* expectations as indicated for key variables in the model by their partial elasticities (Table 16).
For all cotton producing regions, cotton acreage is highly inelastic with respect to price in the short-run as expected, with elasticities ranging from 0.05 in the U.S. Delta region to 0.57 in Mexico (Table 16). The long-run price elasticity of cotton acreage in each region is higher than their short-run counterparts as expected, varying from 0.17 in Uzbekistan to 1.49 in Mexico.

Also, the demand for cotton at the mill level is estimated to be price inelastic as expected. The own-price elasticities for cotton at the mill level range from -0.08 in the U.S. to -0.73 in China. The U.S. mill demand price elasticity is about half the elasticity estimate of –0.17 previously reported by Capps et al. (1997) and much smaller than the -0.40 mill demand price elasticity reported by Murray et al (2001) and the -0.30 elasticity reported by Lowenstein (1952), Wohlgenant (1986), Waugh (1964), and Ding and Kinnucan (1996). Shui, Behgin, and Wohlgenant (1993) reported a much higher cotton mill demand price elasticity of –0.60.[4]

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[4] According to one peer reviewer (Dr. Carl G. Anderson), the inconsistency of estimated cotton mill demand elasticities has been noted by cotton industry analysts for many years.

In all regions except the United States, the estimated cross-price elasticities for polyester in the respective cotton mill demand equations are positive and smaller in magnitude than the corresponding own-price elasticities for cotton. The implication is that polyester and cotton re substitutes in foreign cotton mill use. The cross-price elasticity for polyester in the U.S. cotton mill demand equation, however, is negative and larger in magnitude than the own-price elasticity for cotton implying that cotton and polyester are complements at the cotton mill level of the U.S. cotton industry. Although different from the results for foreign countries in the MCERI model, the finding that cotton and polyester are complements in cotton mill use in the United States is consistent with the conclusions of a number of other studies, including Capps et al. (1997), Ding and Kinnucan (1996), and Murray et al. (2001). The latter study found the elasticity of cotton mill demand with respect to polyester price to be –0.13, lower than the estimate of -0.26 found in this study. Ding and Kinnucan (1996) reported a quite high short-run polyester price elasticity of cotton mill demand of –0.27 and an even higher long-run cross-price elasticity of –0.85. Capps et al. (1997) estimated the polyester cross-price elasticity to be -0.55.

For U.S. man-made fiber mill demand, the estimated own-price elasticity is -0.20 and the estimated cotton cross-price elasticity is -0.08 (Table 16). Because this study is the first to report parameter estimates for U.S. man-made fiber mill demand, there are no results from other studies with which to compare those reported here. However, these results are consistent with those found for U.S. cotton mill demand providing further evidence that cotton and man-made fibers are complements in mill use in this country. Thus, when prices for either cotton or man-made fibers rise (fall), less (more) of both cotton and man-made fiber are demanded by U.S. mills.

At the retail level of fiber markets, the demands for textiles across all countries in the model, including the United States, are found to be inelastic with respect to both the prices of textiles and income (Table 16). In the U.S., the estimated own-price elasticities of cotton fiber textile demand and man-made fiber textile demand are -0.41 and -0.24, respectively. In foreign countries, data limitations restricted the estimation of parameters to the demand for *all* textiles. The estimated own-price elasticities for all textiles in those countries range from -0.03 for Taiwan to -0.53 for Pakistan. The estimated income elasticities range in magnitude from 0.03 in South Korea to 0.81 and 0.87 in Mexico and the U.S, respectively. The U.S. demand for man-made fiber textiles is estimated to be slightly more income inelastic (0.56) than cotton fiber textiles (0.87). Given that the estimated income elasticities of textiles are positive and less than unity in magnitude across all countries, the implication is that consumers in most countries consider textile goods to be necessities rather than luxury goods.

The price elasticities of the foreign supplies of cotton fiber textiles and of man-made fiber textiles are important in determining the extent of the price and quantity responses in the model to any checkoff-induced increases in the retail and mill-level demands for cotton. Recall from an earlier discussion that the share of U.S. cotton fiber textile consumption accounted for by imports since the mid-1980s has increased from about a third to about two-thirds while the domestically produced share has declined from about two-thirds to about one-third over that same period (see Table 9). The import share of U.S. man-made fiber textile consumption also increased dramatically over that same period from about 10% to about one-third while the domestically-produced share has declined from 90% to about two-thirds. Most of the cotton fiber the U.S. imports from other countries is in the form of apparel or intermediate products. Some of those cotton product imports may be manufactured with the raw cotton the U.S. exports to foreign countries. The U.S. also exports some cotton textile products but most are relatively unprocessed and often return to the U.S. in a more finished form. Thus, how effective the cotton checkoff program is at raising cotton and cotton textile prices and generating increased profits at the farm level depends critically on how textile imports respond to any price changes induced by the program. In the model, the import supply elasticity for cotton fiber textiles is estimated to be 0.62 in the short-run and 0.93 in the long-run (Table 16). Thus, a 10% increase in the price of cotton fiber textiles translates into a 6.2% increase in the import supply of cotton fiber textiles in the short-run and a 9.3% increase in the long-run. Murray et al. (2001) estimated an unreasonably large long-run import supply elasticity for cotton fiber textiles of between 4.2 and 7.1. The lower estimated import supply elasticity in this study reflects the effects of nearly 50 years of U.S. restrictions on imports of cotton fiber textiles under the Multi-Fiber Agreement on the price responsiveness of those imports as discussed in an earlier section. Those restrictions were only recently phased out.

For the U.S. import supply of man-made fiber textiles, the price elasticity is estimated to be 0.58 in the short-run and 13.4 in the long-run. No previously published estimates of U.S man-made fiber textile import supply are available. The elasticity estimates indicate that a 10% increase in the man-made fiber textile price translates into a 5.8% increase in the man-made fiber textile import supply in the short-run and a 134% increase in the long-run. Because man-made fibers have faced fewer U.S. import restrictions than has been the case for cotton textiles, the import supply of man-made fiber textiles is estimated to be far more sensitive to changes in its price, at least in the short-run, than is the case for the import supply of cotton fiber textiles.

The U.S. Cotton and Man-Made Fiber Demand Equations in the MCERI Model

The direct effects of the cotton checkoff program in the model are reflected in the four equations in the MCERI model relating to the retail demands for cotton fiber textiles and for man-made fiber textiles and to the mill demands for cotton and for man-made fibers. The estimated coefficients, t-statistics, p-values and other regression statistics associated with these four demand equations are provided in Tables 17 and 18. Given the sample size in this analysis, the significance level chosen for this analysis was 0.10. Consequently, estimated coefficients of the structural parameters were deemed to be statistically different from zero if their corresponding p-values were less than 0.10 for two-tailed tests and less than 0.20 for one-tailed tests. The accompanying definitions of the variable names used in Table 17 are provided in Table 18.

U.S. Cotton Fiber Textile Demand and Man-Made Fiber Textile Demand Equations

The first set of U.S. demand equations in the model represent consumer demand at the retail end of the cotton and man-made fiber marketing chains which include the apparel market, the home furnishings market, and others (see USDAf). As discussed in an earlier section of this report, about two-thirds of the cotton checkoff funds are used for marketing and promotion activities in an attempt to shift out the retail demand for cotton fiber textiles (see Table 15). These two equations provide a statistical analysis of the effectiveness of those expenditures in achieving the goal of shifting the cotton fiber textile demand shifting and of the spillover effects of those expenditures on the demand for man-made fiber textile goods.

Equations (1) and (2) in Table 17 provide the OLS parameter estimates for the U.S. cotton fiber textile demand equation and the U.S. man-made fiber textile demand equation, respectively. The associated goodness-of-fit statistics (R^2) are 0.992 and 0.979, respectively. In other words, these two equations explain nearly all of the variability in the consumption of cotton fiber textiles and man-made fiber textiles over the period of analysis (1976-2004). Neither the Durbin-Watson (DW) statistics nor the Ljung-Box Q-statistics indicate the presence of serial correlation of residuals in either of these structural equations.

The econometric analysis indicates that the statistically significant drivers of cotton fiber textile consumption include the real (inflation-adjusted) cotton textile fiber price, real disposable personal income, real cotton checkoff marketing and promotion expenditures, and qualitative variables related to agricultural and trade policy. The own-price elasticity of demand for cotton fiber textiles is estimated to be -0.41 while the income elasticity of demand for cotton fiber textiles is estimated to be 0.87 (see Table 16).

The carryover effects associated with all advertising and promotion programs (Clarke (1976); Lee and Brown (1992); Forker and Ward (1998)) are accounted for in this analysis through the use of a polynomial distributed lag (PDL) procedure, a lag formulation commonly used in the analysis of advertising effectiveness. A previous analysis of the cotton checkoff program by Murray et al. (2001) used the PDL procedure. The attractive features of the PDL include: (1) a flexible representation of the lag structure allowing for the possibility of humped-shaped or monotonically declining lag weight distributions and (2) a parsimonious representation of the lag structure (Simon and Arndt (1980)). Another previous analysis of the effectiveness of the cotton checkoff program by Capps et al. (1997), however, used a polynomial inverse lag (PIL) structure (Mitchell and Speaker (1986)) rather than the PDL to capture the carryover effects. In contrast to the PDL model, the PIL does not require specifying the lag length, and, thus, is conceptually an infinite lag. In principle, then, the use of the PIL lag formulation imposes the assumption on the model that advertising/promotion expenditures in one period have infinitely long impacts over time on consumption. Consequently, the PDL formulation was adopted for this study in order to allow for testing for lag length, that is, the pattern and time period over which advertising expenditures influence demand. The search for the polynomial degree and lag length for each advertising variable involves a series of nested OLS regressions. Second, third, and fourth degree polynomials with lags up to 10 years were considered in each case. Based on the Akaike Information Criteria (AIC) and the Schwarz Information Criterion (SIC) statistics for selecting lag length, the optimal lag length for the marketing promotion expenditures in both equations was two years while the degree of the polynomial was two with the PDL beginning with the current level of expenditures. This finding is consistent with Capps et al (1997) as well as Ding and Kinnucan (1996). Also, based on the AIC and SIC statistics, both head and tail endpoint restrictions were employed in the analysis.

The estimated short-run advertising elasticity for cotton fiber textiles is 0.05 and the cumulative (long-run) advertising elasticity is estimated to be 0.17 (see Table 16). These results are consistent with the marketing and promotion elasticities of demand reported by most other studies of generic advertising programs which have tended to range between 0.01 and 0.25 in both the short-run and the long-run (Williams and Nichols (1998)). The results imply that cotton checkoff expenditures have effectively shifted out the demand for cotton fiber textiles over time.

Capps et al. (1997) estimated the elasticity of cotton checkoff program expenditures to be 0.06 in the short-run and 0.10 in the long-run. Murray et al (2001), however, estimated a much smaller cotton promotion elasticity of 0.02. Because any lagged effects of marketing and promotion expenditures were assumed away in the Murray et al. study, the short-run and cumulative impacts of marketing and promotion expenditures were the same in that study. Neither the assumption on lagged effects nor the estimated promotion elasticity in Murray et al. is in agreement with the existing literature for cotton promotion. Ding and Kinnucan (1996) estimated the long-run advertising elasticity for cotton to be 0.07. Solomon and Kinnucan (1993) estimated the advertising elasticity for cotton for the export market to be 0.12. Dewbre, Richardson, and Beare (1987) estimated an advertising elasticity of 0.09 for Australian wool promotion in the United States.

Berndt (1990) argued that models based on quarterly and annual data tend to overestimate the cumulative effects of advertising and promotion. However, our estimates of the impact of marketing and promotion activities perhaps are a reflection of the increase in the level of funds that occurred as a result of the amended Act of 1992. Recall from Table 15 that the level of cotton checkoff funding rose from roughly $29 million in 1991 to about $66 million in 2004. Two-thirds of that funding was allocated to marketing and promotion activities over this period. Consequently, this scale effect in the level of funding for marketing and promotion of cotton may account for the magnitude of the cumulative estimate of the advertising elasticity.

Another possibility for the relatively large estimate of the long-run advertising elasticity may be due to the relatively higher level of cotton promotion intensity over time (that is, the level of cotton promotion expenditures compared to cotton farm cash receipts) than normally has been the case for other checkoff commodities. As shown in Table 19, between 1977 and 1992, the ratio of cotton checkoff expenditures to total cotton farm cash receipts (the intensity of the cotton checkoff program) increased from 0.3% to 1%, a more than 3-fold increase. By 2001, however, the ratio doubled to about 2%. For most checkoff program commodities, annual program expenditures as a percent of producer cash receipts have averaged less than 1% over time. For the soybean checkoff program, for example, program expenditures for research and promotion ranged from only 0.08% to 0.20% of soybean farm cash receipts over the history of the program (Williams, Shumway, and Love (2002)). Also, the advertising intensity for the Florida Department of Citrus annual orange juice advertising program dropped from over 3% in the late 1960s to less than 1% in more recent years (Capps, Bessler, and Williams (2004)). With a cotton checkoff advertising intensity that is substantially higher than that of other checkoff programs, the overall impact of the cotton checkoff program may be expected to be greater in both a practical and a statistical sense in its effects on production, demand, prices, and exports than might be the case for other checkoff program commodities.

In addition to the generic cotton promotion expenditures from checkoff dollars collected by the Cotton Board, private industries also spent funds to promote their own particular brands of cotton fiber textiles and man-made fiber textiles. These brand advertising expenditures might be expected to have an impact on the demand for cotton fiber textiles and man-made fiber textiles as well. Data for such expenditures by private companies are proprietary and, thus, were unavailable for this analysis. Statistical theory suggests that omitted variables may result in biased structural parameter estimates, although the direction of the bias is not clear. However, in the estimated cotton and man-made fiber textile demand equations of the MCERI model, no serial correlation pattern was evident in the residuals, based on the Durbin-Watson statistics and the Ljung-Box statistics indicating the absence of any systematic omitted variable bias associated with the structural parameter estimates of the demand functions for both types of fiber textiles. Neither of the previous two studies of the cotton checkoff program (Murray et al. (2001) and Capss et al. (1997)) included the effects of brand promotion expenditures related to man-made fiber textiles due to the unavailability of data. For branded cotton fiber textile promotion, however, Murray et al. obtained data from Levi Strauss to serve as a proxy for branded promotional expenditures for cotton fiber textiles. Importantly, the inclusion of these data in the Murray et al (2001) analysis revealed no statistically significant impact of the branded advertising variable on the structural parameter estimate associated with generic cotton checkoff marketing and promotion expenditures. Capps, Bessler, and Williams (2004) also found that brand advertising expenditures were statistically insignificant in influencing the level of orange juice demand. Insignificant branded advertising and promotion effects, at least from a statistical point of view, are not surprising. Generic advertising and promotion expenditures are designed to increase the demand for a particular commodity while corresponding branded expenditures associated with a given manufacturer are designed primarily to increase the market share for that manufacturer. In other words, generic marketing and promotion expenditures are designed to grow market demand for the product while branded marketing and promotion expenditures are designed to grow the market share associated with that particular brand but not necessarily the overall market demand for the product.

Similar to the estimation results for cotton fiber textile demand, the statistically significant determinants of man-made fiber textile consumption are the real man-made fiber textile price, real disposable income, and qualitative variables related to agricultural and trade policy (Table 17). The own-price and income elasticities of the U.S. demand for man-made fiber textiles are estimated to be -0.24 and 0.56, respectively (see Table 16). The impact of cotton checkoff program marketing and promotion expenditures on man-made fiber textile consumption is found to be positive, a result that is inconsistent with expectations and the theoretical argument made earlier in connection with Figure 19. However, the estimated positive relationship is not statistically different from zero. In other words, the direct effect of the marketing and promotion activities of the Cotton Board on the domestic demand for man-made fiber textiles is negligible and statistically not distinguishable from zero. Based on the statistically insignificant estimated coefficient for the impact of cotton checkoff promotion activities on man-made fiber demand, the short-run and long-run cross-advertising elasticities of man-made fiber textile consumption with respect to marketing expenditures for cotton are calculated to be 0.01 and 0.02 (see Table 16). The important implication of this result is that there is no statistically discernible direct spillover effect of cotton checkoff program expenditures on the U.S. demand for man-made fiber textiles.

U.S. Cotton Mill Use and U.S. Man-Made Fiber Mill Use Equations

The second set of key demand equations represents the demand by U.S. mills for raw cotton and for raw man-made fibers. Each year, roughly 15%-20% of cotton checkoff funds are spent on non-agricultural research activities in attempt to stimulate the mill use of raw cotton (see Table 15). The statistical analysis associated with these two equations provides an empirical assessment of the effectiveness of cotton checkoff funded activities in attempting to directly stimulate U.S. mill demand for raw cotton and of the spillover effects on the demand by U.S. mills for raw man-made fibers. Note that separate demand functions at the retail and at the mill levels of the marketing channel are estimated which is unique to the literature dealing with the evaluation of the cotton checkoff promotion and research activities.

Equations (3) and (4) in Table 17 are the estimated equations for U.S. cotton mill use and U.S. man-made fiber use, respectively. The goodness-of-fit statistics associated with the cotton mill demand and man-made fiber mill demand equations are 0.990 and 0.962, respectively. In other words, these two equations account for most of the variation in the consumption of cotton and man-made fiber at the mill level over the period of analysis (1976-2004). Neither the Durbin-Watson (DW) statistics nor the Ljung-Box Q-statistics indicate the presence of serial correlation of residuals in either of these structural equations. Also, all the estimated coefficients are statistically significant and agree in sign with economic theory.

The statistical results for equation (3) indicate that the statistically significant drivers of cotton consumption at the mill level include real (inflation-adjusted) cotton textile fiber prices, real prices of cotton paid by domestic mills, real prices of polyester paid by domestic mills, cotton mill use in the previous year, real non-agricultural research expenditures financed by cotton checkoff dollars, and qualitative variables related to agricultural and trade policy.

As discussed in the earlier graphical analysis of the cotton checkoff program, the cotton fiber textile price represents the per unit value of the output from cotton mills. Thus, the mill demand for raw cotton should increase with an increase in the output price. The positive and statistically significant sign for the cotton textile price in equation (3) provides statistical evidence that the U.S. mill demand for cotton is responsive to changes in the price of cotton fiber textiles. The estimated coefficient of the cotton fiber textile price implies that a 10% increase in the price of cotton fiber textiles translates into a 4.1% increase in mill use of cotton (see Table 16).
Based on the estimated coefficient of the raw cotton price in equation (3) of Table 17, the estimated own-price elasticity of cotton mill demand is -0.08, implying that U.S. mill demand for raw cotton is less responsive to changes in the market price of raw cotton (the input price) than to the cotton fiber textile price (output price) (see Table 16). The own-price elasticity of cotton mill demand estimated in this study is smaller than the elasticity of -0.17 estimated by Capps et al. (1997) and also smaller than those estimated in several other studies as discussed earlier.

Given the dominance of polyester over other synthetic fabrics in man-made fiber markets, the real price of polyester is used in the mill demand specifications for cotton and man-made fibers to represent the per unit cost of man-made fiber (the man-made fiber input price) at the mill level. Given the high degree of correlation among synthetic fiber prices, using just the polyester price to represent man-made fibers helps avoid potential collinearity problems in the mill demand equations. In the U.S. cotton mill use equation (equation (3) in Table 17), the estimated polyester cross-price elasticity is -0.26 which is larger in absolute value than the own-price elasticity (see Table 16). The implication is that, in the United States, cotton and polyester are complements at the mill level. Although we found the opposite to be the case for foreign cotton mill demand, the finding that cotton and man-made fibers are complements in U.S. mill use is consistent with the findings of previous studies. Our estimated polyester cross-price elasticity is also within the range of the estimates reported by previous studies. For example, Murray et al

(2001) estimated the polyester cross-price elasticity of cotton mill demand to be -0.13 while Ding and Kinnucan (1996) reported a short-run polyester cross-price elasticity of -0.27 and a long-run cross-price elasticity of -0.85. Capps et al. (1997) reported a polyester cross-price elasticity estimate for the cotton mill demand of -0.55.

The U.S. textile industry at the mill level typically is characterized by lags between orders and deliveries. Stennis, Pinar, and Allen (1983) indicate that forward ordering is prevalent in this industry. Distributors and retailers often contract for cotton fiber twelve months or more prior to delivery. Consequently, to account for these dynamics, various lag lengths on prices were tested in the empirical specification for mill demand. Forward contracting, at least historically, has been an integral part of the cotton and textile industry such that the price observed today influences consumption in the future. Textile manufacturers, for example, make future decisions based on today's prices. Using the AIC and the SIC, the optimal lag length on prices was found to be zero in all cases so that all prices in the mill demand equations are contemporaneous. This finding differs from the findings of Wohlgenant (1986); Shui, Beghin, and Wohlgenant (1993); and Ding and Kinnucan (1996) who considered a lag length of 12 months. Because our analysis employs more current data, the justification for our finding is the improvements in the efficiency of ordering and deliveries that have occurred over the last 20 years.

As with the retail demand for cotton fiber textiles, the PDL formulation is used to account for the carryover effects of non-agricultural research expenditures on cotton mill demand in equation (3) (Table 17). The results indicate that after a one-year delay, the estimated short-run elasticity of non-agricultural research expenditures with respect to cotton mill use is 0.03 and that the cumulative (long-run) estimated elasticity is 0.09 (see Table 16). Thus, the results suggest that more time is required before non-agricultural research activities impact cotton mill demand than is the case for the effect of marketing and promotion activity expenditures effects on the retail demand for cotton fiber textiles. Following a one year lag between expenditure and effect, the cumulative effect of a 10% change in non-agricultural research expenditures for cotton, sustained over two years, gives rise to a 0.9% change in domestic mill use of cotton. These results are similar to those of Capps et al. (1997) who estimated the short-run elasticity associated with non-agricultural research expenditures to be 0.08 and the long-run elasticity to be 0.13 after a nine-month delay. Murray et al. (2001) also found a statistically positive and significant relationship between non-agricultural research expenditures and cotton mill use. They estimated the cumulative elasticity to be in the range of 0.31 to 0.35 which is not only well above the estimated elasticity in this study but also exceedingly high relative to those reported previously in the literature for cotton and for other commodities.

In the U.S. man-made fiber mill demand equation (equation (4) in Table 17), based on the estimated coefficients for the real polyester price and the market price of cotton, the own-price elasticity and the raw cotton cross-price elasticity of the U.S. mill demand for man-made fibers are estimated to be -0.20 and -0.08, respectively (see Table 16). Even though no comparison to the results of other studies is possible as discussed earlier, the results provide further evidence of the complementary nature of cotton and man-made fibers at the mill level and identify a potential *indirect* avenue for spillover effects from cotton checkoff programmatic activities.

The results for equation (4) in Table 17, also suggest that non-agricultural research activities associated with the cotton checkoff program are positively related to the mill demand for man-made fibers following a one year delay between expenditures and effect as in the case of cotton mill demand. The results indicate that after a one-year delay, the estimated short-run elasticity of non-agricultural research expenditures with respect to man-made fiber mill use is 0.01 and that the cumulative (long-run) estimated elasticity is 0.02 (see Table 16). Thus, following a one-year lag between expenditure and effect, the cumulative effect of a 10% change in non-agricultural research expenditures for cotton gives rise to a 0.1% change in U.S. man-made fiber mill demand. Sustained over a period of two years, the cumulative effect of a 10% change in non-agricultural research expenditures for cotton is a 0.2% change in U.S. man-made fiber mill demand. This *direct* spillover effect not only is extremely small in magnitude but also is not statistically different from zero. The implication is that the cotton checkoff program expenditures have little, if any, *direct* impact on mill demand for man-made fibers which is the same conclusion reached earlier for the retail demand for man-made fibers.

Summary Comments on the MCERI Model and the Demand Equation Estimation Results

The particular structure of the MCERI model and the parameters estimated for the model equations represent the key assumptions of the methodology for determining the net benefits associated with the cotton checkoff program for cotton producers and cotton importers. Even though both domestic producers and importers pay assessments to fund the checkoff program, the net benefits associated with the programmatic activities of the Cotton Board may be quite different for each group. Using the MCERI model, producer and importer net benefits are separated and government savings as a result of the cotton checkoff program are captured. The key structural parameters that allow a calculation of the benefit-cost ratios as well as government savings are precisely those associated with the cotton checkoff marketing and promotion expenditures and non-agricultural research expenditures, and the price elasticities of demand at the retail and mill levels of the marketing channel.

In particular, several statistical results are key to understanding the conclusions of the analysis of the effectiveness of the cotton checkoff program using the MCERI model. First, note that the demand for cotton fiber textiles at the retail level and the demand for cotton at the mill level are positively and significantly affected by the cotton checkoff expenditures. Perhaps more important is that the long-run elasticity associated with marketing and promotion expenditures (0.17) exceeds the long-run elasticity associated with non-agricultural research expenditures (0.09). Thus, all other factors held constant, equal *percentage* changes in marketing/promotion expenditures and in non-agricultural research expenditures lead to a greater *percentage* change in cotton fiber textile consumption than in mill demand for raw cotton. Second, the cotton checkoff program has no statistically significant impact on either the demand for man-made fiber textiles or the mill demand for man-made fibers. Finally, the only statistically significant spillover effect of the cotton checkoff program on the markets for man-made fibers is through mill level prices as a result of the complementary nature of cotton and man-made fibers in mill use.

Model Validation

Validation of the MCERI model consists of a check on the dynamic, within-sample (ex-post) simulation statistics. The simulation exercise is based on the period from 1986 to 2004. The dynamic simulation statistics, including the root mean squared error as well as the mean squared error, Theil inequality coefficients, and Theil error decomposition proportions (bias, variance, covariance, regression, and disturbance proportions) all indicate a highly satisfactory fit of the historical, dynamic simulation solution values to observed data. Most of the Theil inequality coefficients are close to zero, indicating excellent model performance. As well, the bias and variance proportions are close to zero, indicative of the ability of the structural equations of the MCERI model to not only replicate the observed values of endogenous variables over time on average but also to replicate their variability. Because the model tracks the historical changes in the key market variables (such as quantities and prices) well as indicated by the simulation statistics, the model can be used with confidence to consider the historical functioning of the cotton and man-made fiber and fiber textile markets under various scenarios as done and reported in the following simulation analysis of the effects of the cotton checkoff program.

Simulation Analysis of the Impacts and Returns from the Cotton Checkoff Program

The estimated cotton checkoff elasticities presented and discussed in the previous section of the report provide measurements of the relationship between cotton checkoff expenditures and the U.S. demands for cotton, cotton fiber textiles, man-made fiber, and man-made fiber textiles. While instructive, the expenditure elasticities (advertising and promotion expenditures and non-agricultural expenditures) fall far short of providing a complete understanding of either the market effects of the expenditures or the return they generate to those who pay the assessments for at least two reasons. First, the expenditure elasticities are *static* impact measures and overestimate the effect of an increase in expenditures on quantity demanded. Thus, the expenditure elasticities indicate how demand changes given a change in checkoff expenditures, holding constant all other factors. That is, the assumption underlying the calculation of the cotton checkoff expenditure elasticities is that a change in expenditures that affects demand does not affect prices, imports, supply, or any other market quantities. Undoubtedly, however, if demand shifts as a result of checkoff expenditures, then price <u>will</u> change unless supply is perfectly elastic which, in turn, will change the levels of imports, supply, and many other market variables, including the quantity demanded of the good itself.

A look back at Figure 5 will help illustrate the problem with using an elasticity as the measure of the demand impact of checkoff expenditures. In Figure 5, assume that a 10% increase in checkoff expenditures shifts demand from D_0 to D_1. If price (P_0) does not change, then the demand for the commodity increases from Q_0 to Q_2. If this increase in Q was on the order of 0.5%, then the *expenditure elasticity* (as presented in the previous section) would be 0.05 calculated as the percent change in Q (0.5%) divided by the percent change in expenditures (10%). But if price increases from P_0 to P_1 as would normally happen when the demand shifts from D_0 to D_1 unless supply is perfectly elastic (which is not the case in U.S. cotton markets), then the <u>actual</u> increase in demand following the price increase is only Q_0 to Q_1 a much smaller increase in demand than the expenditure elasticity leads us to believe would happen because of the assumption that price does not change. And, if price changes when the demand changes, then imports, and supply, and many other market variables are likely to change as well.

A second reason that expenditure elasticities are insufficient measures of checkoff program impact is that they provide measures only of the effect of the program expenditures on demand. The primary objective of the cotton checkoff program, however, has not necessarily been to increase the demand for cotton but rather to enhance the profitability of growing cotton for domestic producers. The estimated expenditure elasticities presented and discussed earlier suggest that the cotton checkoff program has had a positive and statistically significant impact on the demand for cotton and cotton fiber textiles. The relevant question for those who pay for the program, however, is whether the increase in demand and any consequent increase in their revenues has been sufficient to cover their assessment costs.

To provide a more accurate measure of the impact of cotton checkoff expenditures on demand as well as a measure of the returns to those who pay the checkoff assessments, the MCERI model was used in this study to conduct a simulation analysis of the cotton checkoff program. The basic simulation analysis with the MCERI included two basic simulation scenarios: (1) the "With Expenditures" scenario in which cotton checkoff expenditures (non-agricultural research expenditures and marketing and promotion expenditures) were set to their actual historical levels and (2) the "Without Expenditures" scenario in which those checkoff expenditures were set to zero over the history of the program. The first step in the analysis was to use the MCERI model to generate a baseline historical simulation of the various endogenous variables in the model (e.g. U.S. cotton and man-made fiber production; world production of cotton; mill use of cotton and man-made fiber; net imports of cotton fiber textiles and man-made fiber textiles; prices of cotton and man-made fiber, etc.) over the 1986/87 to 2004/05 period that closely replicates their actual, historical values. Because all cotton checkoff expenditures were set to their actual historical values, the baseline simulation represents the "With Expenditures Scenario." The baseline simulation accounts for all major exogenous forces affecting world cotton and man-made fiber markets, such as advances in cotton productivity from technological developments and cultural practices (no till programs), the boll weevil eradication programs, and improved cotton varieties (bollworm resistant BT cotton and Roundup Ready varieties).

Then all cotton checkoff expenditures were set to zero and the model was simulated once again over the 1986/87 to 2004/05 period to generate the "Without Scenario" results for the endogenous variables in the model. These results provide a measure of what the levels of production, prices, consumption, mill use, trade, etc. would have been in the absence of the cotton checkoff program. Differences in the solution values of the endogenous variables in the "Without Scenario" from their baseline solution values in the "With Scenario" consequently are direct measures of the effects of the programmatic activities of the Cotton Board over time.

Graphically, the overall effects of the cotton checkoff program, thus, are equivalent to the combination of: (1) Figures 15 and 16 which demonstrate the separate cotton and cotton fiber textile market effects of the non-agricultural research and the market/promotion expenditures by the Cotton Board, (2) Figures 17 and 18 which illustrate the complications imposed by U.S. cotton policy over time, and (3) Figures 19 and 20 which illustrate the spillover effects on man-made fiber and textile markets from the non-agricultural research and the market/promotion expenditures by the Cotton Board. Obviously, the final effects of the cotton checkoff program on cotton and fiber textile markets and prices and on the returns to cotton producers and importers will depend on the nature and strength of the relationships and interactions among the many market variables as captured by the MCERI model.

Because no exogenous or predetermined variable other than cotton checkoff expenditures in the MCERI model (e.g. real disposable income, trade and agricultural policy variables, etc) is allowed to change as the two simulation scenarios are conducted, the process just described effectively isolates the impacts of the both the marketing/promotion expenditures and non-agricultural research expenditures associated with the cotton checkoff program on the respective endogenous variables. Because the cotton cross-expenditure elasticities with respect to both man-made fiber mill demand (non-agricultural research expenditures) and man-made fiber textile demand (marketing/promotion expenditures) were not statistically significant (that is, statistically not different from zero), those elasticities were set to zero in the simulation analysis.

In analyzing the effects of the cotton checkoff program over the entire period of 1986/87 to 2004/05, the effects of the program were divided into two distinct periods: (1)1986/87 to 1991/92 - the period after implementation of the Cotton Research and Promotion Act of 1966 (PL89-502) but before the implementation of the Cotton Research and Promotion Amendments Act of 1990 and (2) 1992/93 to 2004/05 - the period following the implementation of the Cotton Research and Promotion Amendments Act of 1990. The first of the two periods is referred to as as the "voluntary" period because even though all domestic producers were required to pay the cotton checkoff assessment during that period, they could request a refund of their payments. The period of 1992/93 to 2004/05 is labeled the "mandatory" period because all cotton marketed in the U.S., whether from domestic or foreign production, during that period was required to share in the cost of the cotton checkoff program and the right to demand a refund of the assessments was terminated. Given the increase in the magnitude of the budget available to the Cotton Board due to the Cotton Research and Promotion Amendments Act of 1990, the hypothesis is that greater market impacts of the checkoff program occurred in the mandatory period relative to the voluntary period.

The simulation analysis is designed to address many of the key questions regarding the effectiveness of the cotton checkoff program posed at the beginning of this report: (1) What have been the effects on the U.S. and world cotton and cotton fiber textile markets and the associated spillover effects on man-made fiber markets? (2) Have domestic cotton producers and cotton importers benefited from the checkoff program? (3) What have been the implications of the cotton checkoff program for U.S. cotton farm policy costs? (4) What is the overall return on investment associated with the cotton research and promotion program both to importers and to domestic producers? (5) What is the incidence of the cotton checkoff assessments or, in other words, who pays how much of the cost of the cotton checkoff program?

Effects of the Cotton Checkoff Program on U.S. and World Fiber Markets[5]

The simulation results demonstrate clearly that the cotton checkoff program increased U.S. raw cotton production, mill use, and prices over the entire period of 1986/87 2004/05 (Table 20). On the supply side of the U.S. cotton market, the cotton checkoff program boosted annual cotton production by 4% on average over the entire period. Between 1986/87 and 1991/92 (the "voluntary period"), U.S. annual average cotton production was higher by 41 million lb as a result of the cotton checkoff program and by 459 million lb over the following 13 years (the "mandatory period"). Note that the increase in U.S. cotton production as a result of the checkoff program was not uniformly distributed across the Cotton Belt. The largest average annual impacts on cotton production over the entire period from 1986/87 to 2004/05 were in the Southeast and West regions where production increased by 121 million lb (7%) and 110 million lb (8%), respectively. The average annual impacts of the cotton checkoff program on production over the same period in the Delta, the irrigated Southwest, and the dryland Southwest regions were more modest at 46 million lb (2%), 35 million lb (3%), and 16 million lb (2%), respectively.

The average annual mill use of cotton in the United States was 286 million lb higher in the voluntary period and 809 million lb higher in the mandatory period as a result of the cotton checkoff program than would otherwise have been the case (Table 20). Overall, the average annual domestic cotton mill use rose by about 16% over the entire period. Because the cotton research and promotion program induced a larger increase in U.S. cotton mill demand than in U.S. cotton production, cotton was diverted from exports to domestic markets. On average each year, the checkoff program diverted 218 million lb of cotton from exports to domestic mills during the voluntary period and 353 million lb during the mandatory period. Over the entire period of 1986/87 to 2004/05, average annual U.S. cotton exports were 7% lower as a result of the checkoff program. Market farm prices received by cotton producers averaged about 8¢/lb (13%) higher in each year from 1986/87 to 2004/05 as a result of the checkoff program. The average increase in the farm price was two and a half times higher (10¢/lb versus 4¢/lb) in the mandatory period than in the voluntary period. The average changes in the prices paid by domestic mills for cotton were similar to those of farm prices.

In foreign cotton producing and milling countries, the cotton checkoff program boosted cotton mill demand by an annual average of 1% over the entire period leading to an average world price (A-index) increase of 2% and an annual average foreign production response of 2% (Table 20). The average annual increase in foreign production over the entire period (936 million lb) was more than sufficient to meet the increase in foreign mill demand (512 million lb) and still allow an increase in exports to importing countries (241 million lb) to fill the void left by the decline in U.S exports.

The simulation results also indicate that, due to the promotion activities of the Cotton Board, U.S. consumption of cotton fiber textiles was higher by 428 million lb on average during the voluntary period and 1,030 million lb higher on average during the mandatory period. Over the entire period of 1986/87 to 2004/05, the average U.S. consumption of cotton fiber textiles was

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[5] To better comprehend the simulation effects discussed here, the reader is encouraged first to review the graphical analysis presented earlier in this report associated with Figures 9 through 20.

about 10% higher as a result of the checkoff program than otherwise would have been the case. Over this same period, the annual average cotton textile fiber (CFT) price declined by about 2%, indicating that the increase in the retail CFT demand induced by the marketing/promotion expenditures portion of the cotton checkoff program was more than offset by the combined increase in U.S. and foreign supply of CFT induced by the non-agricultural research expenditures of the program. Because the induced increase in U.S. CFT demand was greater than the induced increase in U.S. CFT supplies, the cotton checkoff program also boosted U.S. CFT imports on average each year over the entire period by almost 5%. Because price tended to decline by a smaller percentage (2%) than the increase in consumption (10%), the annual average increase in revenue accruing to cotton textile retailers was higher by about 9% because of the checkoff program.

Recall that the previous section of this report concluded that the direct effect of the cotton checkoff program on man-made fiber mill demand has been positive but quite small and not statistically significant. In other words, there has been no *direct* effect of the cotton checkoff program on the demand for man-made fiber at the mill level. Nevertheless, there is an *indirect* effect of the cotton checkoff program on man-made fiber markets through price linkages between the two markets. Given that cotton and man-made fibers are complements in the production of textiles at the mill level, the nearly 14% increase in the price of cotton as a result of the cotton checkoff program generated a small decline of about 3% in the domestic mill use of man-made fibers on average over the entire period of analysis. Over the voluntary period, man-made fiber mill use declined by an annual average of 118.5 million lb and by 342 million lb during the mandatory period as a result of the checkoff program. The lower mill demand for man-made fibers resulted in a decline in the price of man-made fibers as well, as indicated by the small (1%) decline in the price of polyester over the entire period. The lower price of man-made fibers over the period of analysis generated a small decline in the annual average production of synthetics (polyester) and cellulosics (rayon) of 4 million lb (0.1%) over the entire period.

Also, recall that the estimated effects of the cotton checkoff program on the demand for man-made fiber textile products have been small and statistically insignificant. Thus, no *direct* of the cotton checkoff program on the demand for man-made fiber textile products was found similar to the case of man-made fiber mill demand. Again, however, there is an *indirect* effect because the reduction in the cotton textile fiber price as a result of the cotton checkoff program shifted the demand for man-made fibers slightly to the left. Because the resulting decline in the mill use of man-made fibers over the entire period (278 million lb) as a result of the cotton checkoff program, and consequently in the U.S. production of man-made fiber textiles, is larger than the decline in U.S. consumption of man-made fiber textile products (69 million lb), the relatively small level of U.S. man-made fiber textile imports increased by an average of 209 million lb (22%) over the same period. Also, because the percentage drop in the consumption of man-made fiber textiles was less than the percentage rise in the price of man-made fiber textiles as a result of the cotton checkoff program, retail revenue in the man-made fiber industry increased about 5% over the entire simulation period.

In summary, the key impacts of the cotton checkoff program on world cotton and cotton fiber textile markets on average over the 1986/87 to 2004/05 period according to the simulation analysis were the following (Table 20):

- A 4% increase in U.S. cotton production with much of the increase taking place in western and southeastern states;
- A 2% increase in foreign cotton production;
- Increases in U.S. and foreign cotton mill use of about 16% and 1%, respectively.
- A 7% decline in U.S. cotton exports offset to a large degree by an increase in foreign cotton exports of nearly 2%.
- An increase in the annual average prices of cotton, including the U.S. farm price (13%), the U.S. mill price (14%), and the world price of cotton measured by the A-index (2%);
- A 10% increase in the consumption of cotton fiber textiles along with higher imports of cotton fiber textiles from foreign mills of about 5% resulting in a larger share of the U.S. consumption of cotton fiber textiles being supplied by foreign rather than domestic mills; and
- A decline in the price of cotton fiber textiles by about 2%.

In U.S. man-made fiber and man-made fiber textile markets, the key impacts of the cotton checkoff program on average over the entire simulation period (the spillover effects) included the following (Table 20):

- A small negative impact on the U.S. production of synthetics and cellulosics (0.1%);
- A reduction in U.S. man-made fiber mill use of about 3%;
- A decline in the polyester price of roughly 1.2%;
- A 22% increase in net imports of man-made fiber textiles;
- A 1% decline in the U.S. consumption of man-made fiber textiles; and
- A 5% increase in the price of man-made fiber textiles.

Benefit-Cost Analysis of the Cotton Checkoff Program

While the simulation analysis clearly demonstrates that the cotton checkoff program had measurable impacts not only on the cotton industry but also on the man-made fiber industry, an important question for those who contribute to the cotton checkoff program through the assessments that they pay is whether the market effects have been sufficiently large to justify the cost of the program. The standard method of analysis used to address this question is to calculate the benefit-cost ratio (BCR) of the program (i.e., the *average* return per dollar spent on the checkoff program) for each contributing group. Various definitions for benefit-cost ratio (BCR) have been used in the literature to calculate the returns to those who pay for commodity checkoff program expenditures. Consequently, before using the results of the simulation analysis to calculate the BCR to cotton producers and importers whose checkoff assessments pay for the cotton promotion activities of the Cotton Board, some background on the definition and methods of calculating the BCR for a commodity checkoff program is provided.

Definition and Calculation of a Benefit-Cost Ratio

Most commonly in evaluations of the effectiveness of commodity checkoff programs, the primary focus of the analysis is the impact of the checkoff program expenditures on the retail demand for the commodity. Consequently, the "benefit" in the BCR calculation in such studies is the increase in retail sales revenue brought about by any increase in the demand and price for the commodity. The BCR is then calculated by dividing the value of additional retail sales by the expenditures made to achieve the demand and price increase. Such a "retail level" BCR, however, does not recognize the separate contributions, and therefore, the separate returns potentially earned by the various contributors along the supply chain. More relevant BCR measures are those that calculate the benefit to the individual groups that actually pay for the promotion programs per checkoff dollar spent on those programs. For the cotton checkoff program, cotton producers and importers (retailers) of cotton fiber textile products pay for cotton checkoff program activities through their individual assessments.

For producers, the BCR of a checkoff program can be measured in various ways. One measure of the BCR to producers is the Producer Revenue BCR (RBCR) calculated as the sum of the estimated returns to producers in additional producer revenues or profits over time as a result of the checkoff expenditures divided by those expenditures over the same period. Calculated in this way, an estimated RBCR greater than 1 is taken as an indication that the checkoff expenditures have been beneficial because producer revenues have increased by more than one dollar for every dollar spent on the promotional activities of the commodity board. On the other hand, an RBCR of less than 1 is taken to mean that advertising does not pay since each dollar invested generates less than a dollar in additional producer revenues.

A more meaningful Producer BCR formulation is the Producer Profit Benefit-Cost Ratio (PBCR). As usually calculated, the PBCR is the total producer revenue added as a consequence of the checkoff program expenditures over time divided by the level of checkoff expenditures made to generate those additional revenues after deducting the additional production costs required to produce the additional output generated. The calculation of the PBCR for cotton is illustrated graphically in Figure 26. Recall from the previous section that the cotton checkoff program works to increase the mill demand for U.S. cotton. Given an increase in cotton mill demand from checkoff program expenditures as shown in Figure 26, the cotton market price received by producers also increases in those years in which domestic farm policy allows the market to determine the price received by producers for their cotton. The price increases from the price level that would exist *without* the checkoff program (P_c^{wo} in Figure 26) to the level that occurs *with* the checkoff program expenditures (P_c^{w} in Figure 26). At the same time, sales of cotton increase from Q_c^{wo} *without* the program expenditures to Q_c^{w} *with* the expenditures.

The additional revenue to producers from the checkoff program expenditures is the sum of the two shaded areas in Figure 26 calculated as $P_c^{w} \cdot Q_c^{w}$ - $P_c^{wo} \cdot Q_c^{wo}$. The additional production of cotton induced by the checkoff program expenditures requires additional production costs which must be subtracted from the revenues to arrive at what economists term the additional producer surplus accruing to producers as a result of the checkoff program. These additional costs are represented by the shaded area abQ_c^{wo} Q_c^{w} in Figure 26 so that the remaining producer surplus is the shaded area P_c^{w} P_c^{wo} ba. The concept of the producer surplus is roughly equivalent to producer profit so that the additional producer surplus generated by the cotton checkoff program in each year (R_t) can approximated by the following equation:

(1) $$R_t = (P_{ct}^{w}Q_{ct}^{w} - C_{ct}^{w}Q_{ct}^{w}) - (P_{ct}^{wo}Q_{ct}^{wo} - C_{ct}^{wo}Q_{ct}^{wo}),$$

where P_c is the price for cotton received by producers; C is production cost per unit of output; Q_c corresponds to the production of cotton; and w and wo indicate "with" and "without" cotton checkoff program expenditures, respectively. Then, the Producer Profit BCR is calculated as:

$$(2) \qquad PBCR = \frac{\sum_{t=1}^{T} R_t}{\sum_{t=1}^{T} E_t},$$

where E is the cotton checkoff program expenditures.

If the expenditures in each year (E_t) are first netted out of the additional profit generated (R_t) in those years (i.e., $R_t - E_t$), then the Producer Net Profit BCR (NBCR) is calculated as:

$$(3) \qquad NBCR = PBCR - 1.$$

A number of researchers, including Sellen, Goodard, and Duff (1997), Davis et al (2001), Williams, Shumway, and Love (2002), Williams, Capps, and Bessler (2004) and others, account for the time value of money in calculating the Producer Profit BCR by first discounting the producer profits over time to present value before dividing by the total checkoff expenditures. If i is the discount rate (the cost of capital), then the discounted BCR (DBCR) can be calculated as:

$$(4) \qquad DBCR = \frac{\sum_{t=1}^{T} R_t/(1+i)^t}{\sum_{t=1}^{T} E_t} \quad .$$

In this study, for calculating the producer DBCR, the Treasury bill rate was taken as the cost of capital simply because it represents a realistic alternative investment rate for producers.

Calculating the importer (retailer) BCR, the benefit to importers per dollar of checkoff expenditure, is somewhat more complicated because the cotton checkoff expenditures on retail marketing/promotion activities and on non-agricultural research activities affect the market for cotton textile fibers in different ways. Recall from Figure 15 (bottom left graph) that checkoff expenditures on retail marketing/promotion increase both the price and quantity sold of cotton fiber textiles so that the revenues to the importers who sell those textiles also clearly increase. The revenue increase to importers would, thus, be calculated as $P_{cft}^{w} Q_{cft}^{w}$ - $P_{cft}^{wo} Q_{cft}^{wo}$ where P is price, Q is quantity sold, the subscript cft indicates cotton fiber textiles and the superscripts w and wo again indicate "with" and "without" the cotton checkoff marketing/promotion expenditures. Since the costs to importers associated with additional sales of cotton fiber textiles are unknown, the additional profit accruing to importers in each year (M_t) can be approximated by assuming some realistic profit ratio earned by importers on sales of cotton fiber textiles (π_{cft}) and multiplying that ratio by the additional revenues earned as a result of the cotton checkoff marketing/promotion expenditures:

(5) $$M_t = \pi_{cft}(P^{w}_{cft}Q^{w}_{cft} - P^{wo}_{cft}Q^{wo}_{cft}).$$

In calculating the benefit-cost ratio to importers from checkoff expenditures on non-agricultural research activities, the difficulty is that the expected change in the revenues earned by importers is ambiguous. Recall from Figure 16 that non-agricultural research expenditures would be expected to reduce the market price of cotton fiber textiles (CFT) but increase the quantity demanded of CFT so that any increase in revenues to importers from an increase in consumption would tend to be offset to some extent by the lower CFT price. If the percentage decline in the CFT price is greater than the percentage increase in CFT consumption, then revenues to importers would decline. If the reverse is true, then importer revenues would tend to increase.

In either case, the change in profits (positive or negative) to importers as a result of the non-agricultural research expenditures in each year (N_t) is calculated using the same formula for calculating the change in profits to importers from checkoff expenditures on retail marketing promotion (equation (5)). The importer benefit-cost ratio (IBCR) would then be calculated as the sum of the additional profit earned by importers as a result of the marketing/promotion expenditures (M_t+N_t) over time divided by E_t, the sum of the marketing promotion expenditures (EM_t) and nonagricultural expenditures (EN_t) in each year over time:

(6) $$IBCR = \frac{\sum_{t=1}^{T}(M_t + N_t)}{\sum_{t=1}^{T} E_t}.$$

As with the PBCR, the IBCR can be discounted to present value to account for the time value of money. In this study, the discounted IBCR was calculated assuming a cost of capital to retailers of 5% in each year. While a different rate could have been chosen, a discount rate of 5% was considered a conservative choice such that the discounted IBCR was not likely to be much lower.

Note that if N_t is sufficiently negative in calculating the IBCR in equation (6), the total increase in revenues to importers in any given year (M_t + N_t) or in aggregate over time also could be negative. The implication, therefore, is that cotton checkoff expenditures for retail marketing/promotion and for non-agricultural research together could plausibly lead to a decline in importer profits and yield a negative BCR to importers. Only an empirical investigation of the data can provide some insight into the importer profit impacts of the cotton checkoff program.
In the two previous analyses of the cotton checkoff program, the benefits associated with the program were estimated to outweigh the costs for both producers and importers. In Capps et al (1997), the total net returns to domestic producers plus importers divided by total program costs were estimated to be in the interval from 5.38 to 5.95. In Murray et al. (2001), the ratio of total net returns to total program costs was found to be in the interval of 22.4 to 38.9.

In this study, we calculate the Producer Net Profit BCR (NBCR) and the Importer BCR (IBCR) (discounted and undiscounted) as outlined above. Technically, we report *dynamic* BCRs in which all endogenous variables are allowed to change in the MCERI model in response to changes in the cotton marketing/promotion and non-agricultural research expenditures made by CI. Only a few studies of the returns to commodity checkoff programs have reported such dynamic benefit-cost ratios (e.g. Williams (1985); Sellen, Goddard, and Duff (1997); Schmit and Kaiser (1998); Williams, Shumway, and Love (2002); and Williams, Capps, and Bessler (2004)).

Benefits to Cotton Producers from the Cotton Checkoff Program

The calculation of the producer and importer BCRs is based on the simulation results discussed earlier which provide a measure of the changes in cotton and cotton fiber textile prices and quantities over time as a direct result of the cotton checkoff program. The producer BCRs for the two consecutive time periods discussed earlier are calculated and compared: (1) the "voluntary period" of checkoff assessments from 1986/87 to 1991/92 and (2) the "mandatory period" of checkoff assessments from 1992/93 to 2004/05 (Table 21). As discussed in connection with Figures 17 and 18, the farm program in place affects the returns to producers from the checkoff program each year. Recall from that discussion that in years of deficiency payments and similar government farm programs, the checkoff program could well have resulted primarily in farm program savings rather than revenue increases to producers. For that reason, in reporting the producer benefits, the cumulative added net revenues to cotton producers due to the checkoff program for both participants and non-participants in the existing farm programs during both time periods (voluntary and mandatory) are reported along with the cumulative change in government cotton farm program expenditure savings due to the cotton checkoff program.

Over the voluntary period of the program, the simulation results indicate that the cumulative added net revenues to producers as a result of the checkoff expenditures were $220 million for all cotton producers, roughly $37 million per year or about 0.9% of the total cotton farm receipts received, excluding government payments (Table 21). Note that benefits in terms of added net revenues were positive to non-participants in farm programs and negative for farm program participants during the voluntary period. Because farm program participants during that period received deficiency payments as discussed earlier, the increase in market price had no effect on the revenue per pound of cotton they received. The primary effect on cotton producers that participated in farm programs during that period was a change in the source of about 5% of their total revenues from the government to the market (Table 21). However, the higher cotton farm price induced by the cotton checkoff program during that period encouraged fewer producers to participate in farm programs so that total revenues earned by cotton producers that participated in farm programs was actually lower as a result of the cotton checkoff program. On the other hand, however, the sales of non-participants in farm programs were benefited by the higher cotton farm price of cotton induced by the checkoff program during that period.

During the mandatory period, in contrast, both participants and non-participants in farm programs benefited from the boost in both the price and mill demand for cotton generated by the cotton checkoff program. In the middle of the mandatory period, the 1996 FAIR Act eliminated deficiency payments forcing production decisions to become more responsive to changes in market conditions. Consequently, the price increase achieved by the cotton checkoff program during the mandatory period had larger revenue implications for cotton producers than was the case for the price increases achieved during the voluntary period of the program. According to the simulation results, the cotton checkoff program generated a total of $6.4 billion more in cotton sales during the 13-year mandatory period than would have occurred without the promotion program. The additional cotton cash receipts earned by cotton producers accounted for about 10% of total revenues earned by cotton farmers during that period (excluding government payments). Over the entire simulation period, the added net revenues to cotton producers per year were nearly $350 million, representing 7.5% of the cotton cash receipts earned by cotton producers (excluding government payments).

Using the estimated added net revenues to producers as a result of the cotton checkoff program as the "benefit" of the program to producers as discussed earlier, the calculated undiscounted producer net profit BCR (NBCR) during the voluntary and mandatory periods of the cotton checkoff program were 0.6 and 9.2, respectively. The corresponding discounted BCRs (DBCR) were 0.5 and 7.5. Not surprisingly, as a consequence of the cotton checkoff program, during the voluntary program period most of the returns accrued to the government as cotton program cost savings. Thus, the cotton checkoff program functioned as an effective means of reducing the dependence of cotton producers on government farm programs during that period.

During the mandatory period of the program, the additional cotton sales response to the price increase achieved by the cotton checkoff program that was made possible by the greater market orientation of government farm programs also allowed the checkoff program to more than pay for itself in terms of returns to producers per dollar spent by the Cotton Board on promotion activities. Over the entire simulation period, the undiscounted producer NBCR was 7.6 and the discounted producer NBCR was 5.7. In comparison, Capps et al. (1997) reported undiscounted BCRs for cotton producers in the range of -0.69 to -0.73 under the voluntary program and in the range of 3.23 to 3.49 under the mandatory program. Murray et al. (2001) only reported undiscounted cotton producer BCRs for the mandatory period in the range of 3.20 to 6.00.

In summary, cotton producers clearly have benefited from the cotton checkoff program, particularly in recent years under the mandatory checkoff program. Producer BCRs were much higher in the mandatory period than in the voluntary period.

Government Farm Program Savings from the Cotton Checkoff Program

During the years when the dominant farm program for cotton producers was some form of deficiency payment, price increases resulting from the cotton checkoff program automatically worked to reduce the total amount of those payments to cotton producers. Consequently, because the checkoff program increased the farm price of cotton as discussed earlier, the checkoff program also generated some farm program cost savings to the government in many years. Also, depending on the level of the market price at the time and the extent of the price increase resulting from the checkoff program activities, the checkoff program could have reduced non-recourse loan defaults and government takeovers of cotton in some years. The simulation results clearly demonstrate that the increase in the market price of cotton received by producers induced by the cotton checkoff program worked to increase the percentage of cotton producer revenues coming from their market sales of cotton and reduced the share of their revenues coming from government payments in many years.

During the voluntary period which roughly corresponded to the period when deficiency payments were a major component of government farm policy, the cumulative reduction in government farm program costs due to the cotton checkoff program amounted to about $1.3

billion (Table 21). Thus, during the voluntary period, had it not been for the cotton checkoff program, government cotton program costs would have been higher by about $221 million per year, an annual savings of about 22%. In the mandatory period, the cumulative reduction in government expenditures due to the cotton checkoff program amounted to about $6.5 billion or about $502 million per year, an annual savings of approximately 28%. Over the entire period from 1986/87 to 2004/05, the cumulative savings in government cotton program outlays totaled about $7.9 billion, an annual savings of about $413 million or approximately 27%.

Combining the benefits accruing to domestic producers together with the reduction in government outlays associated with the cotton checkoff program allows a calculation of the total net BCR for the cotton checkoff program at the farm level. For the voluntary period, the undiscounted total net BCR was 10.0 and 9.1 on a discounted basis. During the mandatory period, the undiscounted and discounted total net BCRs were 19.5 and 16.0, respectively. Over the entire simulation period of 1986/87 to 2004/05, the total undiscounted benefit of the cotton checkoff program was an average of $17.8 per dollar spent on cotton marketing/promotion and non-agricultural research activities and 13.4 on a discounted basis at the farm level.

Benefits to Importers from the Cotton Checkoff Program

Importers began paying the cotton checkoff assessment in July of 1992 with the implementation of the Cotton Research and Promotion Amendments Act of 1990. The revenue effects of the cotton check-off program for importers have come from two sources: (1) changes in sales of cotton fiber textiles and (2) changes in sales of man-made fiber textiles. Recall from the earlier discussion of the simulated effects of the cotton checkoff program on market prices and quantities (see Table 20) that the cumulative net change in the revenue accruing to importers in both cases has been positive.

In the case of cotton fiber textiles, the cotton checkoff program was shown to have reduced the price of cotton fiber textiles while increasing their consumption by a greater percentage amount. The consequence was an estimated 9% annual average increase in revenue accruing to importers from sales of cotton fiber textiles as a result of the cotton promotion program since importers began paying the cotton checkoff assessment (Table 22).

In the case of man-made fibers, the cotton program had a negative effect on consumption but boosted the price of man-made fibers by a greater percentage than the decline in their consumption resulting in a 5.5% annual average increase in revenue accruing to importers from sales of man-made fiber textiles as a result of the cotton promotion program (Table 22). Note that the calculated importer BCR captures the man-made fiber market spillover effects associated with the programmatic activities of the Cotton Board.

Although there are virtually no retail sales data for cotton and man-made fiber apparel and home furnishings, estimates of the retail sales of cotton textiles and man-made fiber textiles can be constructed by multiplying an average price series based on consumer panel data by end use data for apparel and home furnishings. Apparent consumption data can be constructed using Fiber Organon's end use survey (U.S. manufactured basis) along with USDA data on fiber trade for finished apparel and home fabrics. According to experts at Cotton Incorporated , these estimates are reasonable approximations of the sales data.

The average selling price for cotton apparel was \$15.20/lb over the period 1992/93 to 2004/05 based on consumer panel data collected by Cotton Incorporated. Based on that same data, the average selling prices of cotton home furnishings, non-cotton apparel, and non-cotton home furnishings over that same period were about \$8.20/lb, \$13.50/b, and \$11.50/lb, respectively. Using end use data from Fiber Organon and USDA, weighted average price series over that period for cotton fiber textiles and for non-cotton fiber textiles were estimated to be \$12.82/lb and \$13.04/lb, respectively. These weighted average prices were useful in the calculation of the cumulative retail sales revenues attributable to the cotton checkoff program.

The total increase in revenue to importers from sales of both cotton fiber textiles and man-made fiber textiles amounted to about \$258 billion or an average of \$19.8 billion per year since importers began paying the cotton checkoff assessment (Table 22). According to the financial data of 18 major apparel and home furnishings retailers, the average industry pre-tax profits to sales ratio ranged from 4.2% to 6.5% from 1994 to 2003 (Table 23). The median pre-tax profit to sales ratio was roughly 5% over this period. Applying the 5% profit ratio to the cumulative additional sales of cotton and man-made fiber textiles generated by the cotton checkoff program yields an increase in profits of the U.S. retail textile sales industry of about \$12.9 billion. Consequently, the undiscounted benefit to the retail textile industry in terms of additional profits as a result of the cotton checkoff program over the 1992/93 to 2004/05 period was \$19.5 per dollar spent or by the Cotton Board on cotton and cotton fiber textile promotion activities (table 22). The discounted importer BCR over the same period was 14.4.

The importer BCR estimate in this study is larger than those reported in the literature. Capps et al. (1997) and Murray et al. (2001) reported undiscounted importer BCRs of between 3.63 and 5.59 and between 1.90 and 3.40, respectively. Recall, however, that those two previous studies failed to capture spillover effects from the man-made fiber industry associated with the program and, therefore, underestimated the retail benefits of the cotton checkoff program. If only the specific effects of the cotton checkoff program on cotton and cotton fiber textiles are considered, then the added profit to importers from the program would be much less at \$7.0 billion and would yield a lower importer BCR of about 10. Differences in time periods and model structure also account for differences in the calculation of importer BCRs. Neither the Capps et al. (1997) nor the Murray et al. (2001) studies estimated separate demand equations for cotton at the mill level or cotton fiber textiles at the retail level.

<u>Sensitivity Tests</u>

Because the calculation of the farm and retail level benefits of the cotton checkoff program may be sensitive to the magnitude of the estimated long-run marketing/promotion elasticity of demand for cotton fiber textiles and to the estimated long-run non-agricultural research elasticity of demand for cotton at the mill level, a sensitivity analysis was performed consisting of two scenarios. In this analysis, the primary concern is to determine reasonable lower bounds for the calculated BCRs presented in Tables 21 and 22. In the first scenario, the estimated coefficients corresponding to the two long-run elasticities were set at one standard deviation below their estimated values giving long-run elasticity values for cotton textile marketing/promotion and non-agricultural research expenditures of 0.12 and 0.03, respectively. In the second scenario, the estimated elasticities corresponding to both expenditure variables were set at half their original levels (0.08 and 0.04, respectively). Because the corresponding elasticities for man-made fiber were not statistically significant (that is, statistically not different from zero), these elasticities were again set to zero in the calculation of the benefit-cost ratios in the sensitivity analyses.

The results of the sensitivity analyses for both scenarios for the producer BCR calculation are exhibited in Table 24 and for the importer BCR calculations in Table 25. In resetting the first scenario (setting the long-run marketing/promotion and non-agricultural research elasticities to one standard deviation below their estimated values), the discounted producer BCR fell from 5.7 (see Table 21) to 4.5 (Table 24). Similarly, in the second scenario (setting the two elasticities to one-half their estimated levels), the discounted producer BCR over the entire simulation period declined to 3.1, lower than in the first scenario.

In summary, even if the BCR estimates for the cotton checkoff program presented here are considered to be on the high side, reducing the estimated responsiveness of cotton and cotton fiber demand to cotton checkoff promotion activities to some lower bound level still results in a return to cotton producers from their investment in the cotton checkoff program of no less than about $3 for every dollar spent on promotion. The strong implication, therefore, is that both cotton producers and taxpayers (through reductions in government outlays) were better off financially over the last two decades as a result of the cotton checkoff program than they would have been without the program.

The sensitivity of the importer BCR results to the magnitudes of the long-run marketing/promotion elasticity of cotton fiber textile demand and the long-run non-agricultural research elasticity of the mill demand for cotton was also examined following the same procedure as for the producer BCR sensitivity analysis. As before, the two elasticities were first set at levels corresponding to the original structural parameter estimates minus one standard deviation and the simulations were re-run and the importer BCR re-calculated. In the other scenario, the same two elasticities are set at precisely half of their original levels. As before, the elasticities for man-made fiber were set to zero in each of the scenarios because the corresponding estimated coefficients for man-made fiber were not statistically significant (that is, statistically not different from zero).

In the first scenario, the discounted importer BCR declined only slightly from 14.4 to 14.3 over the entire simulation period (compare Tables 23 and 26). In the second scenario, the discounted importer BCR dropped even further to 6.0 (Table 25).

In summary, even accounting for the potential sensitivity of the results to changes in the checkoff program expenditures elasticities of the demands for cotton and cotton fiber textiles, the conclusions remain unchanged. Importers of cotton fiber textiles, like domestic U.S. cotton producers, were financially better off over the last 13 years as a result of the cotton promotion activities of the Cotton Board that were funded in part by the cotton checkoff assessments of importers than they would have been in the absence of the cotton checkoff program. The BCRs for importers are more than double those for producers. The benefits to importers are higher, in part, because importers gain not only from the additional revenue from sales of cotton fiber textiles as a result of the cotton checkoff program but also from the additional revenue from sales of man-made fiber textiles, the so-called spillover effects of the program.

Incidence of the Producer and Importer Assessments

In considering the effects of the cotton checkoff program, the incidence of the assessment must be taken into account as discussed in connection with Figures 10 through 14 earlier in this report. Recall that for producers, the assessment represents an increase in their costs. An assessment on imports, on the other hand, is collected by the U.S. Customs Service as the product enters the country just as tariffs and other import duties are collected and affects the market in the much the same way that a tariff does. The annual average assessments paid by producers ranged from 0.460¢/lb to 0.604¢/lb between 1976/77 and 2004/05 (see Table 13). Given that the average market price received by cotton farmers varied from 30.8¢/lb to 75.6¢/lb over the same period, the added cost from the assessment was less than 1% of the farm price in most years. The annual average assessments paid by importers from 1992/93 to 2004/05 ranged from 0.383¢/lb to 0.581¢/lb (see Table 14). With an average price of cotton fiber textiles of $12.82/lb over that period, the importer assessment was about 0.03% to 0.05% of the price received by importers.

As the discussion of the incidence of the checkoff assessment earlier in this report emphasized, while cotton producers and importers are those from whom cotton checkoff assessments are collected, some portion of that cost is passed on to consumers and other groups. Consequently neither producers nor importers pay the full cost of the assessments. In case of the producer assessment, some portion of the cost of the assessment is passed on to domestic and foreign cotton buyers. In the case of importers, virtually all of the cost is either passed forward to consumers of cotton textile fiber products or backwards to foreign producers of cotton textile fiber products. The main question of concern, therefore, is how much of the producer assessment is actually paid by U.S. cotton producers in terms of a lower net price received.

In the case of the importer assessment, the simulation results presented earlier in this report demonstrated clearly that while importers (cotton fiber textile retailers) collect the assessment and forward it on to the Cotton Board, the assessment functions much like an import tariff which pushes up the price to consumers and a reduces the net price received by foreign sellers. The difference between those two prices is the amount of the assessment. Thus, in this case, the assessment is paid by sellers in the foreign producing and exporting countries in terms of a lower price and by U.S. consumers in terms of a higher price. The importers primarily act as the assessment collection agent. The cost of the assessment to cotton importers essentially is reimbursed to them in two ways: (1) through an increase in the price charged to consumers and (2) through a decrease in the price paid to importers. The only real cost to importers would be the cost of acting as the assessment collection agent. In the final analysis, the importer assessment is paid by U.S. consumers and foreign producers. Consequently, referring to “importer checkoff assessments,” the “returns to importers,” and the “importer BCR” is misleading. More proper terminologies might be the “checkoff assessment collected from importers,” the “returns to the expenditure of the checkoff assessments collected from importers,” and the “import checkoff assessment BCR.” The question of the incidence of the assessment collected from importers, therefore, is concerned primarily with the share of the cost paid by U.S. consumers and the share paid by foreign producers/sellers.

The results of simulating the market impacts of the cotton checkoff program presented earlier provide the information needed for calculating the share of each assessment paid for various groups. For the producer assessment, the results indicate that on average over the entire period of analysis, producers paid about 58% of assessment while about 42% was paid by domestic and foreign cotton buyers (mills) (Table 26). Thus, while U.S. producers have paid the largest share of the assessment over the years, an average of about 40% of the cost has been passed on to cotton buyers. There is some evidence, however, that the incidence may be shifting toward buyers. During the voluntary period of the program, producers paid an average of 67% of the assessment and only 54% during the mandatory period.

For the import assessment, the results indicate that, on average over the period of analysis, cotton fiber textile consumers paid 49% of the assessment while foreign cotton textile sellers paid about 51%. Thus, about half of the assessment has been passed on to consumers in terms of a higher retail price they have paid for cotton fiber textiles over the years while foreign sellers have borne the other half of the cost in terms of a lower selling price of their cotton fiber textile goods.

Economic Effects of the Cotton Checkoff Agricultural Research Program

The foregoing analysis centered attention primarily on ascertaining the impacts of cotton checkoff-funded marketing and promotion expenditures and non-agricultural (textile) research expenditures on various segments of the cotton industry, both domestic and foreign. Marketing and promotion expenditures are intended to shift out the retail demand for cotton fiber textile products while non-agricultural research expenditures are intended to shift out the textile mill demand for raw cotton. In contrast, checkoff expenditures in support of agricultural research are intended to shift out the supply of U.S. cotton by increasing production efficiency and/or reducing production costs. No previous study of the cotton checkoff program has ever considered the effects of investing funds in agricultural research.

This section of the report provides an analysis of the economic relationship between checkoff expenditures on cotton research and the U.S. cotton supply. As shown earlier in Table 15, agricultural research currently accounts for about 13% of cotton checkoff expenditures. The share of checkoff funds allocated to agricultural research has grown steadily over time from about 4% in the mid-1980s. Almost all of the growth in the agricultural research share of cotton checkoff dollars has been at the expense of expenditures on non-agricultural textile research which has experienced a declining share since the mid-1980s from about 20% to about 16% in recent years (Table 15).

Typically, agricultural research expenditures that reduce production costs would be expected to lead to an expansion in the acreage dedicated to cotton production. On the other hand, agricultural research expenditures that increase production efficiency would increase production yields, that is, the output per acre in production. Since production is the product of acreage and yield, successful agricultural research of either type would tend to increase output.

The effects of investments in research on the market supply of a commodity like cotton, however, are often not immediate, measurable, or direct. Research investments may fund either basic, long-term types of research or more applied, short-term types of research. Because the lag between research activities, particularly basic research, and the commercialization of new technologies available for adoption by cotton producers may be quite lengthy, the full market impacts and any benefits of checkoff-funded research to cotton producers may not be felt for a long time following the research investment.

Also, research investments may not always result in measurable market impacts. For example, basic or applied research that provides knowledge about what does *not* work in increasing yields or reducing costs has value but is not measurable in terms of market impacts. At the same time, applied research often is related to or depends on previous investments in basic research. Consequently, investments in basic research may have only indirect market effects to the extent that the results of that research lead to more applied research to develop new technologies and processes for adoption by producers. For these and other reasons, accurate quantification of the effectiveness of cotton checkoff agricultural research expenditures over the years on cotton production is difficult at best. An added complication is the difficulty in obtaining the necessary data over a sufficiently long enough period of time to be able to statistically identify the relationship between research and production.

Checkoff dollars represent a small portion of the total investment in cotton production research in this country. Most of the research investment is made by private firms like Monsanto and others and publicly funded research organizations like the agricultural experiment stations at landgrant universities and the Agricultural Research Service of the U.S. Department of Agriculture. In general, most basic, long-term types of research are funded by public and private firm investments. Checkoff dollars are normally invested in more applied, short-term types of research. As a consequence, the relationship between cotton checkoff investments in research and cotton production may be more straightforward and amenable to statistical measurement than might be the case for cotton research funded by other groups.

Major contributions to both the theory and measurement of the returns to producers from investments in agricultural research have been made by a variety of researchers (see, for example, Schultz (1953); Griliches (1958); Evenson (1967); Peterson (1967); Fox (1985); Pardey and Craig (1989); Chavas and Cox (1992); and Williams, Shumway, and Love (2002)). A number of commodities have been analyzed, including corn, poultry, rice, rapeseed, wheat, wool, and soybeans. Unfortunately, little research is available on the returns and supply effects of either public or private investments in cotton research.

Data and Methodology

The first step in the analysis of the cotton supply effects of cotton checkoff investments in agricultural research was to gather annual data pertaining to harvested acreage and yields for various cotton production regions: (1) the West (Arizona, California, and New Mexico); (2) the

Irrigated Southwest (Kansas, Oklahoma, and Texas); (3) the Dryland Southwest (Kansas, Oklahoma, and Texas); (4) the Southeast (Alabama, Florida, Georgia, North Carolina, South Carolina, and Virginia); and (5) the Delta (Arkansas, Louisiana, Mississippi, Missouri, and Tennessee). Over the period of 1977 to 2004, average harvested acreage was the highest in the Delta at 3.31 million acres followed closely by the Dryland Southwest at 3.30 million acres and the lowest in the West at 1.48 million acres followed by the Southeast at 1.76 million acres, and the Irrigated Southwest at 1.97 million acres. Over that same period, the West achieved the highest average yields at 1,139lb/acre followed at a distance by the Delta at 683lb/acre, the Southeast at 599lb/acre, the Irrigated Southwest at 572lb/acre, and finally the Dryland Southwest at 333lb/acre.

Although annual data on harvested acreage and yield are available back to 1962/63 for the various production regions, data on agricultural research expenditures from Cotton Incorporated (CI) are only available back to 1977/78. Thus, the maximum time period available for this analysis covers only the 18 crop years between 1977/78 and 2004/05. Nominal agricultural research expenditures have grown from about \$0.8 million in 1986/87 to \$3.6 million in 1992/93 to \$8.4 million in 2004/05. Since 1992/93, nominal agricultural research expenditures have averaged about \$6.2 million and accounted for about 11% of cotton checkoff expenditures.

The economic relationship between cotton checkoff-funded agricultural research expenditures and cotton harvested acreage and yield was measured using regression analysis. Separate single-equation models are specified corresponding to the harvested acreage and the yields of cotton in each of the five production regions. As with the retail demand for cotton fiber textile and the mill demand for cotton, a polynomial distributed lag (PDL) formulation was used to account for the potential carryover effects of agricultural research expenditures on harvested acreage and on yields across the five production regions. In each region, the logarithm of harvested acreage in the current period is specified to be a function of several variables: (1) the real price of cotton paid by mills in the previous year, (2) a one-year lag of the logarithm of harvested acreage, and (3) the PDL formulation of the logarithm of real agricultural research expenditures. For yield in each region, the logarithm of yield in the current period was specified to be a function of the PDL formulation of the logarithm of real agricultural research expenditures. A second degree polynomial distributed lag with endpoint constraints was used for the acreage and yield equations in each of the 5 production regions. Lag lengths of up to 12 years were considered with the optimal lag lengths chosen based on statistical criteria, namely the use of the Schwarz Information Criterion (SIC) and the Akaike Information Criterion (AIC).

Empirical Results

Following the procedure described above, agricultural research expenditures were found to positively and significantly affect yields with no discernable effect on harvested acreage. The cumulative or long-run elasticities on yields as well as the length of time to reach the cumulative effect by production region are exhibited in Table 27. The long-run percentage changes in yields due to a 1% change in real agricultural research expenditures were found to vary among regions from 0.04 in the Dryland Southwest to 0.18 in the Irrigated Southwest. The cumulative impact of agricultural research expenditures on yields was quite similar in magnitude to the cumulative impact of marketing/promotion expenditures on the demand for retail cotton fiber textile products as well as the cumulative impact of non-agricultural research expenditures on the demand for cotton at the mill level. Importantly, however, the length of time to reach this cumulative effect varied from six to ten years across the respective production regions. The conclusion from this analysis is that that agricultural research expenditures funded with cotton checkoff dollars effectively enhanced cotton yields and, thus, cotton production over the years. The amount of time required to reach this cumulative impact, however, is between six and ten years depending on the production region.

CONCLUSIONS

This study is a retrospective economic analysis of the Cotton Checkoff Research and Promotion Program to determine the market results and returns achieved through the investment of the checkoff funds collected by the Cotton Board. Specifically, this study focuses on the answers to the following questions:

- What are the effects of the cotton checkoff program on the demand for raw cotton (mill level) and the demand for cotton fiber textile products (retail level)?
- What are the spillover effects of the cotton checkoff program on man-made fiber markets?
- What are the effects of the agricultural research programs funded by the cotton checkoff program?
- What is the incidence (that is, who pays the cost) of the cotton checkoff assessments on domestically produced cotton and on cotton fiber textile product imports?
- What is the overall return on investment associated with the cotton checkoff program to U.S. cotton producers and importers of cotton fiber textile products?
- What are the implications of cotton checkoff program activities for government cotton program costs?

This report is the third in the series of economic evaluations of the cotton checkoff program and focuses on the period of 1986/87-2004/05. The analysis presented in this report is an updated and revised version of a comprehensive analysis of the effects of the cotton checkoff program recently completed by the authors in connection with the recent legal defense of the program. The analysis is conducted with the use of a multi-equation, econometric simulation model of U.S. and foreign fiber markets originally developed by the Cotton Economics Research Institute (CERI) at Texas Tech University. The model was modified by the authors to account for the programmatic activities of the Cotton Board and, hence, is referred to as the modified CERI model or the MCERI model.

Extensive and fundamentally important advances in the methodology for analyzing the cotton checkoff program were made in this analysis leading to the most accurate, reliable, and defensible measurement of the impacts and returns from the cotton checkoff program to date. A few of the more salient advances made include the following:

- The MCERI model used in this study is a more formal and structurally comprehensive model than used in previous studies.

- The model also explicitly includes both the raw cotton and man-made fiber markets as well as cotton and man-made fiber textile markets and their extensive market linkages and interrelationships.
- The analysis explicitly measures the "spillover" effects of the cotton checkoff program, that is, the impacts of the program on not only the cotton industry but also the man-made fiber industry.
- The MCERI model also explicitly accounts for the incidence of the checkoff assessments allowing a detailed measurement of the share of the costs of the assessments borne by U.S. producers, importers, foreign producers, foreign mills, and consumers.
- The MCERI model includes detailed representations of the complicated government cotton policy over the years so that the savings to taxpayers in terms of reduced government outlays to cotton farmers over time that are directly attributable to the cotton checkoff program can be measured.
- This study provides the first ever measurement of the impacts of agricultural research funded by the cotton checkoff program on cotton harvested acreages and yields in five production regions across the United States.
- This study provides both discounted and undiscounted average benefit-cost ratios (BCR) for both domestic producers as well as for importers over the period of 1986/87 through 2004/05.
- Because the cotton checkoff program became mandatory in 1992, the BCR analysis is decomposed into two time periods: (1) the "voluntary contribution period" of 1986/87 through 1991/92 and (2) the "mandatory contribution period" of 1992/93 through 2004/05.

The MCERI model functions through the *simultaneous* interaction of supply, demand, trade, and price components across various commodities and regions of the world. The main components of the model include: (1) the U.S. and foreign cotton production; (2) U.S. and foreign man-made fiber production; (3) U.S. and foreign cotton and man-made fiber mill demands; (4) U.S. and foreign demands for cotton textiles and man-made fiber textiles; (5) world trade and price linkages for cotton, cotton textiles, man-made fiber, and man-made fiber textiles; and (6) international trade policy and U.S. government farm policy elements.

Based on the simulation analysis conducted with the MCERI model, the key average annual impacts of the cotton checkoff program on world cotton and cotton fiber textile markets over the 1986/87 to 2004/05 period were the following: (1) a 4% increase in U.S. cotton production, mostly in western and southeastern states; (2) a 2% increase in foreign cotton production; (3) a 16% and a 1% increase in U.S. and foreign cotton mill use, respectively; (4) a 7% decline in U.S. cotton exports offset somewhat by a 2% increase in foreign cotton exports; (5) a 13% increase in the average annual U.S. cotton farm price, a 14% increase in the U.S. cotton mill price, and a 2% increase in the world price of cotton (A-index); (6) 10 % increase in U.S. consumption of cotton fiber textiles along with a 5% increase in imports of cotton fiber textiles from foreign mills; (7) a larger share of the U.S. consumption of cotton fiber textiles being supplied by foreign rather than domestic mills; and (8) a 2% decline in the price of cotton fiber textiles.

In U.S. man-made fiber and man-made fiber textile markets, the key average annual impacts of the cotton checkoff program over the entire simulation period (the spillover effects) included: (1) a small negative impact on U.S. production of synthetics and cellulosics; (2) a reduction in U.S.

man-made fiber mill use by 3%; (3) a 1.2% decline in the polyester price; (4) higher net imports of man-made fiber textiles by 22%; (5) lower U.S. consumption of man-made fiber textiles by 1%; and (6) a higher price of man-made fiber textiles by nearly 5%.

Over the voluntary period of the checkoff program (1986/87-1991/92), the simulation results indicate that the cumulative added net revenues to producers as a result of the cotton checkoff program were $220 million for all cotton producers, roughly $37 million per year and about 0.9% of the farm receipts received by cotton producers, excluding government payments, during that time period. Benefits in terms of added net revenues were positive to non-participants in farm programs and negative for farm program participants during this period. Because farm program participants during that period received deficiency payments, their cotton farm revenues were not affected by any price increase achieved by the checkoff program. Non-participants in farm programs, however, were benefited by the higher farm price of cotton induced by the checkoff program during that period.

During the mandatory period (1992/93-2004/05), in contrast, both participants and non-participants in farm programs benefited from the price and demand increase generated by the cotton checkoff program. Cumulative added net revenues for participants in the farm program during the mandatory period were close to $6.1 billion compared to $322 million for non-participants primarily due to the much larger number of participants than non-participants in cotton farm programs. Added net revenues to cotton producers per year was almost $493 million during the mandatory period representing about 10.4% of the farm receipts received by cotton producers during that period, excluding government payments. Over the entire simulation period, the added net revenues to cotton producers per year were nearly $350 million, representing 7.5% of the farm receipts received by cotton producers, excluding government payments.

The calculated undiscounted producer net benefit cost ratios (NBCR) during the voluntary and during the mandatory periods of the cotton checkoff program were 0.6 and 9.2, respectively. The discounted producer NBCRs during those two periods are estimated at 0.5 and 7.5, respectively. Over the entire simulation period, the undiscounted and discounted producer NBCRs were 7.6 and 5.7, respectively. Clearly, cotton producers have benefited from the cotton checkoff program, particularly in the mandatory stage of the program.

During the voluntary period which roughly corresponded to the period when deficiency payments were a major component of government farm policy, the cumulative reduction in government farm program costs due to the cotton checkoff program amounted to slightly less than $1.3 billion. Thus, during the voluntary period, had it not been for the cotton checkoff program, government cotton program costs would have been higher by about $221 million per year, an annual savings of about 22%. In the mandatory period, the cumulative reduction in government expenditures due to the cotton checkoff program amounted to slightly more than $6.5 billion or about $502 million per year, an annual savings of approximately 28%. Over the entire period from 1986/87 to 2004/05, the cumulative savings in government cotton program outlays totaled about $7.8 billion, an annual savings of about $413 million or 27%.

Combining the benefits accruing to domestic producers together with the reduction in government outlays associated with the cotton checkoff program generates an undiscounted total BCR of 17.8 at the farm level over the entire period (13.4 on a discounted basis). Over the voluntary period of the program, the undiscounted and discounted total BCRs at the farm level were 10.0 and 9.1, respectively. For the mandatory period, the undiscounted and discounted BCRs at the farm-level were 19.5 and 16.0. respectively. Even after accounting for the sensitivity of the results to changes in key parameters in the model, the conclusion that both cotton producers and taxpayers (in the way of reductions in government outlays) are better off with the cotton checkoff program is still strongly supported by the empirical results.

The cumulative retail sales revenues for cotton fiber textiles attributed to the checkoff program over the period of 1992 to 2004 were nearly \$140 billion, about \$11 billion per year. The cumulative retail sales revenues for man-made fiber textiles attributed to the checkoff program over the same period were \$118 billion, about \$9 billion per year. The sum of the cumulative total revenue from retail sales of both cotton and man-made fiber textiles over the simulation period, then, was \$258 billion, or nearly \$20 billion per year. According to financial data of 18 major apparel and home furnishings retailers, the average pre-tax profits to sales ratio ranged from 4.2% to 6.5% from 1994 to 2003. The median pre-tax profits to sales ratio was roughly 5% over this period. Consequently, the additional profit to the retail textile industry per dollar spent by the Cotton Board was \$19.5 (undiscounted) or \$14.4 on a discounted basis. Again, even after accounting for the sensitivity of the results to key model parameters, the analysis clearly demonstrates that importers, like domestic producers, are better off economically with the cotton checkoff program. The BCRs for importers are found to be higher than those for producers indicating that importers have benefited more from the cotton checkoff program than have domestic producers. The higher return to importers is due largely to the spillover effects of cotton checkoff programs at retail to man-made fiber textile markets. That is, importers gained from the cotton checkoff program not only from additional sales of cotton fiber textiles but also from additional related sales of man-made fiber textiles.

To put these importer BCR calculations into perspective with the extant literature, Capps et al. (1997) and Murray et al. (2001) found the undiscounted importer BCR to be in the interval of 3.63 to 5.59 and 1.90 to 3.40, respectively. The lower BCRs for importers in these earlier studies are largely explained by the fact that they did not account for the spillover benefits to the retail textile industry in additional man-made fiber textile sales that are captured in this study.

In considering the effects of the cotton checkoff program, the incidence of the assessment, that is, the share of the cost of the assessment paid by the various contributors, was also taken into account. For producers, their assessment is tantamount to an added cost. For importers, their assessment is akin to a tariff. The annual average assessments paid by producers in each year was usually less than 1% of the farm price. The annual average assessments paid by importers was equivalent to about 0.03% to 0.05% of the price received by importers. A comparison of the producer and importer assessments demonstrates that they have not been equal over time. The importer assessment exceeded the producer assessment in every year from 1992/93 to 2000/2001 except for 1994/95 and 1995/96. Since 2001/02, however, the annual producer assessment has been greater than the importer assessment. On average, the analysis shows that 58% of the producer assessment was paid by U.S. cotton producers and about 42% by domestic buyers (mills) and foreign cotton buyers (mills). With respect to the importer assessment, an average of 49% was paid by U.S. cotton fiber textile consumers and roughly 51% by foreign cotton fiber textile sellers.

While this study focuses primarily on cotton checkoff expenditures intended to shift out the mill demand for cotton and the retail demand for cotton fiber textiles, the study also analyzes the cotton production effects of the 13% of cotton checkoff dollars that are spent on agricultural research. The results indicate that over the period of 1977/78 through 2004/05, cotton checkoff funded agricultural research activities positively and significantly affected yields with no statistically discernible effect on harvested acreage. Over the long-run, percentage changes in yields due to a 1% change in inflation-adjusted agricultural research expenditures were calculated to have varied among U.S. cotton-producing regions from 0.04 in the Dryland Southwest to 0.18 in the Irrigated Southwest. The length of time required for such expenditures to achieve their maximum cumulative effect was 6 to 10 years, depending on the production region.

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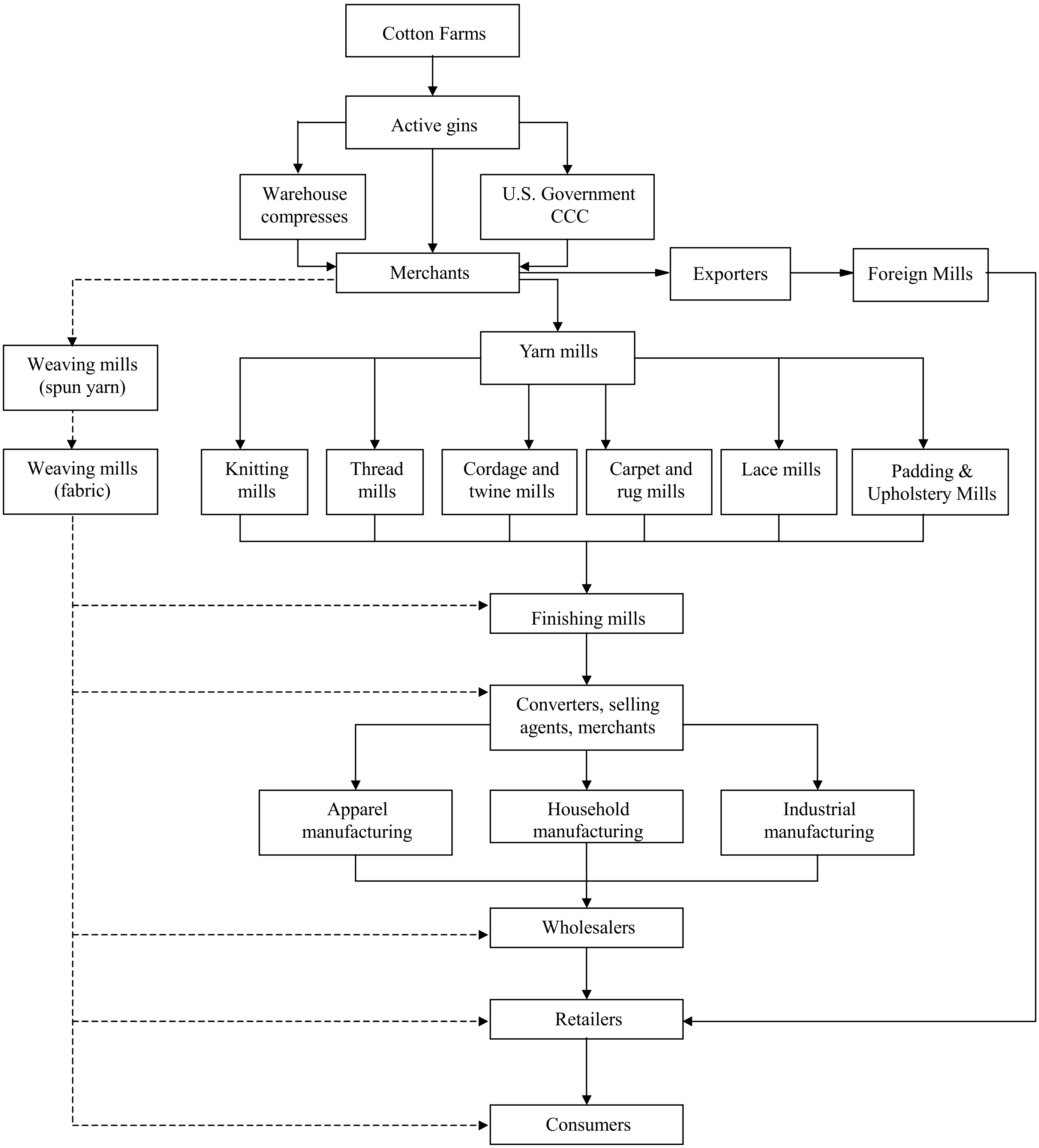
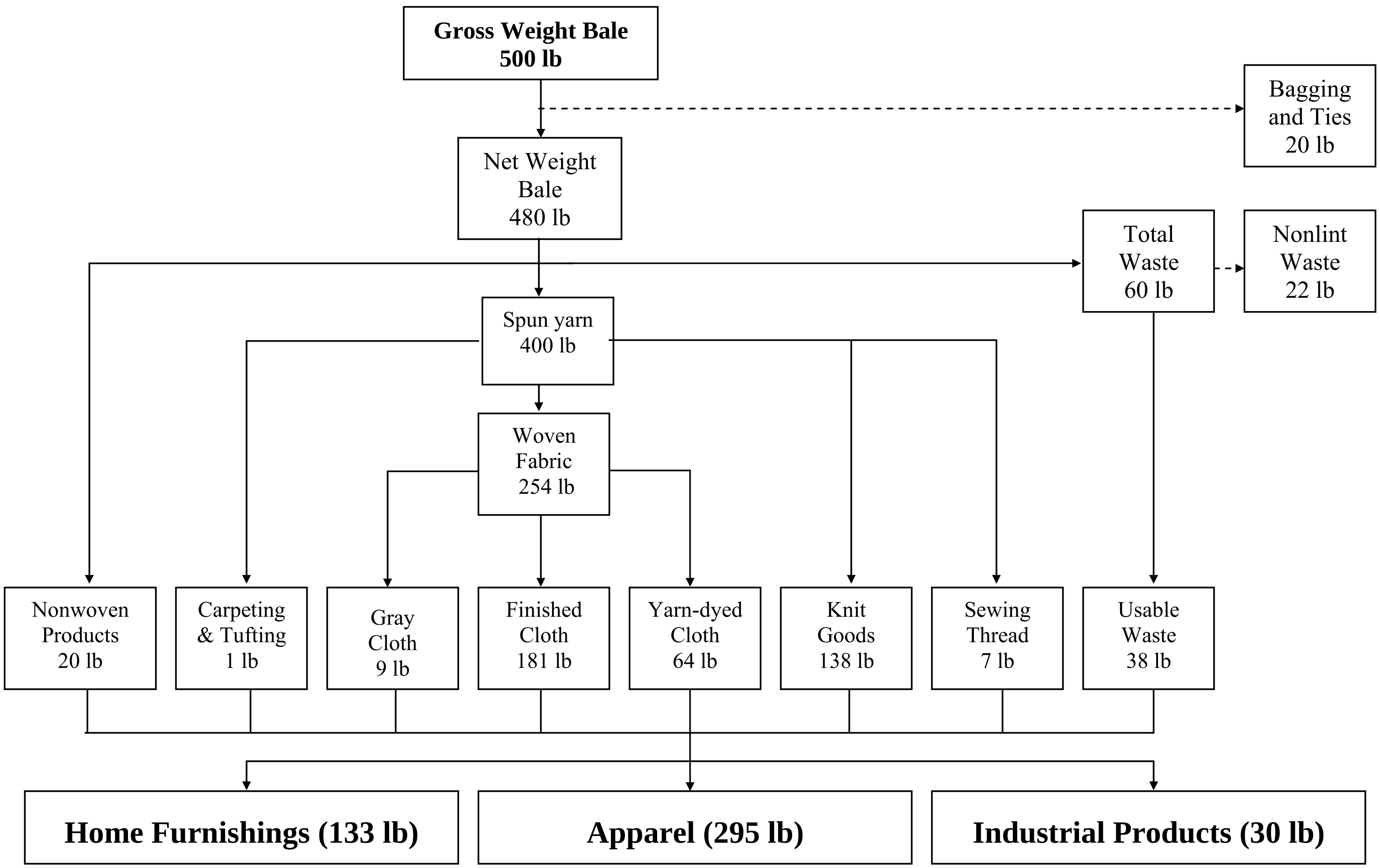
FIGURES

Figure 1: U.S. Cotton-Textile Supply Chain



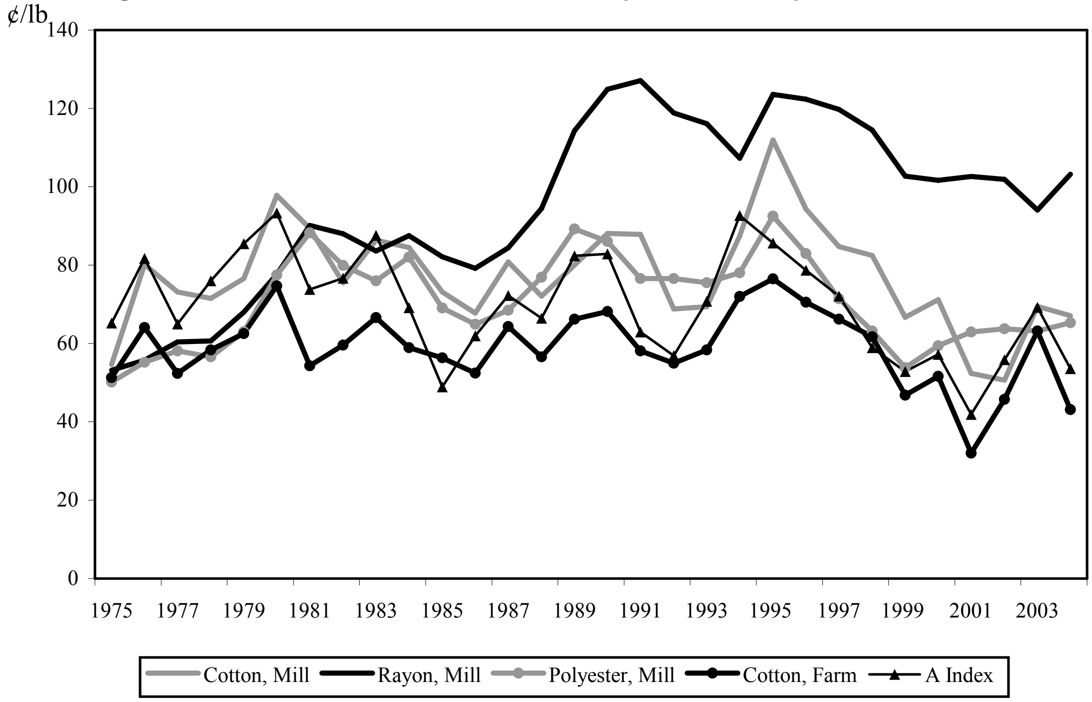
Source: Based on Glade, Meyer, and Stults (1996).

Figure 2: Distribution of an Average Bale of U.S. Cotton



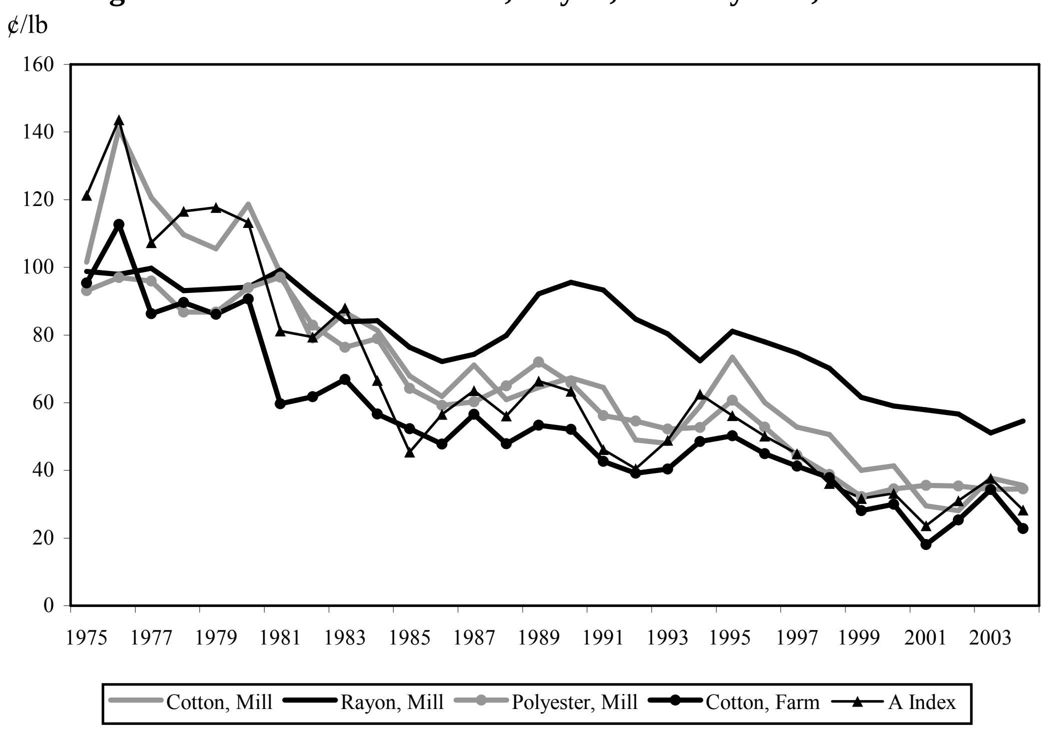
Source: Glade, Meyer, and Stults (1996)

Figure 3: Nominal Prices of Cotton, Rayon, and Polyester, 1975-2004[a]



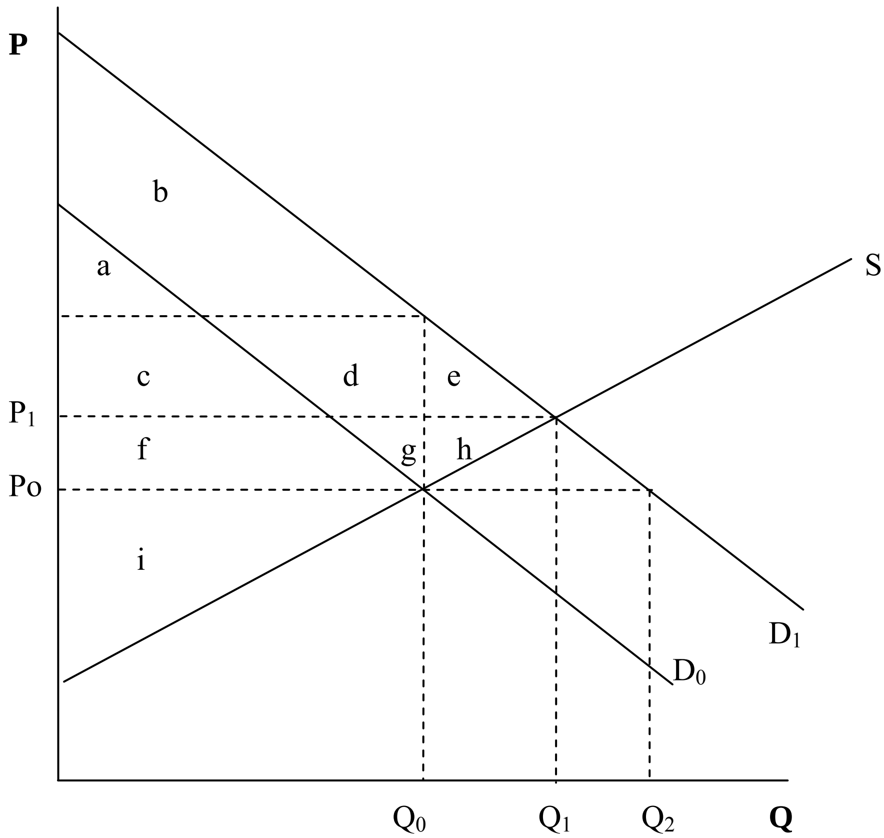
[a] Mill prices are raw-fiber equivalent.
Source: USDAb.

Figure 4: Real Prices of Cotton, Rayon, and Polyester, 1975-2004[a]



[a] Mill prices are raw-fiber equivalent. Prices are deflated by the CPI (U.S. city average) (1982-84=100)
Source: USDAb.

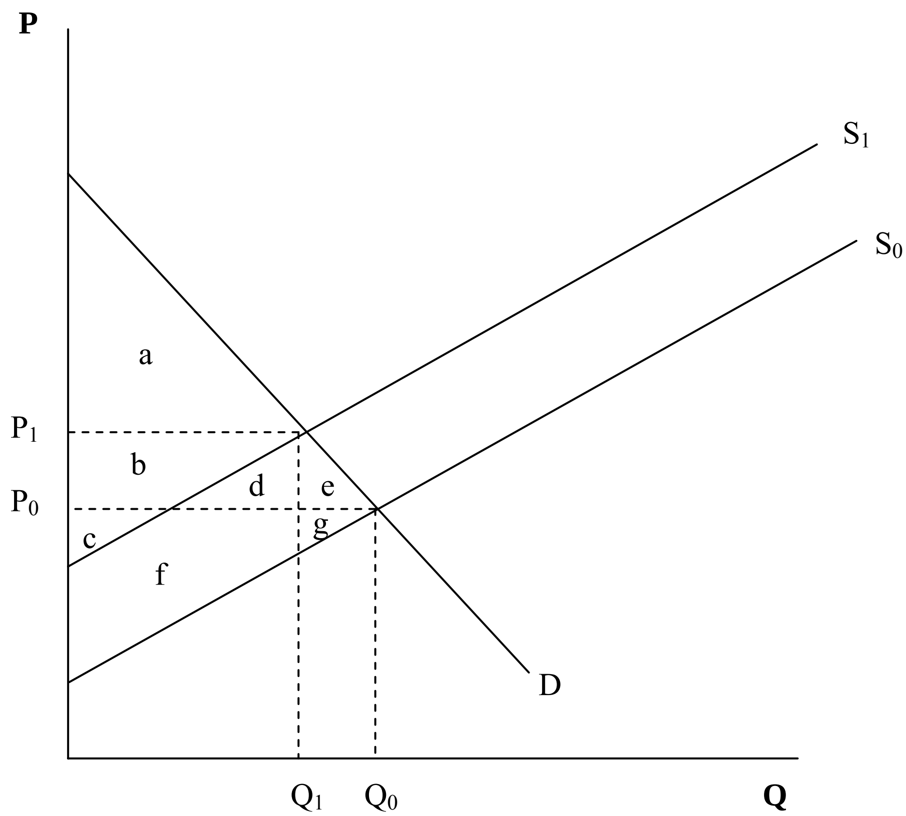
Figure 5: Welfare Effects from a Rightward Shift in the Market Demand Function from a Demand Expansion Program



	Consumer Surplus	Producer Surplus	Total
Before	a + c + f	i	a + c + f + i
After	(a + b) + c + d + e = (a + c + f) + c + d + e	f + g + h + i	(a + b) + c + d + e + f + g +h + i = (a + c + f) + c + d + e + f + g +h + i
Change	c + d + e	f + g + h	c + d + e + f + g + h

Net benefit to society: Area c + d + e + f + g + h

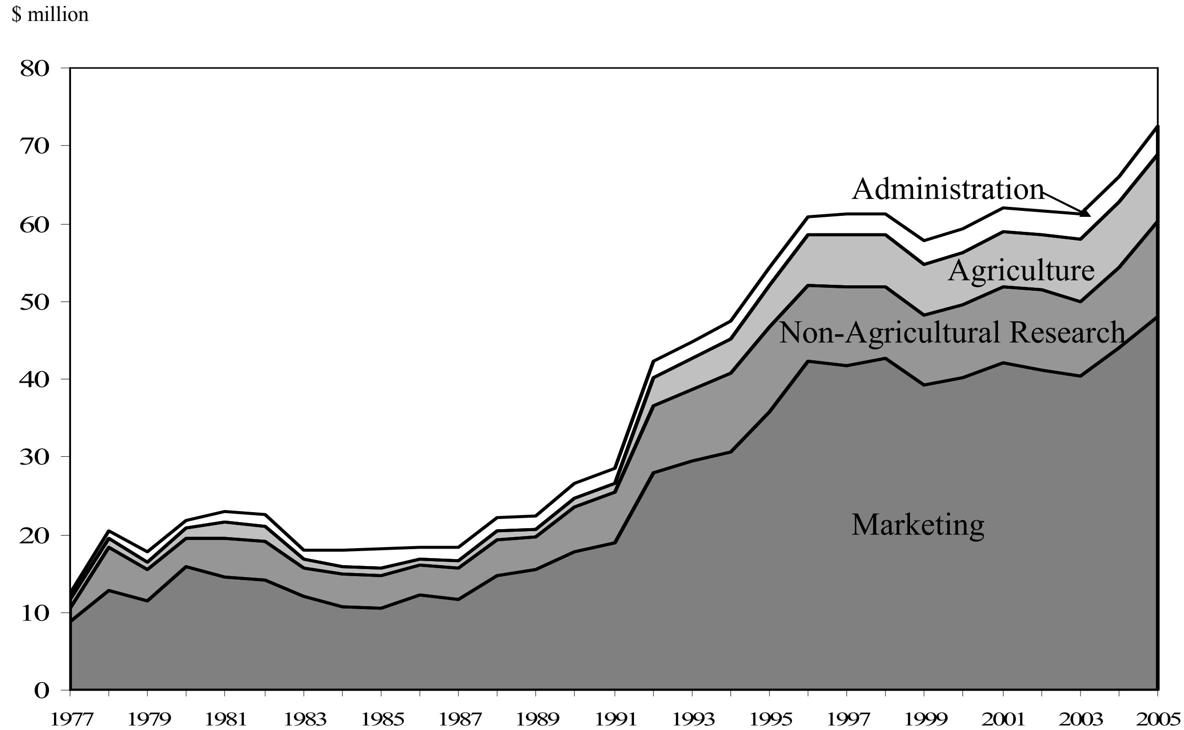
Figure 6: Welfare Effects from a Leftward Shift in the Market Supply Function from a Production Control Program



	Consumer Surplus	Producer Surplus	Total
Before	a + b + d + e	c +f + g	a + b + c + d + e + f + g
After	a	b + c	a + b + c
Change	- (b + d + e)	b – (f + g)	- (d + e + f + g)

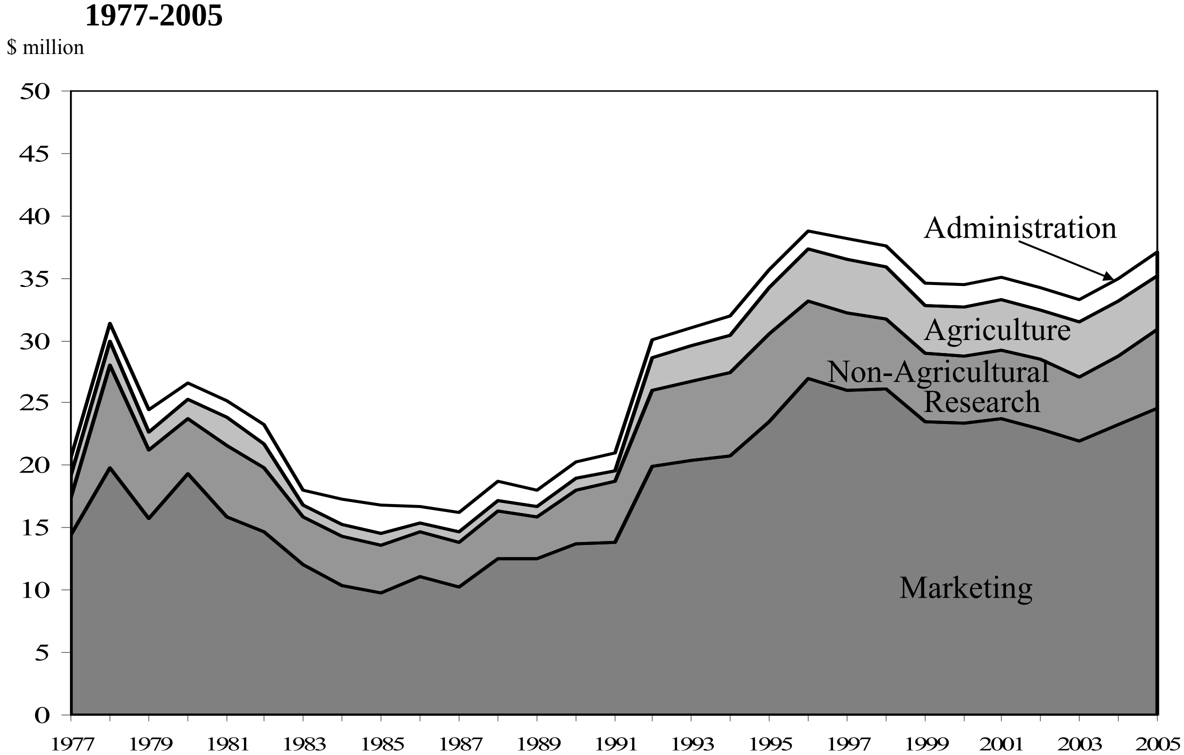
Net benefit to society: Area - (d + e + f + g)

Figure 7: Nominal Cotton Incorporated Expenditures by Category, 1977-2005



Source: Cotton Incorporated.

Figure 8: Real Cotton Incorporated Expenditures by Category (1982-84=100), 1977-2005



Source: Cotton Incorporated.

Figure 9: Conceptual Representation of the World Cotton and Cotton Textile Markets

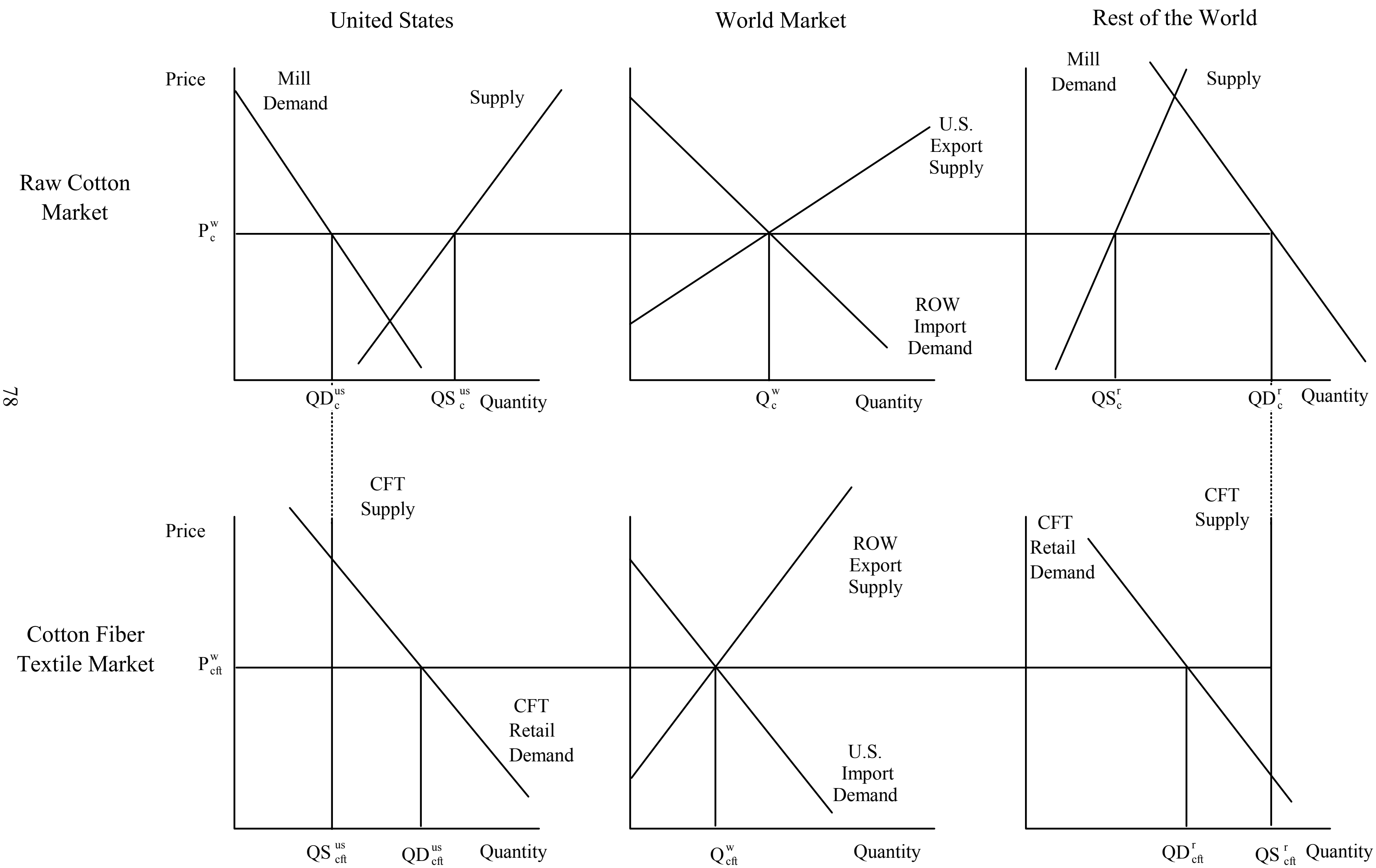


Figure 10: Incidence of an Assessment on a Domestically Produced Commodity

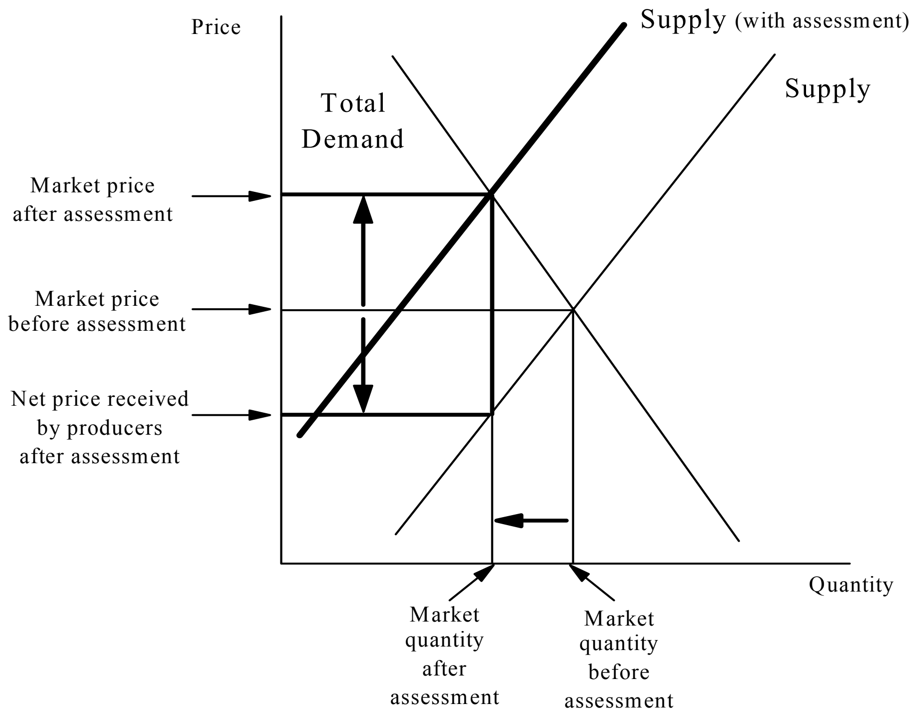


Figure 11: Effect of Market Structure on the Incidence of an Assessment on a Domestically Produced Commodity

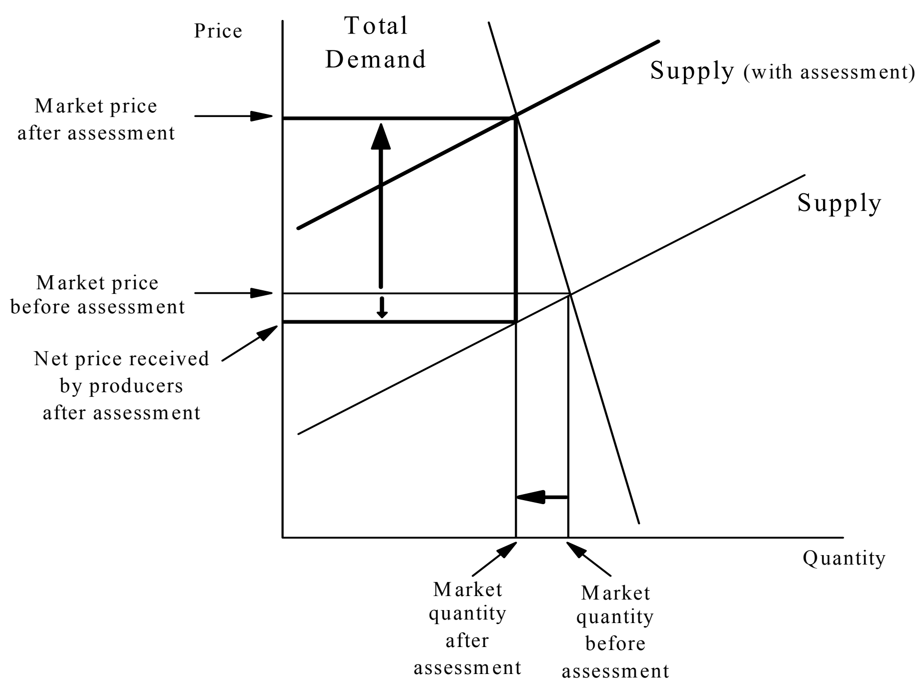


Figure 12: Incidence of an Assessment on an Imported Product

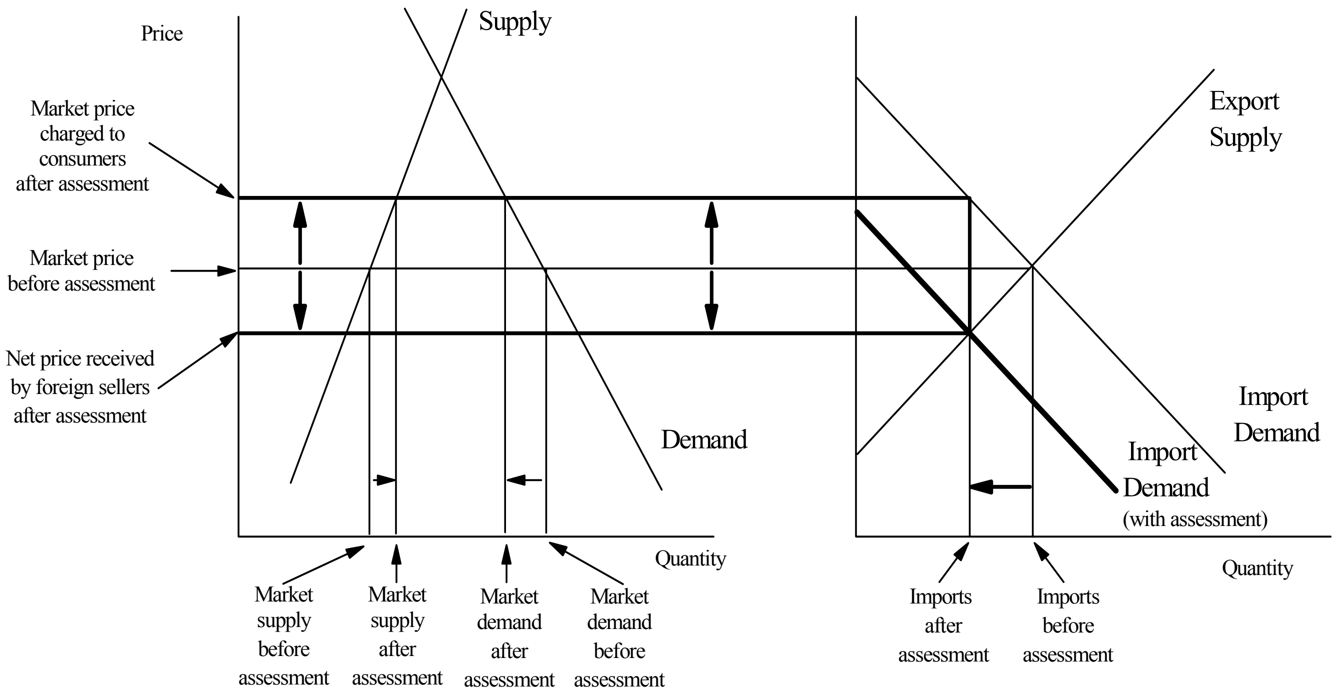


Figure 13: Incidence of U.S. Cotton Producer Checkoff Assessment

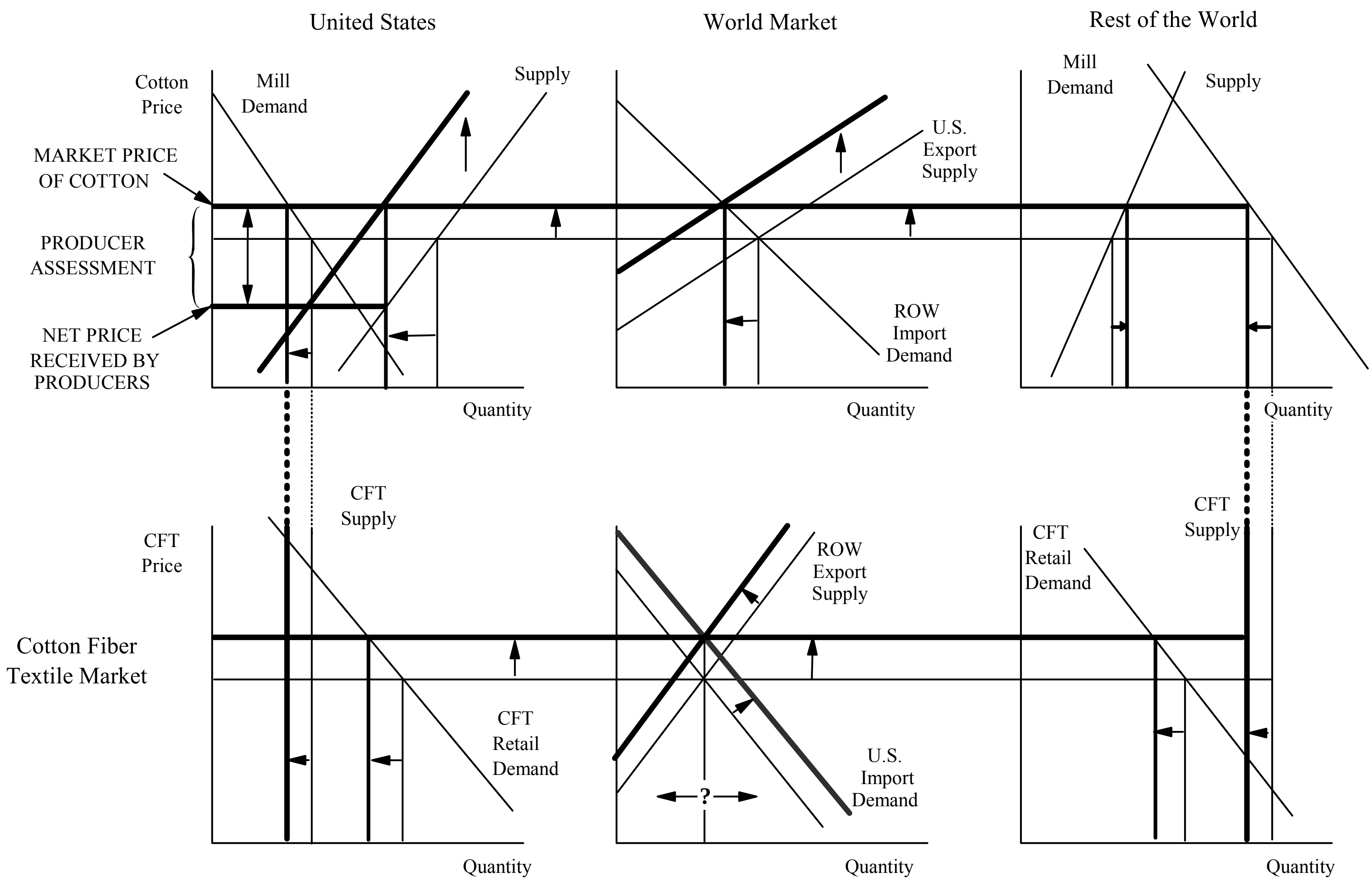


Figure 14: Incidence of U.S. Cotton Textile Importer Checkoff Assessment

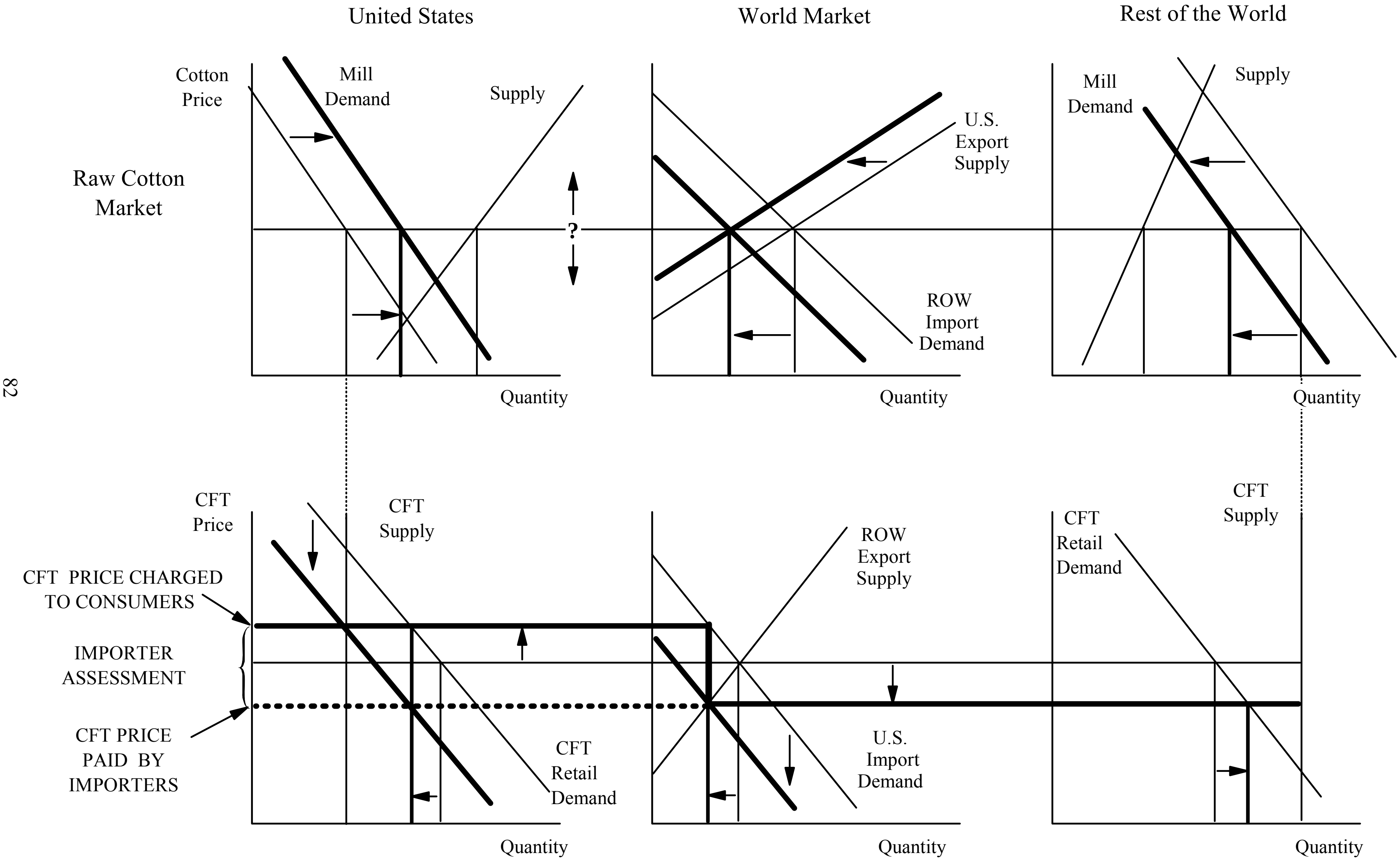


Figure 15: Effects of Cotton Checkoff Marketing/Promotion Expenditures on Cotton and Cotton Fiber Textile Markets

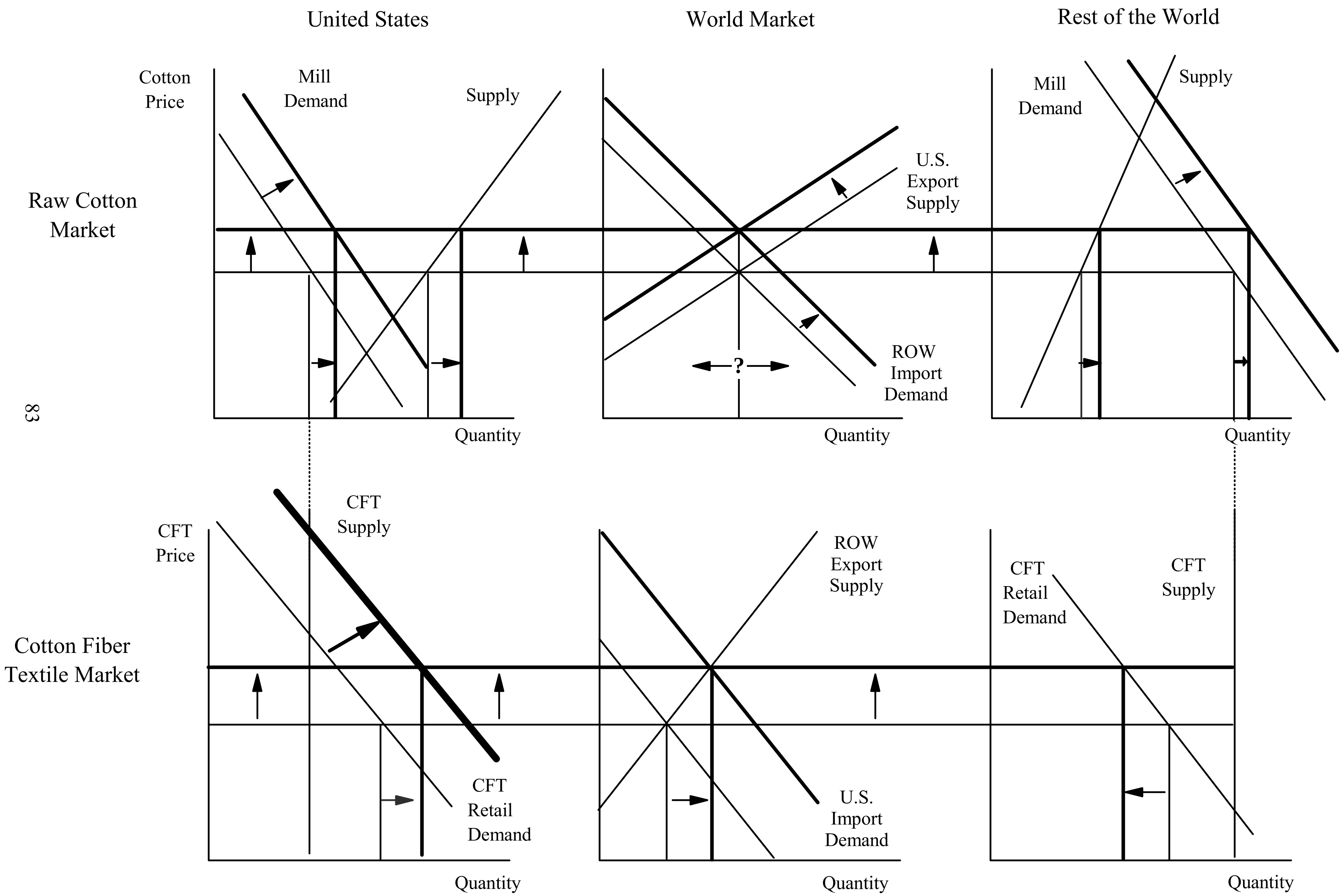


Figure 16: Effects of Cotton Checkoff Non-Agricultural Research Expenditures on Cotton and Cotton Fiber Textile Markets

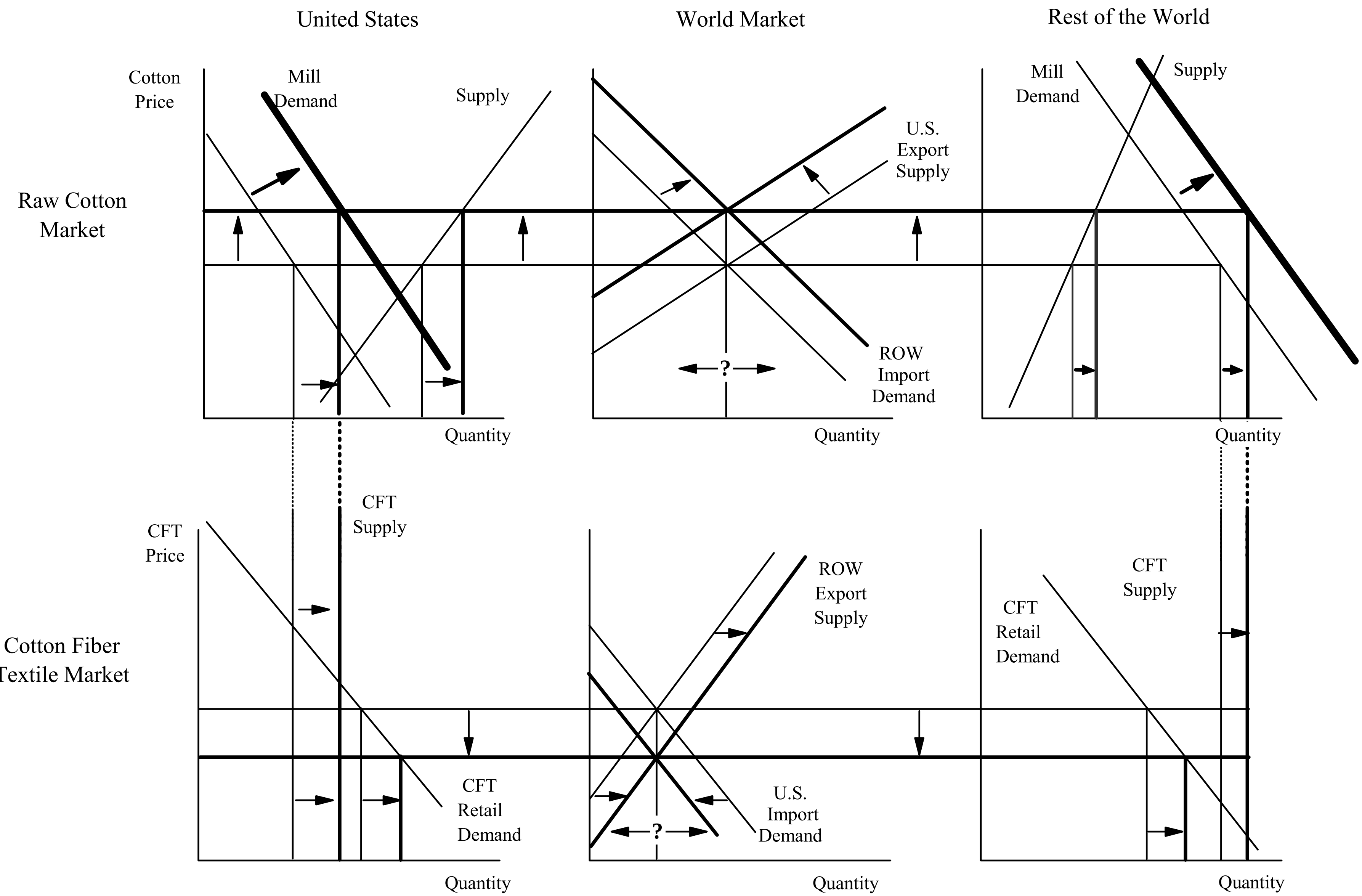


Figure 17: Pre-1996 Farm Bill Effects of Cotton Research and Promotion Expenditures on Government Payments to Cotton Farmers

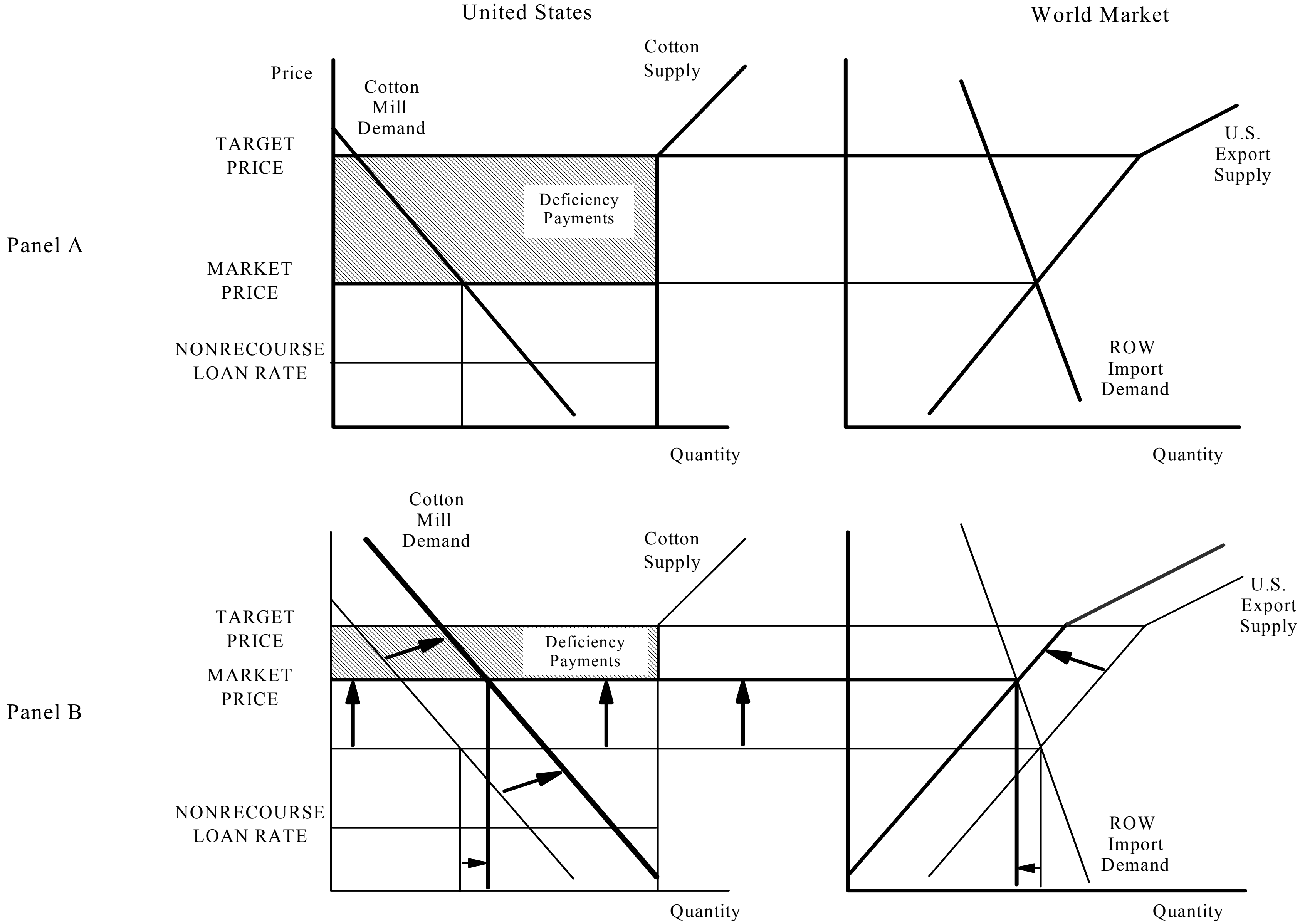


Figure 18: Post-2002 Farm Bill Effects of Cotton Research and Promotion Expenditures on Government Payments to Cotton Farmers

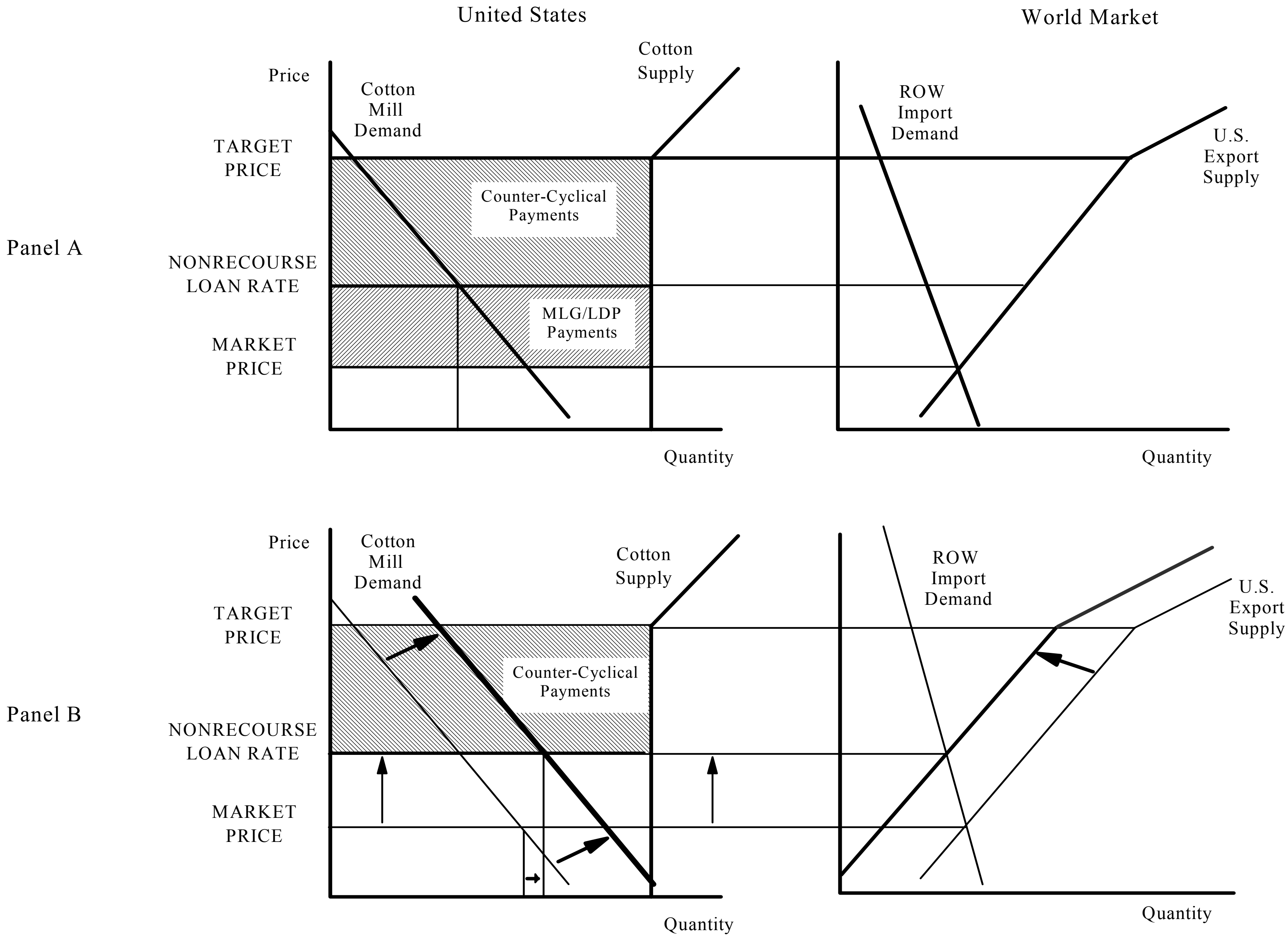


Figure 19: Effects of Cotton Checkoff Marketing/Promotion Expenditures on Man-Made Fiber and Man-Made Textile Markets

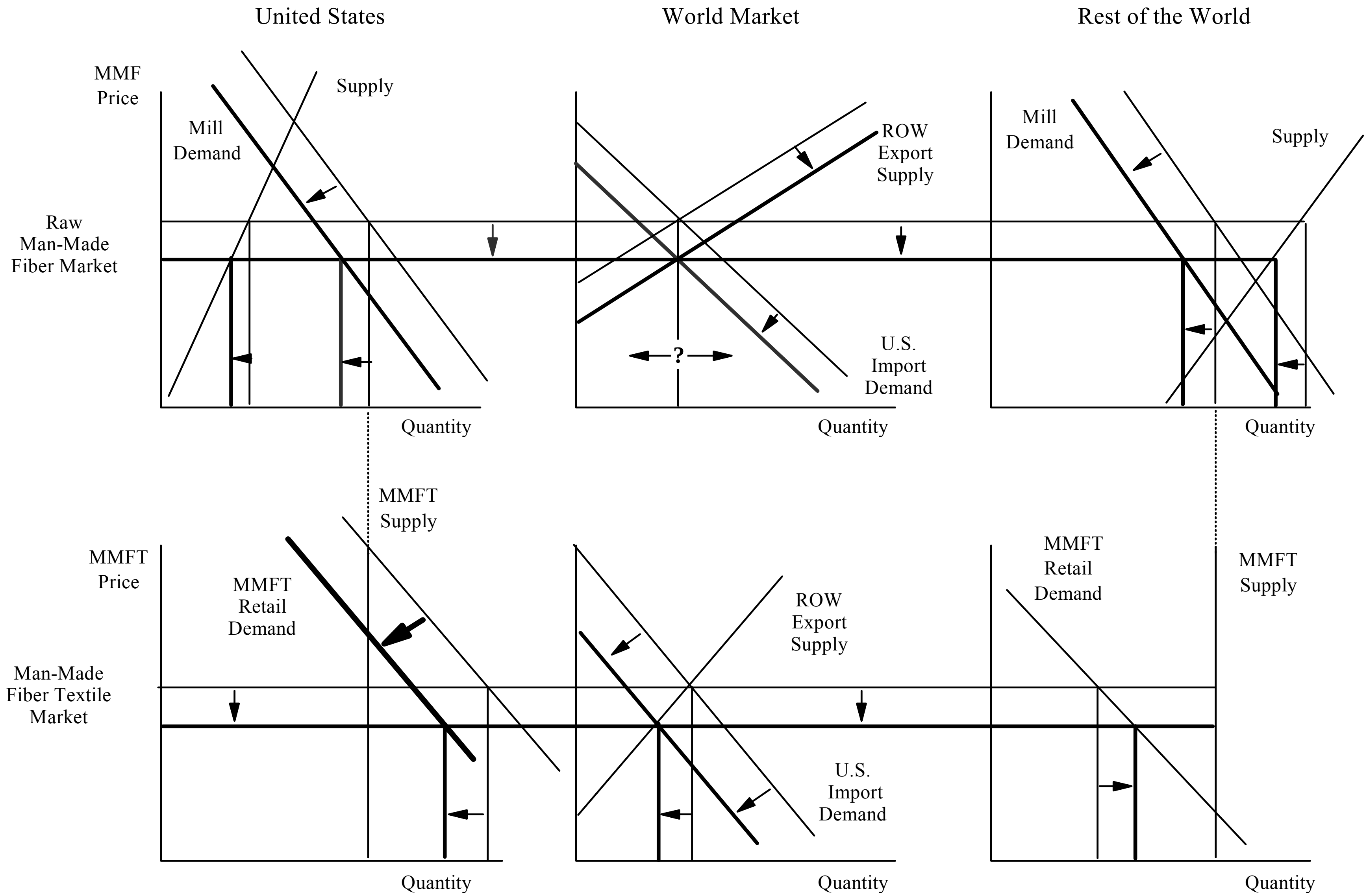


Figure 20: Effects of Cotton Checkoff Non-Agricultural Research Expenditures on Man-Made Fiber and Man-Made Textile Markets

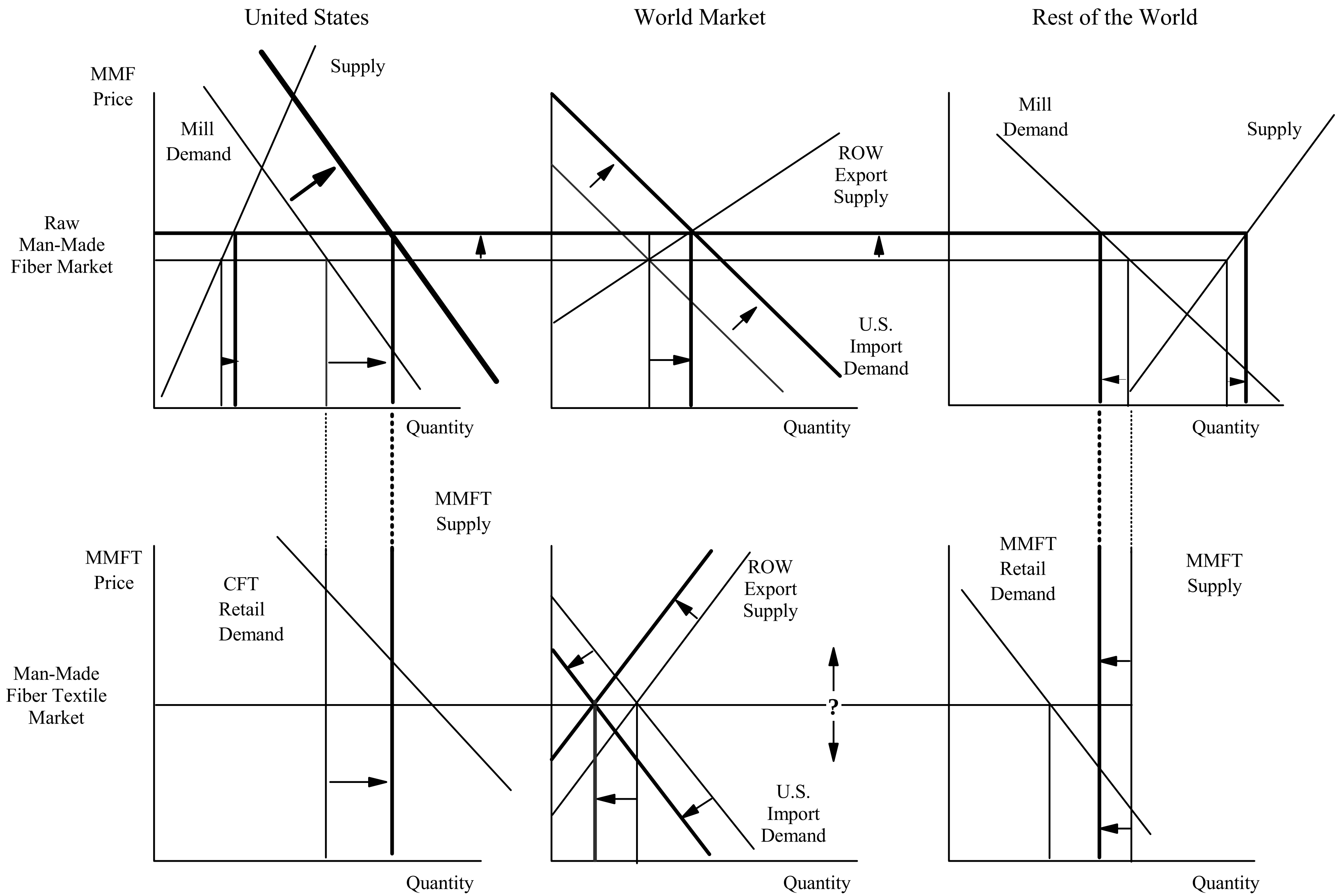
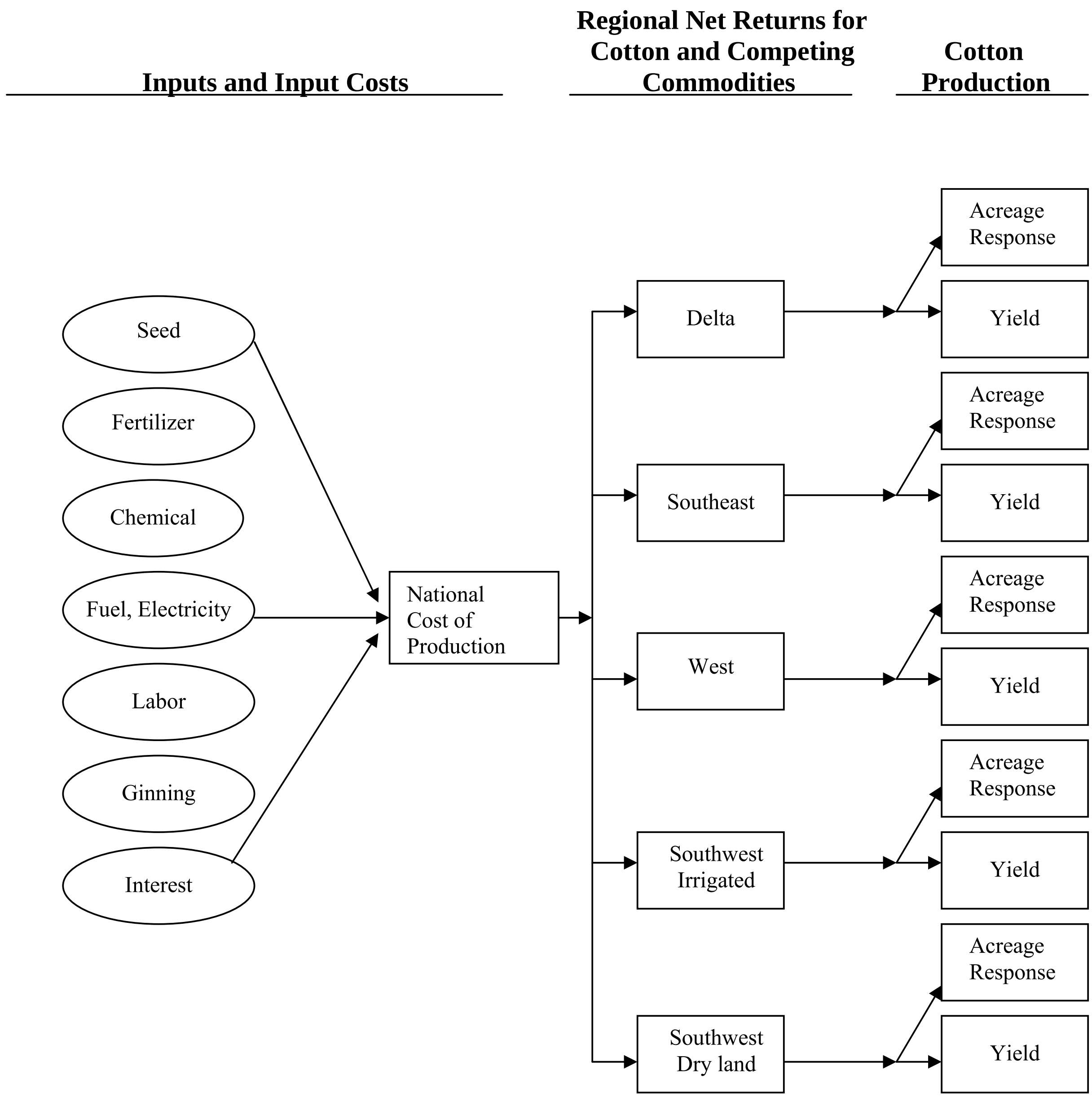
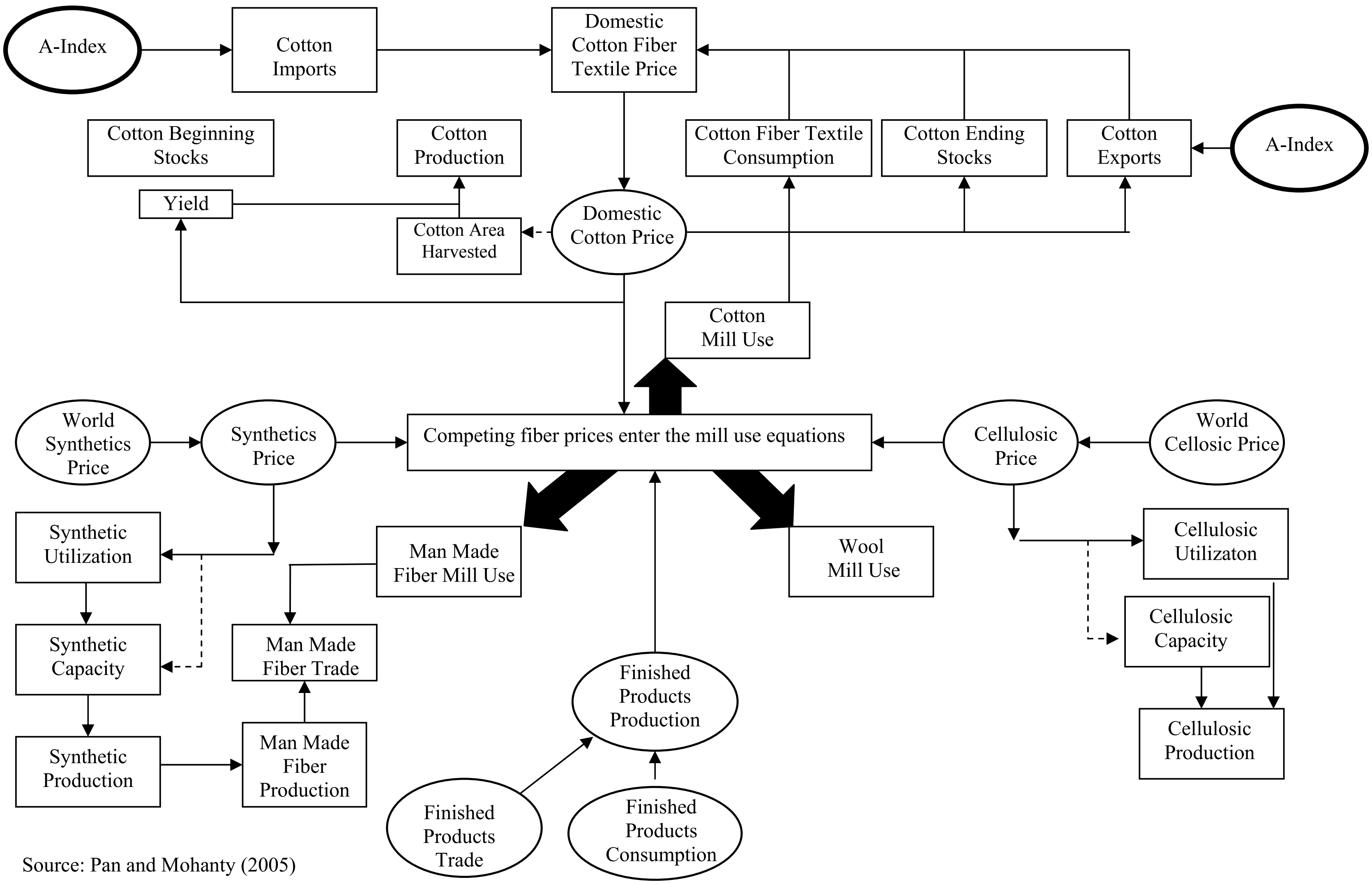


Figure 21: Schematic Representation of U.S. Cotton Supply Sector in the MCERI Model



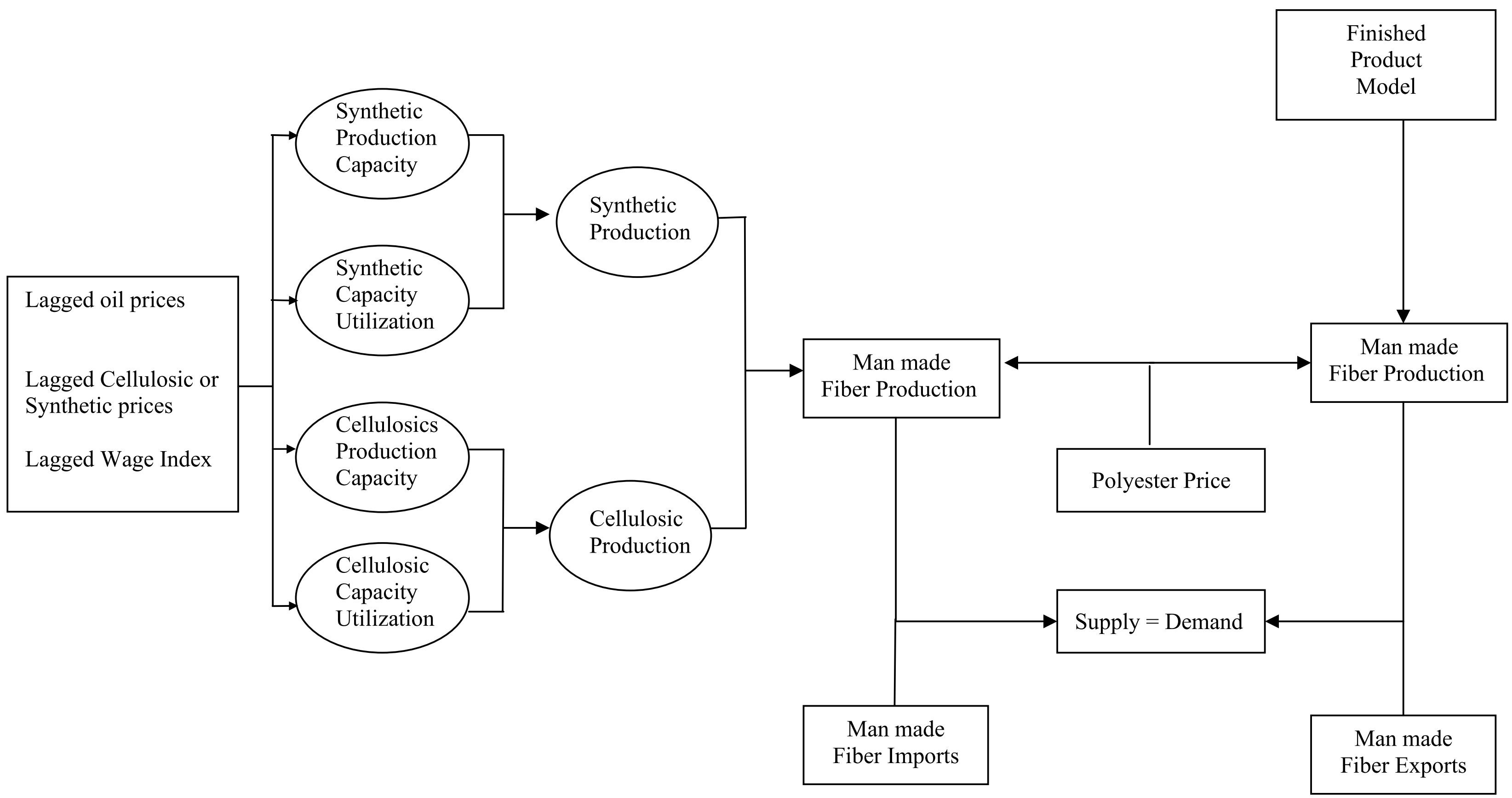
Source: Based on Pan and Mohanty (2005)

Figure 22: Schematic Representation of the Regional Cotton and Man-Made Fiber Components of the MCERI Model



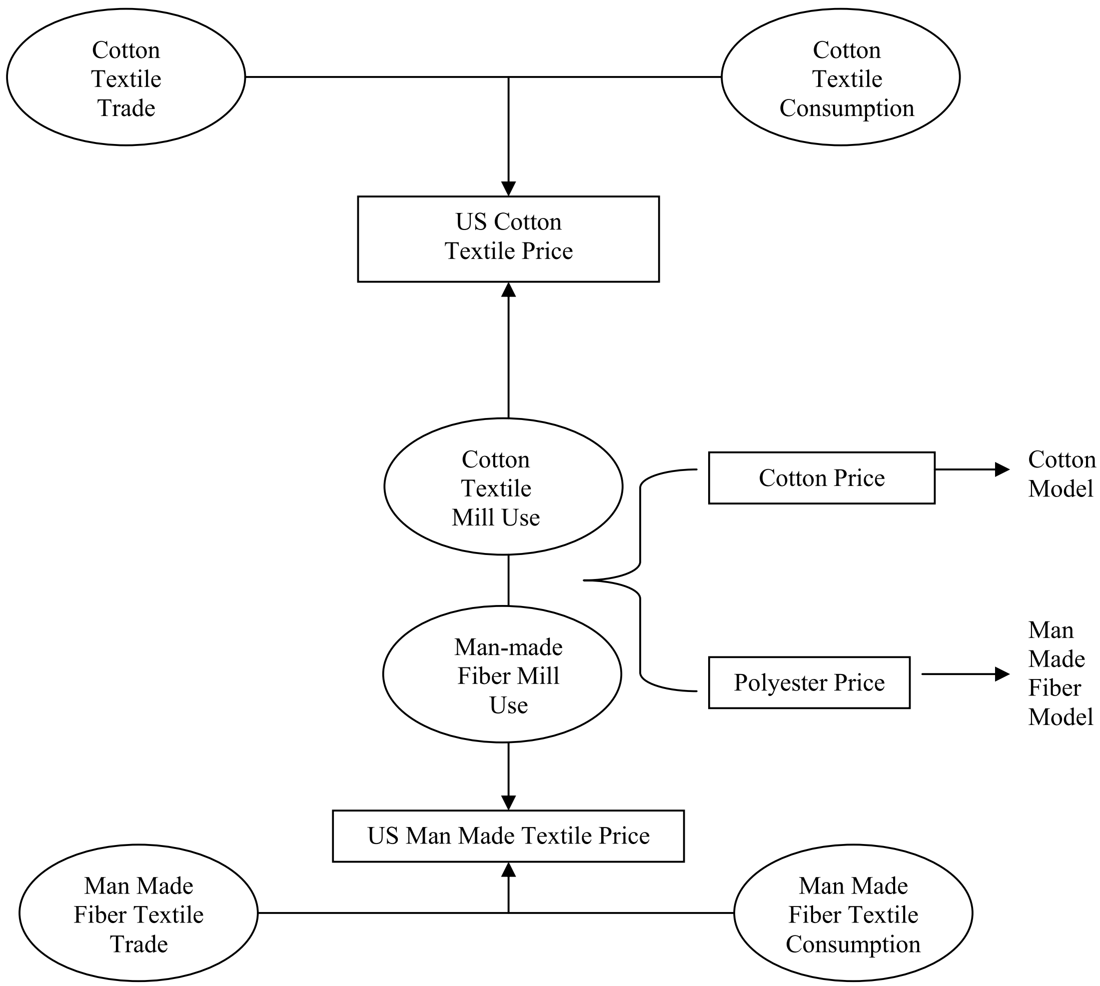
Source: Pan and Mohanty (2005)

Figure 23: Schematic Representation of the Man-Made Fiber Sector in the MCERI Model



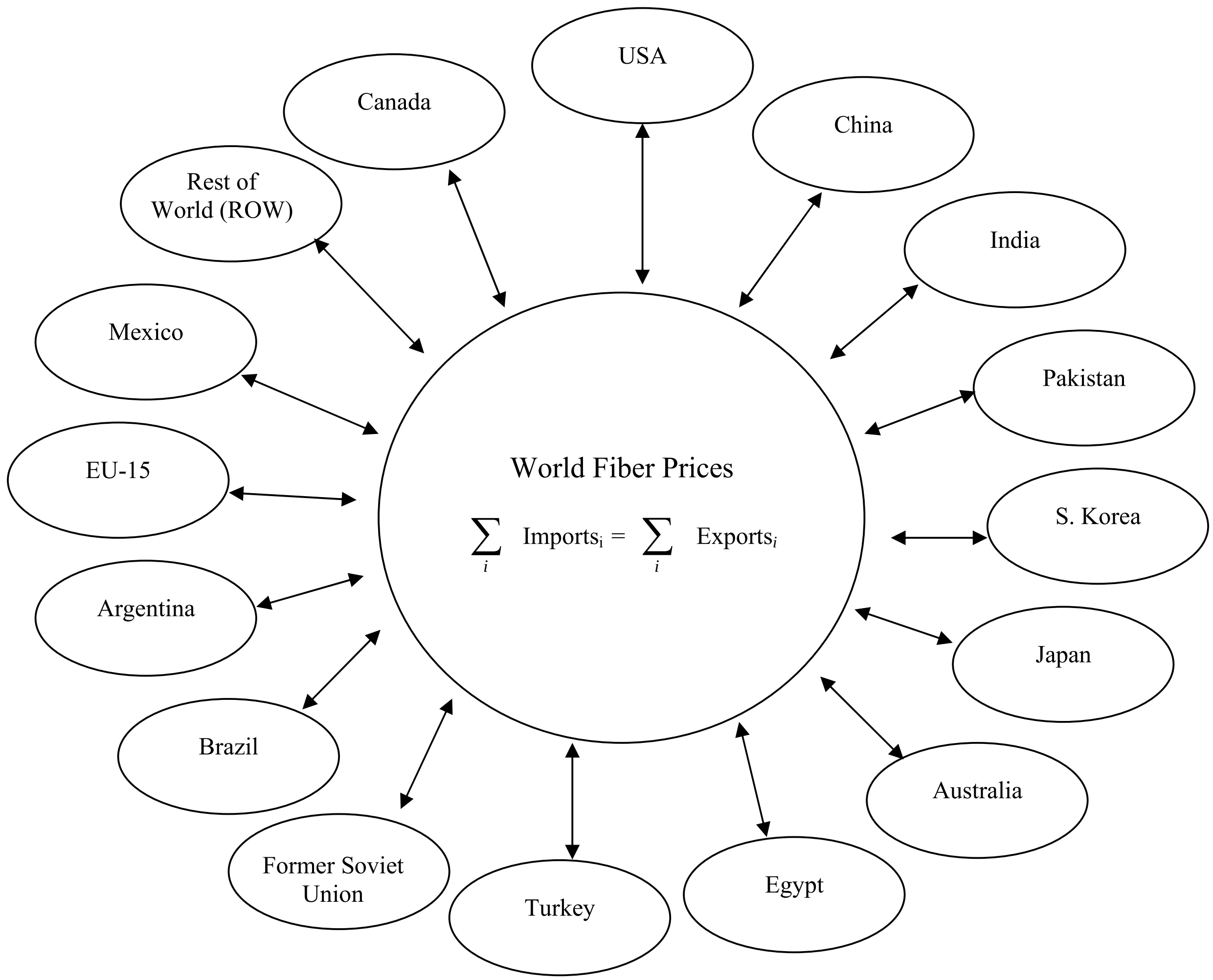
Source: Based on Pan and Mohanty (2005)

Figure 24: Schematic Representation of the U.S. Cotton and Man-Made Fiber Textile Sector in the MCERI Model



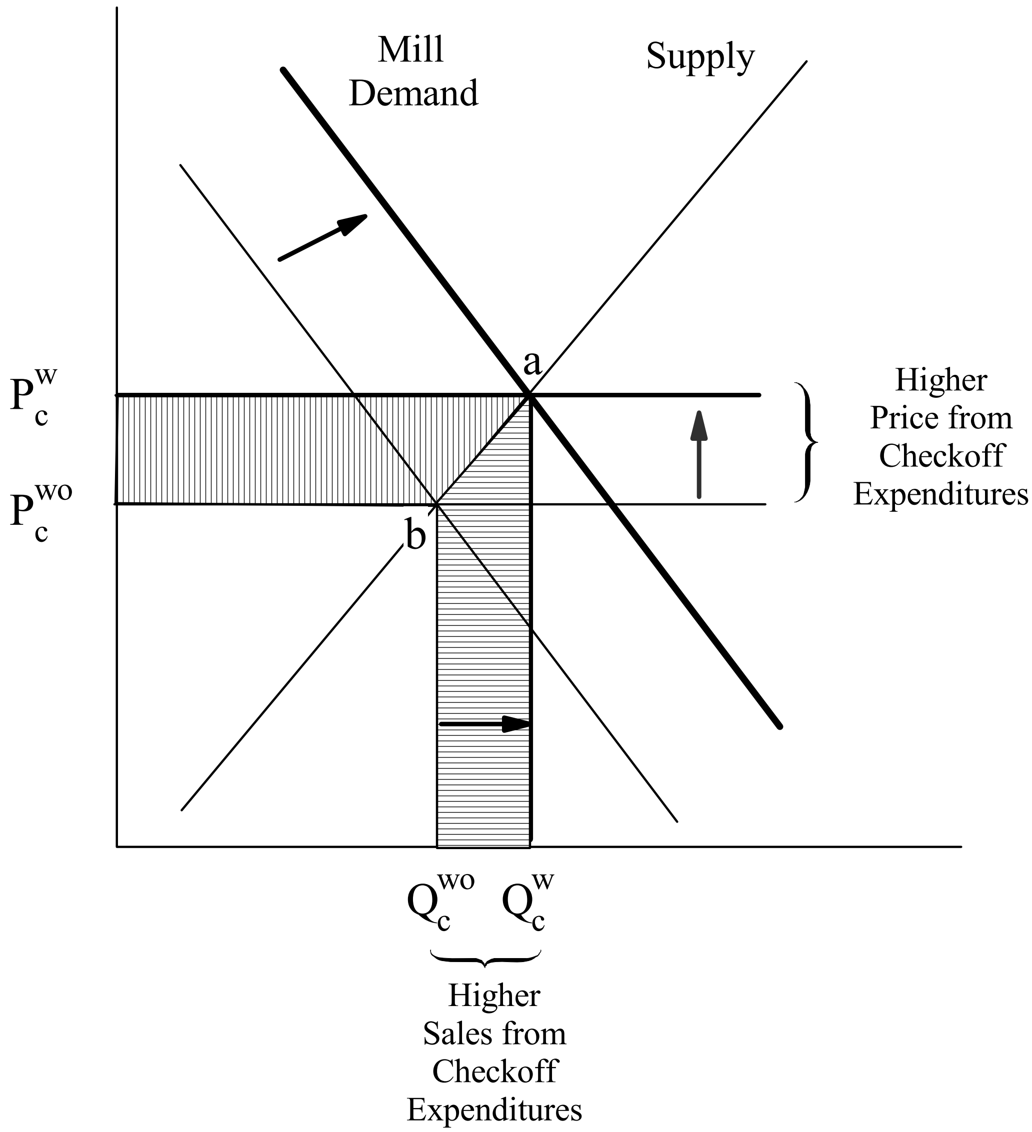
Source: Pan and Mohanty (2005)

Figure 25: Schematic Representation of the Price and Trade Linkages in the MCERI Model



Source: Pan and Mohanty (2005)

Figure 26: Calculating the Cotton Producer Benefit-Cost Ratio



TABLES

Table 1: Importance of the Food and Fiber Industry to the U.S. Economy, 1993-2002[a]

Year	Value Added by Food and Fiber Sector	U.S. Gross Domestic Product (GDP)	Food and Fiber Share of GDP	Food and Fiber Sector Employment	U.S. Civilian Employment	Food and Fiber Employment Share
	$ billion	$ billion	%	million	million	%
1993	955.2	6,657.2	14.4	24.0	129.2	18.6
1994	1016.4	7,072.2	14.4	24.5	131.1	18.7
1995	1,024.5	7,397.7	13.9	24.3	132.3	18.4
1996	1,066.8	7,816.9	13.7	24.3	133.9	18.2
1997	1,076.6	8,304.3	13.0	23.9	136.3	17.5
1998	1,092.5	8,747.0	12.5	24.0	137.7	17.4
1999	1,127.1	9,268.4	12.2	24.1	139.4	17.3
2000	1,170.7	9,817.0	11.9	24.2	142.6	17.0
2001	1,193.7	10,100.8	11.8	24.0	143.7	16.7
2002	1,241.7	10,983.9	11.3	23.2	144.9	16.0

[a] Data published by USDA only through 2002.
Source: USDAa.

Table 2: U.S. Cotton Acreage, Yields, Production, Farm Price, and Farm Receipts, 1965-2004

Crop Year	Planted Acres	Harvested Acres	Yield	Production	Farm Price	Loan Rate	Farm Receipts[1]
	1,000 acres	1,000 acres	lbs/acre	million lbs	---------------- ¢/lb	----------------	million $
1965	14,152	13,613	527	7,174	29.4	29.0	$2,109
1966	10,349	9,553	480	4,585	21.8	21.0	$1,000
1967	9,450	7,997	447	3,575	26.7	20.25	$954
1968	10,913	10,159	516	5,242	23.1	20.25	$1,211
1969	11,883	11,051	434	4,796	22.0	20.25	$1,055
1970	11,945	11,155	438	4,886	22.0	20.25	$1,075
1971	12,355	11,471	438	5,024	28.2	19.5	$1,417
1972	14,001	12,984	507	6,583	27.3	19.5	$1,797
1973	12,480	11,970	520	6,224	44.6	19.5	$2,776
1974	13,679	12,547	442	5,546	42.9	25.3	$2,379
1975	9,478	8,796	453	3,985	51.3	34.3	$2,044
1976	11,636	10,914	465	5,075	64.1	37.2	$3,253
1977	13,680	13,275	520	6,903	52.3	42.6	$3,610
1978	13,375	12,400	420	5,208	58.4	48.0	$3,041
1979	13,978	12,831	547	7,019	62.5	50.2	$4,387
1980	14,534	13,215	404	5,339	74.7	48.0	$3,988
1981	14,330	13,841	542	7,502	54.3	52.5	$4,073
1982	11,345	9,734	590	5,743	59.6	57.1	$3,423
1983	7,926	7,348	508	3,733	66.6	55.0	$2,486
1984	11,145	10,379	600	6,227	58.9	55.0	$3,668
1985	10,685	10,229	630	6,444	56.3	57.3	$3,628
1986	10,045	8,468	552	4,674	52.4	55.0	$2,449
1987	10,397	10,030	706	7,081	64.3	52.3	$4,553
1988	12,515	11,948	619	7,396	56.6	51.8	$4,186
1989	10,587	9,538	614	5,856	66.2	50.0	$3,877
1990	12,348	11,732	634	7,438	68.2	50.3	$5,073
1991	14,052	12,960	652	8,450	58.1	50.8	$4,909
1992	13,240	11,123	700	7,786	54.9	52.4	$4,275
1993	13,438	12,783	606	7,746	58.4	52.4	$4,524
1994	13,720	13,322	708	9,432	72.0	50.0	$6,791
1995	16,931	16,007	537	8,596	76.5	51.9	$6,576
1996	14,653	12,888	705	9,086	70.5	51.9	$6,406
1997	13,898	13,406	673	9,022	66.2	51.9	$5,973
1998	13,393	10,684	625	6,678	61.7	51.9	$4,120
1999	14,874	13,425	607	8,149	46.8	51.9	$3,814
2000	15,517	13,053	632	8,249	51.6	51.9	$4,257
2001	15,769	13,828	705	9,749	32.0	51.9	$3,120
2002	13,958	12,417	665	8,257	45.7	52.0	$3,774
2003	13,480	12,003	730	8,762	63.2	52.0	$5,538
2004	13,659	13,057	855	11,164	43.1	52.0	$4,812
Mean	12,745	11,703	574	6,760	51.4	43.4	$3,560
Median	13,384	11,987	571	6,790	55.6	51.3	$3,721
Std Dev	1,939	1,853	106	1,801	16.2	13.6	$1,572
Min	7,926	7,348	404	3,575	21.8	19.5	$954
Max	16,931	16,007	855	11,164	76.5	57.3	$6,791

Source: USDAb.

[1] Excludes government payments.

Table 3: Harvested Acres, Yields, and Production of Cotton in Selected Countries, 1970 -2004

Year Beginning August 1	Former Soviet Union			Brazil			Turkey			China			India			Pakistan		
	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn
	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales
1970	2.746	854	10,770	2.469	241	2,733	0.526	759	1,835	4.997	458	10,500	7.605	127	4,423	1.748	311	2,500
1971	2.770	847	10,780	2.590	263	3,123	0.688	760	2,400	4.923	429	9,700	7.800	162	5,787	1.957	362	3,249
1972	2.735	877	11,020	2.307	282	2,990	0.761	714	2,495	4.896	400	9,000	7.679	147	5,167	2.010	336	3,100
1973	2.742	876	11,030	2.287	234	2,459	0.678	756	2,355	4.942	515	11,700	7.574	143	4,958	1.845	343	2,909
1974	2.879	924	12,220	2.216	241	2,448	0.838	716	2,755	5.013	491	11,300	7.562	159	5,505	2.031	300	2,802
1975	2.924	865	11,610	1.815	220	1,837	0.670	717	2,205	4.955	479	10,900	7.350	154	5,192	1.851	267	2,269
1976	2.950	886	12,010	1.990	297	2,710	0.581	819	2,185	4.929	420	9,500	6.885	147	4,646	1.865	224	1,921
1977	2.992	907	12,470	2.015	243	2,246	0.778	739	2,640	4.845	422	9,400	7.866	156	5,645	1.843	300	2,539
1978	3.038	853	11,907	1.965	277	2,499	0.653	728	2,182	4.867	445	9,950	8.119	166	6,192	1.902	244	2,132
1979	3.090	904	12,833	1.975	290	2,627	0.612	778	2,186	4.512	487	10,100	8.127	168	6,262	2.023	368	3,417
1980	3.147	858	12,401	2.015	295	2,728	0.673	743	2,296	4.920	549	12,400	7.823	169	6,071	2.108	339	3,280
1981	3.168	758	11,032	2.070	328	3,123	0.654	746	2,241	5.185	571	13,600	8.057	177	6,559	2.215	338	3,434
1982	3.188	725	10,619	2.113	277	2,691	0.595	822	2,246	5.828	616	16,500	7.871	187	6,755	2.263	364	3,782
1983	3.192	680	9,976	1.960	344	3,096	0.614	850	2,398	6.077	763	21,300	7.721	173	6,122	2.221	223	2,271
1984	3.347	776	11,928	2.420	400	4,446	0.743	781	2,664	6.923	903	28,700	7.382	247	8,360	2.236	451	4,630
1985	3.316	839	12,777	2.290	346	3,642	0.660	785	2,379	5.140	805	19,000	7.533	261	9,021	2.366	514	5,587
1986	3.475	765	12,217	2.130	297	2,907	0.589	880	2,380	4.306	824	16,300	6.948	227	7,254	2.505	527	6,062
1987	3.527	709	11,491	2.156	401	3,968	0.586	916	2,465	4.844	876	19,500	6.471	240	7,140	2.568	572	6,744
1988	3.432	805	12,686	2.367	300	3,258	0.737	882	2,985	5.535	751	19,100	7.343	244	8,214	2.508	569	6,551
1989	3.338	796	12,203	1.900	350	3,058	0.725	851	2,835	5.203	728	17,400	7.331	313	10,541	2.599	560	6,687
1990	3.171	818	11,910	1.977	363	3,293	0.641	1,021	3,007	5.588	807	20,700	7.440	267	9,135	2.662	615	7,522
1991	3.010	800	11,065	1.969	339	3,064	0.599	937	2,578	6.539	869	26,100	7.661	264	9,291	2.836	768	10,000
1992	2.888	690	9,146	1.485	283	1,929	0.637	901	2,635	6.835	659	20,700	7.543	311	10,775	2.836	543	7,073
1993	2.903	703	9,378	1.085	445	2,219	0.568	1,060	2,766	5.000	749	17,200	7.440	287	9,800	2.805	488	6,282
1994	2.707	706	8,778	1.220	440	2,467	0.582	1,080	2,886	5.530	784	19,900	7.861	309	11,148	2.650	514	6,250

Continued on next page

Table 3 (continued)

Year Beginning August 1	Former Soviet Union			Brazil			Turkey			China			India			Pakistan		
	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn	Area	Yield	Prdctn
	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales	million hectares	kg/ha	1000 480 lb bales
1995	2.573	699	8,260	1.130	363	1,884	0.757	1,125	3,911	5.422	879	21,900	9.063	318	13,250	3.048	586	8,200
1996	2.535	566	6,588	0.695	440	1,405	0.743	1,055	3,600	4.722	890	19,300	9.122	332	13,918	3.148	506	7,323
1997	2.502	619	7,108	0.765	538	1,890	0.722	1,101	3,651	4.491	1,023	21,100	8.904	302	12,337	2.960	528	7,175
1998	2.550	564	6,600	0.685	760	2,391	0.757	1,110	3,860	4.459	1,011	20,700	9.287	302	12,883	2.923	469	6,300
1999	2.507	634	7,300	0.752	931	3,216	0.719	1,100	3,634	3.726	1,028	17,600	8.791	302	12,180	2.915	642	8,600
2000	2.436	571	6,385	0.853	1,101	4,312	0.654	1,198	3,600	4.058	1,089	20,300	8.576	278	10,931	2.928	610	8,200
2001	2.515	641	7,410	0.748	1,024	3,519	0.693	1,249	3,975	4.820	1,102	24,400	8.730	307	12,300	3.116	580	8,300
2002	2.441	613	6,875	0.735	1,152	3,890	0.700	1,300	4,179	4.184	1,176	22,600	7.667	301	10,600	2.796	607	7,800
2003	2.476	592	6,735	1.100	1,191	6,015	0.710	1,257	4,100	5.110	950	22,300	7.785	386	13,800	3.092	546	7,750
2004	2.638	664	8,040	1.172	1,096	5,900	0.700	1,291	4,150	5.690	1,110	29,000	9.000	460	19,000	3.190	771	11,300
Mean	2.910	754	10,159	1.698	468	3,028	0.673	929	2,876	5.115	745	17,419	7.883	243	8,890	2.473	465	5,541
Median	2.903	765	11,020	1.969	344	2,907	0.673	880	2,640	4.955	763	19,000	7.721	247	8,360	2.508	506	6,250
Std Dev	0.328	111	2,189	0.620	303	1,009	0.071	190	691	0.710	236	5,724	0.674	80	3,427	0.459	148	2,543
Min	2.436	564	6,385	0.685	220	1,405	0.526	714	1,835	3.726	400	9,000	6.471	127	4,423	1.748	223	1,921
Max	3.527	924	12,833	2.590	1191	6,015	0.838	1,300	4,179	6..923	1,176	29,000	9.287	460	19,000	3.190	771	11,300

Source: USDA b.

Table 4: Cotton Exports of Major Foreign Exporters, 1965-2004

Year	Uzbekistan	Africa	Pakistan	India	China	Turkey	Sudan	Brazil	Egypt	Other Foreign Sources	All Foreign Sources	U.S.	World	Foreign Share of World Exports	U.S. Share of World Exports
	1,000 480 lb bales													%	%
1965	0	372	492	155	500	959	570	937	1,575	4,039	13,931	3,035	16,966	82.1	17.9
1966	0	446	558	198	500	1,093	682	1,014	1,428	4,474	13,475	4,832	18,307	73.6	26.4
1967	0	527	887	191	300	1,083	794	836	1,171	4,770	13,259	4,361	17,620	75.2	24.8
1968	0	633	606	160	300	993	848	1,765	1,087	4,437	14,205	2,825	17,030	83.4	16.6
1969	0	670	393	169	400	1,186	1,081	1,933	1,463	4,792	14,857	2,878	17,735	83.8	16.2
1970	0	535	473	139	500	1,124	1,049	1,011	1,397	11,759	19,685	3,897	23,582	83.5	16.5
1971	0	637	1,151	166	700	1,539	990	1,409	1,366	11,540	21,450	3,385	24,835	86.4	13.6
1972	0	647	822	198	2,000	1,489	1,090	1,333	1,387	11,315	22,505	5,311	27,816	80.9	19.1
1973	0	590	196	182	1,800	1,000	729	661	1.199	12,030	20,097	6,123	26,220	76.6	23.4
1974	0	611	1,060	89	700	583	568	269	878	13,575	20,369	3,926	24,295	83.8	16.2
1975	0	771	418	294	250	2,163	1,097	356	775	15,020	22,656	3,311	25,967	87.2	12.8
1976	0	794	65	35	200	580	607	54	606	15,356	19,819	4,784	24,603	80.6	19.4
1977	0	684	471	11	100	1,218	689	192	686	15,032	20,957	5,484	26,441	79.3	20.7
1978	0	808	246	195	15	962	814	141	690	14,274	21,073	6,180	27,253	77.3	22.7
1979	0	803	1,177	399	12	617	805	0	876	13,756	21,433	9,229	30,662	69.9	30.1
1980	0	849	1,489	527	6	1,028	426	42	749	12,451	20,339	5,926	26,265	77.4	22.6
1981	0	766	1,096	339	0	956	269	138	898	11,281	19,197	6,567	25,764	74.5	25.5
1982	0	933	1,272	500	75	654	640	1,021	920	11,591	20,308	5,207	25,515	79.6	20.4
1983	0	932	377	299	760	499	1,004	80	780	11,384	18,547	6,786	25,333	73.2	26.8
1984	0	1,070	1,260	151	944	684	590	354	560	11,740	20,985	6,215	27,200	77.2	22.8
1985	0	1,541	3,146	336	2,799	322	499	358	837	12,094	26,118	1,960	28,078	93.0	7.0
1986	0	1,533	2,870	1,018	3,169	510	820	303	586	12,419	26,666	6,684	33,350	80.0	20.0
1987	6,284	1,749	2,358	19	2,322	197	725	597	436	4,996	23,521	6,582	30,103	78.1	21.9
1988	7,006	1,982	3,780	149	1,636	666	775	464	294	4,809	27,333	6,148	33,481	81.6	18.4
1989	6,810	2,115	1,371	1,077	865	205	750	661	211	4,698	23,663	7,694	31,357	75.5	24.5

Continued on next page

Table 4 (continued)

Year	Uzbekistan	Africa[a]	Pakistan	India	China	Turkey	Sudan	Brazil	Egypt	Other Foreign Sources	All Foreign Sources	U.S.	World	Foreign Share of World Exports	U.S. Share of World Exports
	1000 480 lb bales													%	%
1990	5,393	2,055	1,357	708	928	753	400	716	90	4,385	21,787	7,793	29,560	73.6	26.4
1991	5,200	2,247	2,059	303	620	289	400	133	90	3,925	21,602	6,646	28,248	76.5	23.5
1992	5,500	2,048	1,175	990	684	269	200	110	85	4,509	20,274	5,201	25,475	79.6	20.4
1993	5,800	2,026	318	369	749	500	200	5	525	4,850	19,798	6,862	26,660	74.3	25.7
1994	5,006	2,682	148	104	183	9	350	152	307	5,532	18,755	9,402	28,157	66.6	33.4
1995	4,524	2,798	1,433	567	20	266	425	101	87	5,059	19,686	7,675	27,361	71.9	28.1
1996	4,550	3,308	119	1,187	10	207	362	0	211	4,180	19,998	6,865	26,863	74.4	25.6
1997	4,570	3,617	380	312	25	100	344	0	322	3,140	19,222	7,500	26,722	71.9	28.1
1998	3,812	3,596	10	195	676	394	247	23	450	3,037	19,226	4,298	23,524	81.7	18.3
1999	4,200	3,736	415	70	1,692	207	185	12	425	2,163	20,445	6,750	27,195	75.2	24.8
2000	3,450	3,261	575	94	442	127	159	315	375	2,089	19,653	6,740	26,393	74.5	25.5
2001	3,500	3,551	160	60	342	133	289	674	410	2,067	18,006	11,000	29,006	62.1	37.9
2002	3,400	3,781	231	56	751	313	377	489	700	2,434	18,420	11,900	30,320	60.8	39.2
2003	3,100	4,436	200	625	173	357	412	964	400	3,292	19,403	13,758	33,161	58.5	41.5
2004	3,950	4,081	550	800	30	152	284	1,557	600	3,678	20,550	14,409	34,959	58.8	41.2
Mean	4,781	1,756	929	336	704	660	589	530	698	7,699	20,082	6,198	26,485	76.4	23.6
Median	4,560	1,302	567	197	500	582	580	355	646	4,923	20,186	6,180	26,691	76.9	23.1
Std Dev	1,182	1,248	876	311	789	476	282	528	426	4,554	3,146	2,453	4,369	7.5	7.5
Min	3,100	372	10	11	0	9	159	0	85	2,067	13,259	1,960	16,966	58.5	7.0
Max	7,006	4,436	3,780	1,187	3,169	2,163	1,097	1,933	1,575	15,356	27,333	13,759	34,959	93.0	41.5

Source: USDAb.

Table 5: Foreign Cotton Harvested Acres, Yields, and Production, 1965-2004

Year Beginning August 1	Foreign Harvested Area	Foreign Average Yield	Foreign Production	U.S. Share of Total World Harvested Area	U.S. Share of Total World Production	Ratio of US to Foreign Ave. Yield
	million acres	lb/acre	million lbs	%	%	lb/acre
1965	68.6	294	20,159	16.5	26.2	1.79
1966	67.5	304	20,499	12.4	18.3	1.58
1967	68.4	310	21,176	10.5	14.4	1.44
1968	68.7	321	22,065	12.9	19.2	1.61
1969	69.2	308	21,282	13.8	18.4	1.41
1970	67.4	323	21,783	14.2	18.3	1.36
1971	70.1	333	23,364	14.1	17.7	1.31
1972	69.9	331	23,118	15.7	22.2	1.53
1973	69.2	343	23,762	14.7	20.8	1.51
1974	70.2	357	25,093	15.2	18.1	1.24
1975	65.0	337	21,923	11.9	15.4	1.34
1976	64.5	342	22,054	14.5	18.7	1.36
1977	69.7	341	23,769	16.0	22.5	1.52
1978	68.9	339	23,347	15.3	18.2	1.24
1979	66.8	365	24,392	16.1	22.4	1.50
1980	66.8	376	25,085	16.5	17.5	1.08
1981	67.5	378	25,533	17.0	22.7	1.43
1982	67.8	385	26,097	12.5	18.0	1.53
1983	69.1	407	28,083	9.6	11.7	1.25
1984	73.0	498	36,348	12.5	14.6	1.20
1985	67.8	472	32,026	13.1	16.8	1.33
1986	64.1	454	29,102	11.7	13.8	1.22
1987	66.3	483	32,010	13.1	18.1	1.46
1988	71.5	462	33,029	14.3	18.3	1.34
1989	68.4	474	32,410	12.2	15.3	1.30
1990	70.2	490	34,386	14.3	17.8	1.29
1991	73.0	511	37,287	15.1	18.5	1.28
1992	69.5	456	31,723	13.8	19.7	1.53
1993	63.1	468	29,526	16.8	20.8	1.30
1994	66.2	483	31,964	16.7	22.8	1.47
1995	72.9	499	36,395	18.0	19.1	1.08
1996	70.5	484	34,122	15.5	21.0	1.46
1997	70.1	503	35,252	16.1	20.4	1.34
1998	70.6	487	34,360	13.1	16.3	1.28
1999	66.3	512	33,961	16.8	19.3	1.19
2000	66.1	521	34,398	16.5	19.3	1.21
2001	69.5	542	37,655	16.6	20.6	1.30
2002	62.8	543	34,101	16.5	19.5	1.23
2003	68.0	542	36,868	15.0	19.2	1.35
2004	75.6	617	46,635	14.7	19.3	1.39
Mean	68.5	425	29,154	14.5	18.8	1.36
Median	68.7	455	29,314	14.7	18.6	1.34
Std Dev	2.7	87	6,376	2.0	2.8	0.15
Min	62.8	294	20,158	9.6	11.7	1.08
Max	75.6	617	46,635	18.0	26.2	1.79

Source: USDAb.

Table 6: World Textile Fiber Production, 1980-2003

Year	Rayon and Acetate Production	Rayon and Acetate Share	Non-cellulosic Fibers Production	Non-cellulosic Fibers Share	Cotton Production	Cotton Share	Wool Production	Wool Share	Silk Production	Silk Share	Flax Production	Flax Share	Hemp Production	Hemp Share	World Total Fiber Production
	million lbs.	%	million lbs.	%	million lbs.	%	million lbs.	%	million lbs.	%	million lbs.	%	million lbs.	%	million lbs.
1980	7,147	10.59	23,095	34.22	31,427	46.57	3,732	5.53	123	0.18	1,389	2.06	569	0.84	67,482
1981	7,064	10.52	23,869	35.54	30,474	45.38	3,781	5.63	126	0.19	1,347	2.01	492	0.73	67,153
1982	6,493	9.74	22,368	33.57	31,993	48.01	3,765	5.65	121	0.18	1,437	2.16	459	0.69	66,636
1983	6,457	9.42	24,418	35.64	31,560	46.06	3,821	5.58	121	0.18	1,733	2.53	406	0.59	68,516
1984	6,605	8.14	26,023	32.08	42,552	52.45	3,869	4.77	123	0.15	1,512	1.86	443	0.55	81,127
1985	6,462	8.22	27,533	35.00	38,541	49.00	3,849	4.89	150	0.19	1,642	2.09	481	0.61	78,658
1986	6,304	8.42	28,499	38.06	33,880	45.24	3,975	5.31	139	0.19	1,605	2.14	485	0.65	74,887
1987	6,229	7.58	30,293	36.85	38,891	47.31	4,079	4.96	139	0.17	2,108	2.56	474	0.58	82,213
1988	6,385	7.47	31,784	37.16	40,514	47.37	4,202	4.91	141	0.16	2,039	2.38	465	0.54	85,530
1989	6,488	7.72	32,512	38.68	38,280	45.54	4,431	5.27	146	0.17	1,799	2.14	397	0.47	84,053
1990	6,079	6.97	32,838	37.67	41,808	47.96	4,359	5.00	146	0.17	1,570	1.80	364	0.42	87,164
1991	5,365	5.91	33,678	37.12	45,636	50.29	3,931	4.33	148	0.16	1,541	1.70	439	0.48	90,738
1992	5,130	5.95	35,629	41.31	39,650	45.97	3,783	4.39	148	0.17	1,484	1.72	432	0.50	86,256
1993	5,171	6.12	36,566	43.31	37,234	44.10	3,682	4.36	150	0.18	1,369	1.62	260	0.31	84,432
1994	5,087	5.60	39,549	43.51	41,229	45.35	3,419	3.76	152	0.17	1,261	1.39	209	0.23	90,906
1995	5,320	5.56	40,514	42.30	44,868	46.85	3,269	3.41	247	0.26	1,426	1.49	123	0.13	95,767
1996	4,980	5.14	43,574	45.01	43,208	44.63	3,265	3.37	194	0.20	1,448	1.50	137	0.14	96,806
1997	5,079	4.91	49,375	47.73	44,170	42.70	3,120	3.02	187	0.18	1,365	1.32	148	0.14	103,444
1998	4,910	4.83	51,266	50.38	41,255	40.54	3,047	2.99	225	0.22	935	0.92	121	0.12	101,759
1999	4,572	4.35	53,980	51.38	42,084	40.05	3,020	2.87	216	0.21	1,078	1.03	117	0.11	105,067
2000	4,883	4.44	57,803	52.56	42,856	38.97	2,976	2.71	236	0.21	1,116	1.01	112	0.10	109,982
2001	4,592	4.00	58,162	50.70	47,344	41.27	2,851	2.49	289	0.25	1,341	1.17	134	0.12	114,713
2002	4,676	4.11	61,747	54.29	42,547	37.41	2,765	2.43	291	0.26	1,549	1.36	170	0.15	113,745
2003	4,982	4.16	65,032	54.24	45,040	37.57	2,714	2.26	306	0.26	1,625	1.36	187	0.16	119,886
Mean	5,686	6.66	38,754	42.01	39,877	44.86	3,571	4.16	178	0.19	1,488	1.72	318	0.39	89,872
Median	5,343	6.04	34,654	39.99	41,242	45.46	3,749	4.37	149	0.18	1,466	1.71	381	0.44	86,710
Std Dev	815	2.05	12,999	6.99	4,767	3.82	498	1.14	57	0.03	264	0.47	156	0.23	15,458
Min	4,572	4.00	22,368	32.08	30,474	37.41	2,714	2.26	121	0.15	935	0.92	112	0.10	66,636
Max	7,147	10.59	65,032	54.29	47,344	52.45	4,431	5.65	306	0.26	2,108	2.56	569	0.84	119,886

Source: USDAb

Table 7: U.S. Cotton Exports and Imports, 1965-2004

Year	Production	Exports	Export Share of Production	Imports
	-------------- 1,000 480 lb bales	-------------	%	1,000 480 lb bales
1965	14,938	3,035	20.3	118
1966	9,557	4,832	50.6	105
1967	7,443	4,361	58.6	149
1968	10,926	2,825	25.9	68
1969	9,990	2,878	28.8	52
1970	10,192	3,897	38.2	37
1971	10,477	3,385	32.3	72
1972	13,704	5,311	38.8	34
1973	12,974	6,123	47.2	48
1974	11,540	3,926	34.0	34
1975	8,302	3,311	39.9	92
1976	10,581	4,784	45.2	38
1977	14,389	5,484	38.1	5
1978	10,856	6,180	56.9	4
1979	14,629	9,229	63.1	5
1980	11,122	5,926	53.3	28
1981	15,646	6,567	42.0	26
1982	11,963	5,207	43.5	20
1983	7,771	6,786	87.3	12
1984	12,982	6,215	47.9	24
1985	13,432	1,960	14.6	33
1986	9,731	6,684	68.7	3
1987	14,760	6,582	44.6	2
1988	15,411	6,148	39.9	5
1989	12,196	7,694	63.1	2
1990	15,505	7,793	50.3	4
1991	17,614	6,646	37.7	13
1992	16,218	5,201	32.1	1
1993	16,134	6,862	42.5	6
1994	19,662	9,402	47.8	20
1995	17,900	7,675	42.9	408
1996	18,942	6,865	36.2	403
1997	18,793	7,500	39.9	13
1998	13,918	4,298	30.9	439
1999	16,968	6,750	39.8	97
2000	17,188	6,740	39.2	16
2001	20,303	11,000	54.2	21
2002	17,209	11,900	69.1	67
2003	18,255	13,758	75.4	45
2004	23,251	14,409	62.0	29
Mean	14,084	6,403	45.6	65
Median	14154	6,198	42.7	28
Std Dev	3,752	2,775	14.8	107
Min	7,443	1,960	14.6	1
Max	23,251	14,409	87.3	439

Source: USDAb.

Table 8: Cotton Imports of Major Importers, 1965-2004

Year	EU-25	Russia	Japan	Indonesia	South Korea	Thailand	Taiwan	India	Pakistan	China	Major Foreign Importers	US
	---------	---------	---------	---------	---------	1000 480 lb bales	---------	---------	---------	---------	---------	---------
1965	8,136	0	3,078	0	327	105	305	457	7	500	12,915	118
1966	8,013	0	3,556	160	362	105	357	649	10	500	13,712	105
1967	7,774	0	3,499	62	404	129	471	644	4	300	13,287	149
1968	7,571	0	3,131	107	450	78	464	377	4	300	12,482	68
1969	7,470	0	3,448	160	470	135	507	721	0	400	13,311	52
1970	7,347	0	3,669	180	557	212	735	693	6	500	13,899	37
1971	7,335	0	3,555	230	523	230	584	642	7	700	13,806	72
1972	7,895	0	3,883	279	484	299	657	400	4	2,000	15,901	34
1973	6,926	0	3,728	250	788	389	911	119	2	1,800	14,913	48
1974	6,750	0	3,228	157	722	262	652	113	1	700	12,585	34
1975	7,101	0	3,220	351	1,013	389	1,024	96	0	900	14,094	92
1976	6,550	0	3,037	287	909	409	801	447	2	650	13,092	38
1977	6,743	0	3,150	394	1,312	329	1,052	398	1	1,600	14,979	5
1978	6,508	0	3,382	404	1,363	457	855	44	4	2,125	15,142	4
1979	7,070	0	3,336	474	1,627	376	1,248	2	4	4,100	18,237	5
1980	6,234	0	3,207	490	1,527	402	965	0	5	3,550	16,380	28
1981	6,556	0	3,504	490	1,496	243	1,135	36	5	2,199	15,664	26
1982	6,883	0	3,137	492	1,562	397	1,044	3	4	1,085	14,607	20
1983	7,081	0	3,338	603	1,602	558	1,171	0	240	664	15,257	12
1984	7,260	0	3,125	538	1,601	614	1,294	0	9	85	14,526	24
1985	7,171	0	3,054	808	1,682	703	1,534	0	6	1	14,959	33
1986	8,276	0	3,688	919	1,901	1,290	2,357	0	3	16	18,450	3
1987	8,299	5,395	3,431	882	1,957	872	1,608	107	4	86	22,641	2
1988	7,936	5,827	3,491	1,112	2,145	1,252	1,781	171	5	1,448	25,168	5
1989	7,643	5,878	3,165	1,292	2,040	1,207	1,301	15	17	1,873	24,431	2

Continued on next page

Table 8 (continued)

Year	EU-25	Russia	Japan	Indonesia	South Korea	Thailand	Taiwan	India	Pakistan	China	Major Foreign Importers	US
	------------------------------------					1000 480 lb bales					------------------------------------	
1990	6,172	5,290	2,949	1,490	2,052	1,624	1,479	0	2	2,205	23,263	4
1991	5,823	3,900	2,705	1,873	1,801	1,641	1,484	214	20	1,630	21,091	13
1992	6,256	2,650	2,228	1,989	1,711	1,522	1,264	102	24	242	17,988	1
1993	6,261	3,000	1,993	2,039	1,689	1,613	1,236	222	350	808	19,211	6
1994	6,040	2,159	1,650	2,075	1,747	1,440	1,114	442	696	4,060	21,423	20
1995	5,777	1,100	1,514	2,139	1,661	1,545	1,380	85	122	2,908	18,231	408
1996	5,832	1,000	1,342	2,147	1,504	1,414	1,300	15	279	3,491	18,324	403
1997	5,694	1,225	1,341	1,910	1,322	1,236	1,209	145	120	1,725	15,927	13
1998	4,783	850	1,263	2,323	1,472	1,207	1,375	508	925	332	15,038	439
1999	4,863	1,600	1,280	2,076	1,524	1,696	1,438	1,600	475	117	16,669	97
2000	4,720	1,650	1,138	2,650	1,420	1,573	1,040	1,567	450	230	16,438	16
2001	4,425	1,800	1,063	2,356	1,616	1,882	1,531	2,388	1,000	449	18,510	21
2002	3,923	1,650	1,013	2,228	1,492	1,945	1,219	1,216	850	3,127	18,663	67
2003	3,103	1,475	778	2,150	1,274	1,678	1,011	800	1,850	8,832	22,951	45
2004	3,022	1,450	815	2,400	1,343	2,282	1,337	800	1,400	6,385	21,234	29
Mean	6,481	1,197	2,678	1,074	1,311	894	1,106	406	223	1,616	16,985	65
Median	6,747	0	3,134	706	1,494	659	1,153	193	6	854	15,914	29
Std Dev	1,342	1,784	994	878	533	655	420	523	429	1,839	3,503	107
Min	3,022	0	778	0	327	78	305	0	0	1	12,482	1
Max	8,299	5,878	3,883	2,650	2,145	2,282	2,357	2,388	1,850	8,832	25,168	439

Source: USDAb.

Table 9: U.S. Processed Cotton Consumption, Total and Per Capita, 1986-2004[1]

Year	Mill Use of Raw Cotton	Imports of Processed Cotton	Exports of Processed Cotton	Net Imports of Processed Cotton	Total U.S. Cotton Consumption	Domestic (Mill) Share of U.S. Consumption	Net Import Share of U.S. Consumption	Mill Use Per Capita	Net Imports Per Capita	Total U.S. Consumption Per Capita
	---------- million lbs ----------					%	%	---------- lb ----------		
1986	3,337.0	1,910.5	274.8	1,635.6	4,972.6	67.1	32.9	13.9	6.8	20.7
1987	3,743.0	2,336.2	298.0	2,038.2	5,781.3	64.7	35.3	15.4	8.4	23.8
1988	3,519.4	2,118.8	330.3	1,788.5	5,307.9	66.3	33.7	14.4	7.3	21.7
1989	4,052.2	2,304.8	467.2	1,837.6	5,889.8	68.8	31.2	16.4	7.4	23.8
1990	4,115.5	2,370.2	623.8	1,746.4	5,861.9	70.2	29.8	16.5	7.0	23.4
1991	4,347.5	2,586.6	676.3	1,910.3	6,257.8	69.5	30.5	17.1	7.5	24.7
1992	4,761.6	3,180.0	795.0	2,385.0	7,146.6	66.6	33.4	18.5	9.3	27.8
1993	4,937.7	3,576.8	914.7	2,661.1	7,599.8	65.0	35.0	19.0	10.2	29.2
1994	5,230.6	3,826.5	1,080.8	2,745.7	7,976.3	65.6	34.4	19.9	10.4	30.3
1995	5,183.5	4,089.5	1,330.8	2,758.7	7,942.2	65.3	34.7	19.4	10.3	29.8
1996	5,226.8	4,222.8	1,524.7	2,698.1	7,924.9	66.0	34.0	19.4	10.0	29.4
1997	5,441.4	5,084.1	1,792.4	3,291.7	8,733.1	62.3	37.7	19.9	12.1	32.0
1998	5,234.3	6026.2	1,957.1	4,069.1	9,303.4	56.3	43.7	19.0	14.7	33.7
1999	4,962.3	6,711.4	2,073.5	4,637.9	9,600.2	51.7	48.3	17.8	16.6	34.4
2000	4,747.0	7,541.4	2,443.0	5,098.4	9,845.4	48.2	51.8	16.8	18.1	34.9
2001	3,848.4	7,545.2	2,136.8	5,421.4	9,269.8	41.5	58.5	13.5	19.0	32.5
2002	3,693.8	8,502.2	2,186.1	6,316.1	10,009.9	36.9	63.1	12.8	21.9	34.7
2003	3,227.5	9,231.7	2,317.1	6,914.6	10,142.1	31.8	68.2	11.1	23.8	34.9
2004	3,130.8	9,523.3	2,342.9	7,180.4	10,311.2	30.4	69.6	10.7	24.4	35.1
Mean	4,354.7	4,878.3	1,344.9	3,533.5	7,888.2	57.6	42.4	16.4	12.9	29.3
Median	4,347.5	4,089.5	1,330.8	2,745.7	7,942.2	65.0	35.0	16.8	10.3	29.8
Std Dev	778.7	2,586.0	787.6	1,850.5	1,792.6	13.4	13.4	3.0	6.0	4.9
Min	3,130.8	1,910.5	274.8	1,635.6	4,972.6	30.4	29.8	10.7	6.8	20.7
Max	5,441.4	9,523.3	2,443.0	7,180.4	10,311.2	70.2	69.6	19.9	24.4	35.1

[1] The trade and consumption data are expressed in raw cotton fiber equivalents.
Source: USDAb.

Table 10: U.S. Man-Made Fiber (MMF) Consumption, Total and Per Capita, 1986-2004[1]

Year	Mill Use of MMF	Imports of Processed MMF	Exports of Processed MMF	Net Imports of Processed MMF	Total U.S. MMF Consumption	Domestic (Mill) Share of U.S. Consumption	Net Import Share of U.S. Consumption	Mill Use Per Capita	Net Imports Per Capita	Total U.S. Consumption Per Capita
	million lbs					%	%	lb		
1986	8,652.7	1,703.0	519.3	1,183.7	9,836.4	88.0	12.0	36.0	4.9	40.9
1987	9,065.7	1,805.4	591.9	1,213.5	10,279.2	88.2	11.8	37.3	5.0	42.3
1988	9,207.9	1,758.9	681.6	1,077.3	10,285.2	89.5	10.5	37.6	4.4	42.0
1989	9,228.1	2,670.2	1,162.6	1,507.6	10,735.8	86.0	14.0	37.3	6.1	43.4
1990	9,052.6	2,708.5	1,530.5	1,178.0	10,230.6	88.5	11.5	36.2	4.7	40.9
1991	8,535.7	1,861.6	1,397.9	463.7	8,999.4	94.8	5.2	33.7	1.8	35.5
1992	9,173.2	2,095.8	1,438.3	657.5	9,830.7	93.3	6.7	35.7	2.6	38.3
1993	9,566.2	2,329.2	1,493.3	835.9	10,402.1	92.0	8.0	36.8	3.2	40.0
1994	10,217.6	2,611.7	1,554.3	1,057.4	11,275.0	90.6	9.4	38.8	4.0	42.8
1995	9,832.7	2,714.6	1,671.0	1,043.6	10,876.3	90.4	9.6	36.9	3.9	40.8
1996	10,053.4	2,886.2	1,833.4	1,052.8	11,106.2	90.5	9.5	37.3	3.9	41.2
1997	10,675.0	3,464.2	2,119.8	1,344.4	12,019.4	88.8	11.2	39.1	4.9	44.0
1998	10,744.0	3,881.1	2,176.2	1,704.9	12,448.9	86.3	13.7	38.9	6.2	45.1
1999	11,075.8	4,250.5	2,161.9	2,088.6	13,164.4	84.1	15.9	39.7	7.5	47.1
2000	11,144.3	4,825.2	2,466.5	2,358.7	13,503.0	82.5	17.5	39.5	8.4	47.8
2001	10,040.5	4,910.6	2,370.2	2,540.4	12,580.9	79.8	20.2	35.2	8.9	44.1
2002	10,402.4	5,586.6	2,269.1	3,317.5	13,719.9	75.8	24.2	36.1	11.5	47.6
2003	10,082.3	6,093.3	2,149.1	3,944.2	14,026.5	71.9	28.1	34.6	13.6	48.2
2004	10,182.5	6,546.2	2,354.1	4,192.1	14,374.6	70.8	29.2	34.6	14.3	48.9
Mean	9,838.6	3,405.4	1,681.1	1,724.3	11,562.9	85.9	14.1	36.9	6.3	43.2
Median	10,040.5	2,714.6	1,671.0	1,213.5	11,106.2	88.2	11.8	36.9	4.9	42.8
Std Dev	784.8	1,543.8	615.5	1,082.6	1,622.6	6.9	6.9	1.7	3.6	3.6
Min	8,535.7	1,703.0	519.3	463.7	8,999.4	70.8	5.2	33.7	1.8	35.5
Max	11,144.3	6,546.2	2,466.5	4,192.1	14,374.6	94.8	29.2	39.7	14.3	48.9

[1] The trade and consumption data are expressed in raw cotton fiber equivalents.

Source: USDA b and Meyer (2006).

Table 11: U.S. Total Fiber Consumption, Total and Per Capita, 1986-2004

Year	Mill Use	Imports	Exports	Net Imports	Total Domestic Consumption	Mill Use Share of Domestic Consumption	Net Import Share of Domestic Consumption	Mill Use Per Capita	Net Imports Per Capita	Total Domestic Consumption Per Capita	Cotton Share Total Domestic Consumption	Man-Made Fiber Share Total Domestic Consumption
	million lb					%		lb			%	
1986	11,989.7	3,613.5	794.1	2,819.3	14,809.0	81.0	19.0	49.8	11.7	61.6	33.6	66.4
1987	12,808.7	4,141.6	889.9	3,251.7	16,060.5	79.8	20.2	52.8	13.4	66.2	36.0	64.0
1988	12,727.3	3,877.7	1,011.9	2,865.8	15,593.1	81.6	18.4	52.0	11.7	63.7	34.0	66.0
1989	13,280.3	4,975.1	1,629.8	3,345.3	16,625.5	79.9	20.1	53.7	13.5	67.2	35.4	64.6
1990	13,168.1	5,078.7	2,154.4	2,924.4	16,092.5	81.8	18.2	52.7	11.7	64.4	36.4	63.6
1991	13,157.0	5,311.5	2,253.9	3,057.6	16,214.6	81.1	18.9	51.9	12.1	64.0	38.6	55.5
1992	14,192.8	6,174.1	2,431.0	3,743.1	17,935.9	79.1	20.9	55.2	14.6	69.8	39.8	54.8
1993	14,765.6	6,892.5	2,614.1	4,278.4	19,044.0	77.5	22.5	56.7	16.4	73.2	39.9	54.6
1994	15,723.8	7,507.6	2,870.6	4,637.0	20,360.8	77.2	22.8	59.7	17.6	77.3	39.2	55.4
1995	15,304.7	7,840.8	3,264.4	4,576.4	19,881.1	77.0	23.0	57.4	17.2	74.6	39.9	54.7
1996	15,601.9	7,990.4	3,659.5	4,330.9	19,932.8	78.3	21.7	57.8	16.1	73.9	39.8	55.7
1997	16,430.5	9,601.0	4,263.8	5,337.2	21,767.7	75.5	24.5	60.2	19.6	79.8	40.1	55.2
1998	16,264.7	10,960.2	4,496.5	6,463.7	22,728.4	71.6	28.4	58.9	23.4	82.3	40.9	54.8
1999	16,278.4	12,032.6	4,601.1	7,431.5	23,709.9	68.7	31.3	58.3	26.6	84.9	40.5	55.5
2000	16,097.6	13,627.2	5,334.6	8,292.6	24,390.2	66.0	34.0	57.0	29.4	86.4	40.4	55.4
2001	14,087.9	13,591.3	4,897.0	8,694.3	22,782.2	61.8	38.2	49.4	30.5	79.9	40.7	55.2
2002	14,220.9	15,289.9	4,815.9	10,474.0	24,694.9	57.6	42.4	49.3	36.3	85.7	40.5	55.6
2003	13,437.8	16,693.1	4,786.6	11,906.5	25,344.3	53.0	47.0	46.2	40.9	87.1	40.0	55.3
2004	13,434.0	17,628.1	5,004.3	12,623.8	26,057.8	51.6	48.4	45.7	43.0	88.7	39.6	55.2
Mean	14,499.0	9,400.7	3,387.7	6,013.0	20,512.0	72.2	27.8	54.2	21.9	76.0	39.0	57.3
Median	14,206.9	7,915.6	3,462.0	4,606.7	20,146.8	77.1	22.9	54.5	17.4	75.9	39.9	55.4
Std Dev	1,320.9	4,460.5	1,451.1	3,174.0	3,557.7	10.0	10.0	4.5	10.2	8.7	2.1	4.0
Min	12,727.3	3,877.7	889.9	2,865.8	15,593.1	51.6	18.2	45.7	11.7	63.7	34.0	54.6
Max	16,430.5	17,628.1	5,334.6	12,623.8	26,057.8	81.8	48.4	60.2	43.0	88.7	40.9	66.0

Source: USDAb and Meyer (2006).

Table 12: Government Payments Made to U.S. Cotton Farmers, 1986/87-2004/05

Crop Year	Government Outlays to Cotton Farmers
	million $
1986/87	1,385.5
1987/88	953.5
1988/89	1,336.6
1989/90	825.9
1990/91	452.5
1991/92	939.7
1992/93	1,626.2
1993/94	1,719.3
1994/95	370.2
1995/96	217.0
1996/97	759.0
1997/98	1,163.0
1998/99	1,947.0
1999/00	3,432.0
2000/01	2,149.0
2001/02	3,937.0
2002/03	3,075.0
2003/04	1,021.0
2004/05	2,244.0
Sum	29,553.4
Mean	1,555.4
Median	1,336.6
Std Dev	1,063.9
Min	217.0
Max	3,937.0

Source: USDAe and Baffes (2005).

Table 13: Estimated Annual Assessment of U.S. Cotton Producers, 1976-2004

Crop Year	Average Farm Price[1]	Loan Rate	Maximum of Farm Price or Loan Rate	Calculation of Assessment Rate	Average Assessment Per RB[2]	Average Assessment Per Pound
	------------------- ¢/lb	----------------------			$/RB	$/lb
1976	64.1	38.9	64.1	$1 per RB + .006 x value	$2.92	$0.00585
1977	53.4	44.6	53.4	$1 per RB + .006 x value	$2.60	$0.00520
1978	57.6	48.0	57.6	$1 per RB + .006 x value	$2.73	$0.00545
1979	62.1	50.2	62.1	$1 per RB + .006 x value	$2.86	$0.00573
1980	74.0	48.0	74.0	$1 per RB + .006 x value	$3.22	$0.00644
1981	56.4	52.5	56.4	$1 per RB + .006 x value	$2.69	$0.00538
1982	59.9	57.1	59.9	$1 per RB + .006 x value	$2.80	$0.00559
1983	66.3	55.0	66.3	$1 per RB + .006 x value	$2.99	$0.00598
1984	59.0	55.0	59.0	$1 per RB + .006 x value	$2.77	$0.00554
1985	57.2	57.3	57.3	$1 per RB + .006 x value	$2.72	$0.00544
1986	53.5	55.0	55.0	$1 per RB + .006 x value	$2.65	$0.00530
1987	61.7	52.3	61.7	$1 per RB + .006 x value	$2.85	$0.00570
1988	55.8	51.8	55.8	$1 per RB + .006 x value	$2.68	$0.00535
1989	63.5	50.0	63.5	$1 per RB + .006 x value	$2.91	$0.00581
1990	67.4	50.3	67.4	$1 per RB + .006 x value	$3.02	$0.00604
1991	57.0	50.8	57.0	$1 per RB + .006 x value	$2.71	$0.00542
1992[3]	53.9	52.4	53.9	$1 per RB + .0055 x value	$2.48	$0.00496
1993	60.0	52.4	60.0	$1 per RB + .005 x value	$2.50	$0.00500
1994	74.6	50.0	74.6	$1 per RB + .005 x value	$2.86	$0.00573
1995	75.6	51.9	75.6	$1 per RB + .005 x value	$2.89	$0.00578
1996	69.2	51.9	69.2	$1 per RB + .005 x value	$2.73	$0.00546
1997	65.8	51.9	65.8	$1 per RB + .005 x value	$2.65	$0.00529
1998	59.3	51.9	59.3	$1 per RB + .005 x value	$2.48	$0.00496
1999	46.3	51.9	51.9	$1 per RB + .005 x value	$2.30	$0.00460
2000	48.1	51.9	51.9	$1 per RB + .005 x value	$2.30	$0.00460
2001	30.8	51.9	51.9	$1 per RB + .005 x value	$2.30	$0.00460
2002	43.4	52.0	52.0	$1 per RB + .005 x value	$2.30	$0.00460
2003	59.6	52.0	59.6	$1 per RB + .005 x value	$2.49	$0.00498
2004	44.2	52.0	52.0	$1 per RB + .005 x value	$2.30	$0.00460

[1] Upland cotton
[2] RB = Running Bale which generally weighs 500 lb.
[3] Assessment changed in August 1992. Average calendar year assumed to be average of .006 and .005.
Source: Constructed from information from various sources, including National Cotton Council and USDAa.

Table 14: Estimated Annual Assessment of U.S. Cotton Importers, 1992-2004

Year	Total Importer Assessment	Volume Assessed	Assessment per Pound
	$	1000 lb	$/lb
1992[1]	4,346,256	845,575	0.00514
1993	14,319,289	2,806,380	0.00510
1994	13,833,760	2,987,981	0.00463
1995	14,934,106	3,028,836	0.00493
1996	18,735,007	3,338,497	0.00561
1997	19,299,015	3,322,875	0.00581
1998	20,855,888	3,798,294	0.00549
1999	23,441,363	4,434,036	0.00529
2000	22,536,343	4,762,643	0.00473
2001	22,211,764	4,980,039	0.00446
2002	24,234,799	5,799,761	0.00418
2003	24,157,639	6,315,593	0.00383
2004	24,720,900	6,462,980	0.00383

[1] Importer assessment began in August 1992.
Source: National Cotton Council and USDAa.

Table 15: Cotton Incorporated Annual Marketing and Research Expenditures[1], 1986-2004

	Expenditures					Share of Total CI Expenditures				Assessments		Share of CI Expenditures	
	Marketing	Textile Research	Agricultural Research	Administrative	Total	Marketing	Textile Research	Ag Research	Admin-istrative	Imports	Producer	Imports	Producer
	$					%				$		%	
1986	12,157,924	3,924,016	807,938	1,465,898	18,355,776	66.2	21.4	4.4	8.0	NA	18,355,776	NA	100.0
1987	11,610,134	4,166,364	855,385	1,777,437	18,409,320	63.1	22.6	4.6	9.7	NA	18,409,320	NA	100.0
1988	14,784,245	4,507,161	1,091,429	1,758,128	22,140,963	66.8	20.4	4.9	7.9	NA	22,140,963	NA	100.0
1989	15,474,691	4,205,688	1,026,656	1,696,965	22,404,000	69.1	18.8	4.6	7.6	NA	22,404,000	NA	100.0
1990	17,888,468	5,708,869	1,174,591	1,778,072	26,550,000	67.4	21.5	4.4	6.7	NA	26,550,000	NA	100.0
1991	18,887,491	6,574,114	1,219,089	1,872,051	28,552,745	66.1	23.0	4.3	6.6	NA	28,552,745	NA	100.0
1992	28,031,978	8,536,696	3,559,076	2,086,473	42,214,223	66.4	20.2	8.4	4.9	4,346,256	37,867,967	10.3	89.7
1993	29,481,154	9,179,814	4,037,752	2,130,284	44,829,004	65.8	20.5	9.0	4.8	14,319,289	30,509,715	31.9	68.1
1994	30,709,947	9,977,975	4,399,945	2,290,980	47,378,847	64.8	21.1	9.3	4.8	13,833,760	33,545,087	29.2	70.8
1995	35,757,359	10,866,604	5,503,535	2,245,353	54,372,851	65.8	20.0	10.1	4.1	14,934,106	39,438,745	27.5	72.5
1996	42,360,691	9,746,135	6,501,893	2,270,865	60,879,584	69.6	16.0	10.7	3.7	18,735,007	42,144,577	30.8	69.2
1997	41,683,949	10,086,715	6,777,091	2,729,671	61,277,426	68.0	16.5	11.1	4.5	19,299,015	41,978,411	31.5	68.5
1998	42,640,979	9,131,940	6,750,132	2,812,962	61,336,013	69.5	14.9	11.0	4.6	20,855,888	40,480,125	34.0	66.0
1999	39,154,136	9,062,859	6,538,030	2,967,687	57,722,712	67.8	15.7	11.3	5.1	23,441,363	34,281,349	40.6	59.4
2000	40,277,315	9,242,313	6,691,148	3,092,212	59,302,988	67.9	15.6	11.3	5.2	22,536,343	36,766,645	38.0	62.0
2001	42,117,341	9,759,805	7,061,347	3,147,837	62,086,330	67.8	15.7	11.4	5.1	22,211,764	39,874,566	35.8	64.2
2002	41,191,178	10,216,087	7,071,020	3,168,988	61,647,273	66.8	16.6	11.5	5.1	24,234,799	37,412,474	39.3	60.7
2003	40,347,871	9,510,292	8,070,376	3,276,592	61,205,131	65.9	15.5	13.2	5.4	24,157,639	37,047,492	39.5	60.5
2004	43,977,405	10,416,252	8,378,760	3,216,127	65,988,544	66.6	15.8	12.7	4.9	24,720,900	41,267,644	37.5	62.5
Mean	30,975,487	8,148,405	4,606,063	2,409,715	46,139,670	66.9	18.5	8.9	5.7	18,575,436	32,653,331	32.8	77.6
Median	35,757,359	9,179,814	5,503,535	2,270,865	54,372,851	66.8	18.8	10.1	5.1	20,077,452	35,523,997	34.0	69.2
Std Dv	12,023,027	2,427,456	2,773,842	610,981	17,575,635	1.6	2.8	3.2	1.6	5,611,409	7,844,086	8.0	16.9
Min	11,610,134	3,924,016	807,938	1,465,898	18,355,776	63.1	14.9	4.3	3.7	4,346,256	18,355,776	10.3	59.4
Max	43,977,405	10,866,604	8,378,760	3,276,592	65,988,544	69.6	23.0	13.2	9.7	24,234,799	42,144,577	40.6	100.0

[1] Nominal dollars
NA = Not applicable because importer assessments began in 1992.
Source: Cotton Incorporated.

Table 16: Key Partial Elasticities for Selected Variables in the MCERI Model

	Price Elasticities							Checkoff Expenditure Elasticities			
	Raw Fibers			Textiles				Marketing		Non-Ag Research	
	Cotton		Man-made	All	Cotton	Man-made	Income	Short-	Long-	Short-	Long-
Variable	Short-run	Long-run	Fibers[a]	Textiles	Fiber	Fiber	Elasticities	run	run	run	run
Cotton Acreage											
United States											
Delta	0.06	0.16									
South East	0.21	4.02									
Southwest Irrigated	0.20	b									
Southwest Dryland	0.40	b									
West	0.27	b									
China											
Xinjinag	0.19	1.01									
Yangtze River	0.21	0.79									
Yellow river	0.25	0.65									
Other	0.56	0.91									
India											
North	0.21	1.23									
Central	0.20	1.31									
South	0.17	0.28									
Brazil	0.16	0.45									
Egypt	0.24	0.77									
Australia	0.19	1.44									
Uzbekistan	0.13	0.17									
Pakistan	0.23	1.08									
Mexico	0.57	1.49									
Cotton Mill Use											
United States	-0.08		-0.26		0.41					0.03	0.09
China	-0.73		0.54								
India	-0.19		0.11								
Pakistan	-0.25		0.19								
Taiwan	-0.46		0.24								
South Korea	-0.51		0.31								
Japan	-0.47		0.21								
Mexico	-0.28		0.14								
Egypt	-0.36		0.12								
Man-Made Fiber Mill Use											
United States	-0.08		-0.20			0.20				0.01[c]	0.02[c]
Textile Fiber Consumption											
United States (Cotton)					-0.41		0.87	0.05	0.17		
United States (Man-made)						-0.24	0.56	0.01[c]	0.02[c]		
China				-0.25			0.74				
India				-0.05			0.57				
Pakistan				-0.53			0.64				
Taiwan				-0.03			0.09				
South Korea				-0.04			0.03				
Japan				-0.09			0.15				
Egypt				-0.38			0.52				
Turkey				-0.35			0.36				
EU-15				-0.11			0.21				
Mexico				-0.29			0.81				
U.S. Fiber Textile Import Supply											
Cotton					0.62[d] 0.93[e]						
Man-made fiber						0.58[d] 13.4[e]					

[a] Polyester. [b] Not statistically different from short-run elasticity. [c] Not statistically different from zero. [d] Short-run price elasticity. [e] Long-run price elasticity.

Table 17: The Four Key U.S. Demand Equations in the MCERI Model[a]

(1) TCFCUS =

6520.30	- 36.59*RCTFPIUS	+ 1.04*RDPI	- 361.14*QUOTA	- 411.91*DSTRUC5
(2074.39)	(19.83)	(0.17)	(191.74)	(176.05)
[0.005]	[0.081]	[0.000]	[0.075]	[0.030]

- 49.79*RCPIE	+ 943.95*D2004	+ 17.87*RMEXP$_{t}$	+ 23.83*RMEXP$_{t-1}$	+ 17.87*RMEXP$_{t-2}$
(6.28)	(345.79)	(4.45)	(5.93)	(4.45)
[0.000]	[0.013]	[0.001]	[0.001]	[0.001]

Adj. R^2 = 0.992 DW = 2.00

(2) MMFCUS =

7012.19	- 33.47*RMMFPIUS	+ 1.06*RDPI	+ 488.02*WTOLIB	- 1636.37*D80	- 1578.59*D81
(2595.13)	(20.34)	(0.22)	(318.35)	(371.99)	(361.78)
[0.0146]	[0.117]	[0.000]	[0.143]	[0.000]	[0.000]

- 898.48*D899091	- 945.40*D2000	+ 2.99*RMEXP$_{t}$	+ 3.99*RMEXP$_{t-1}$	+ 2.99 * RMEXP$_{t-2}$
(225.31)	(367.43)	(5.64)	(7.52)	(5.64)
[0.001]	[0.019]	[0.602]	[0.602]	[0.602]

Adj. R^2 = 0.979 DW = 1.90

(3) CTMILLUSE =

242.79	+ 21.21*RCTFPIUS	- 598.62*RECMPUS	- 17.40*RPOLYP	- 857.54*WTOLIB
(701.29)	(11.50)	(498.29)	(6.27)	(105.32)
[0.734]	[0.085]	[0.248]	[0.014]	[0.000]

+ 0.83*CTMILLUSE$_{t-1}$	- 4109.93*DSTRUC4	+ 365.15*D9495	+ 443.26*D99	+ 379.09*D2004
(0.05)	(71.43)	(90.07)	(143.64)	(155.58)
[0.000]	[0.000]	[0.000]	[0.008]	[0.028]

+ 19.60 * RNAEXP$_{t-1}$	+ 26.13 * RNAEXP$_{t-2}$	+ 19.60* RNAEXP$_{t-3}$
(13.23)	(17.65)	(13.23)
[0.159]	[0.159]	[0.159]

Adj. R^2 = 0.990 DW = 2.49

(4) MMFMILLUSE =

2359.92	+ 24.16*RMMFPIUS	- 1488.48*RECMPUS	- 31.97*RPOLYP	- 696.85*WTOLIB
(1730.47)	(17.97)	(939.15)	(9.31)	(128.60)
[0.193]	[0.199]	[0.134]	[0.004]	[0.000]

+ 0.83*MMFMILLUSE$_{t-1}$	- 1331.41*D82	- 847.17*D2000	+ 9.24*RNAEXP$_{t-1}$	+ 12.32*RNAEXP$_{t-2}$
(0.10)	(325.90)	(267.05)	(18.01)	(24.02)
[0.000]	[0.001]	[0.006]	[0.616]	[0.616]

+ 9.24*RNAEXP$_{t-3}$	- 0.451*AR(1)
(18.01)	(0.24)
[0.616]	[0.084]

Adj. R^2 = 0.962 DW = 2.17

[a] See definition of variable names in Table 18. Estimated standard errors are reported in parentheses below the corresponding coefficients. Two-sided p-values associated with the corresponding estimated coefficients are reported in brackets.

Table 18: Definitions of Variables in the Four Key Demand Equations of the MCERI Model

Variable		Description
AR(1)	=	Coefficient in the autoregressive process (AR) of order 1 for the residuals, e(t)-AR(1)*e(t-1)
CPIE	=	Consumer price index for energy, 1982-84=100
CPIU	=	Nominal CPI for all items in the U.S., 1982-84=100
CTFPIUS	=	Cotton textile fiber price index, 1991-92=100
CTMILLUSE	=	Mill level consumption of cotton fiber (million lb)
CTMPUS	=	Nominal price of cotton paid by domestic mills ($/lb)
CTSWPUS	=	Nominal price of cotton related to the two-step program
D200x	=	Dummy variable = 1 for year 200x; 0 otherwise
DSTRUC4	=	D81+D84-D89-D91
DSTRUC5	=	D85+D87+D89
Dxx	=	Dummy variable = 1 for year 19xx; 0 otherwise
MEXPND	=	Nominal advertising and promotion expenditures (million $)
MMFCUS	=	Total man-made fiber textile consumption (million lb)
MMFMILLUSE	=	Mill level consumption of man-made fiber (million lb)
MMFPIUS	=	Nominal man-made fiber textile price index, 1991-92=100
NAEXPND	=	Nominal non-agricultural research expenditures (million $)
POLYESTERPUS	=	Nominal price of polyester in the U.S., ¢/lb
RPOLYP	=	Real price of polyester (POLYESTERPUS*100/CPIU)
QUOTA	=	D2000 + D2001
RCPIE	=	Real CPI for energy (CPIE*100/CPIU)
RCTFPIUS	=	Real cotton textile fiber price index (CTFPIUS*100/CPIU)
RDPI	=	Real disposable personal income in the US (billion $)
RECMPUS	=	Real price of cotton paid by domestic mills ((CTMPUS-.85*CTSWPUS)*100/CPIU)
RMEXP	=	Real advertising and promotion expenditures (million $) (MEXPND*100/CPIU)
RMMFPIUS	=	Real man-made fiber textile price index (MMFPIUS*100/CPIU)
RNAEXP	=	Real non-agricultural research expenditures (million $) (NAEXPND*100/CPIU)
TCFCUS	=	Total cotton fiber textile consumption (million lb)
WTOLIB	=	Dummy variable 1 for years 1998 and beyond; 0 otherwise

Table 19: Cotton Checkoff Program Expenditure Intensity, 1977-2004

Crop Year	Farm Receipts[a]	Nominal Expenditures by Cotton Incorporated	Program Expenditure Intensity[b]
	million $	million $	%
1977	3,610	12.5	0.3
1978	3,041	20.5	0.7
1979	4,387	17.8	0.4
1980	3,988	21.9	0.5
1981	4,073	22.9	0.6
1982	3,423	22.5	0.7
1983	2,486	18.0	0.7
1984	3,668	18.0	0.5
1985	3,628	18.1	0.5
1986	2,449	18.4	0.7
1987	4,553	18.4	0.4
1988	4,186	22.1	0.5
1989	3,877	22.4	0.6
1990	5,073	26.6	0.5
1991	4,909	28.6	0.6
1992	4,275	42.2	1.0
1993	4,524	44.8	1.0
1994	6,791	47.4	0.7
1995	6,576	54.4	0.8
1996	6,406	60.9	1.0
1997	5,973	61.3	1.0
1998	4,120	61.3	1.5
1999	3,814	57.7	1.5
2000	4,257	59.3	1.4
2001	3,120	62.1	2.0
2002	3,774	61.6	1.6
2003	5,538	61.2	1.1
2004	4,812	66.0	1.4
Mean	4,333	37.5	0.9
Median	4,153	27.6	0.7
Std Dev	1,125	19.3	0.4
Min	2,449	12.5	0.3
Max	6,791	66.0	2.0

[a] Excluding government payments
[b] Ratio of program expenditures to farm receipts.
Sources: USDA and Cotton Incorporated

Table 20: Simulated Effects of Cotton Marketing Promotion and Non-Agricultural Research Expenditures on U.S. Cotton and Cotton Fiber Textile Markets, Man-made Fiber and Textile Markets, and Foreign Cotton Markets, 1986/87-2004/05[1]

	1986/87 - 1991/92	1992/93 - 2004/05	All Years of Expenditures (1986/87-2004/05)	
U.S. Cotton Market	---------------average annual change ---------------			ave. annual % change
Cotton Production (million lbs)				
Delta	3.4	63.1	46.0	1.7
Southeast	11.4	164.8	121.0	7.3
Southwest irrigated	6.1	21.2	35.2	2.6
Southwest dryland	3.5	21.3	16.3	1.5
West	12.8	149.5	110.4	7.5
Total production	40.8	458.7	339.3	4.0
Mill Use (million lbs)	285.7	808.7	659.3	15.8
Exports (million lbs)	-218.2	-353.3	-314.7	-7.1
Prices (cents/lb)				
Farm price	4.0	10.0	8.2	13.2
Effective Price Paid by Mills	4.3	10.8	8.9	13.5
Foreign Cotton Markets				
Production (million lbs)	193.9	1,232.3	935.7	2.3
Mill Use (million lbs)	-56.5	739.9	512.4	1.2
Exports (million lbs)	264.2	231.0	240.5	1.9
World Price (A-index) (Cents/lb)	0.0	1.9	1.4	1.8
U.S. Cotton Fiber Textile Market				
Consumption (million lbs)	428.4	1,029.9	858.0	10.2
Net Imports (milion lbs)	142.6	221.1	198.7	4.6
Cotton Fiber Textile Price Index	2.7	-3.7	-1.9	-2.0
U.S. Man-made Fiber Market				
Production (million lbs)				
Synthetic	-0.8	-5.5	-4.1	-0.1
Cellulosic	-1.2	0.1	-0.2	-0.1
Mill Use (million lbs)	-118.5	-341.5	-277.8	-2.9
Polyester Price (cents/lb)	-1.4	-0.6	-0.9	-1.2
U.S. Man-made Fiber Textile Market				
Consumption (million lbs)	-8.0	-93.1	-68.8	-0.6
Net Imports (million lbs)	110.5	248.4	209.0	22.4
Man-made Fiber Textile Price Index	0.4	4.6	3.4	5.2

[1] Includes effects of expenditures on indicated variables in each year in the given time periods in not only the corresponding years but also in the years beyond the year of expenditure.

Table 21: Producer Benefit-Cost Analysis, 1986/87-2004/05

	Voluntary Period 1986/87-1991/92		Mandatory Period 1992/93-2004/05		Entire Period of Analysis 1986/87-2004/05	
	Cumulative	**Annual Average**	**Cumulative**	**Annual Average**	**Cumulative**	**Annual Average**
Added Net Revenues to Cotton Producers ($ million)						
Non-Participants in Farm Program	251.2	41.9	321.8	24.8	573.0	30.2
Farm Program Participants	-31.1	-5.2	6,084.6	468.0	6,053.5	318.6
All Cotton Producers	220.1	36.7	6,406.4	492.8	6,626.5	348.8
Historical Cotton Producer Revenues ($ million)	25,047.2	4,174.5	63,898.8	4,915.3	88,946.1	4,681.4
Ratio of Added Net Revenues to Historical Revenues	0.9%		10.0%		7.5%	
Farm Program Cost Savings ($ million)	1,328.1	221.4	6,523.7	501.8	7,851.8	413.3
Historical Cotton Farm Program Cost ($million)	5,893.7	982.3	23,659.7	1,820.0	29,553.4	1,555.4
Ratio of Cost Savings to Total Cotton Program Costs	22.5%		27.6%		26.6%	
Ratio of Cost Savings to Total Cotton Producer Revenue	5.3%		10.2%		8.8%	
Total Added Revenue (Producers + Government) ($ million)	1,548.2	258.0	12,930.1	994.6	14,478.3	762.0
Total Cotton Check-off Expenditures[1] ($ million)	140.3	23.4	629.3	48.4	769.6	40.5
Net Benefit-Cost Ratios ($ Added Net Revenue/$ Spent)						
Producer Net BCR (Added Net Revenue/$ Spent)[2]	0.6		9.2		7.6	
Government Net BCR (Cost Savings/$ Spent)	9.5		10.4		10.2	
Total Net BCR (Producers and Government)[2]	10.0		19.5		17.8	
Discounted Benefit-Cost Ratios ($ Added NR/$ Spent)[3]						
Producer Discounted BCR (Added NR/$ Spent)[2]	0.5		7.5		5.7	
Government Discounted BCR (Cost Savings/$ Spent)	7.6		7.7		6.9	
Total Discounted BCR (Producers and Government)[2]	9.1		16.0		13.4	

[1] Non-agricultural research and marketing/promotion expenditures.
[2] Producer assessment has been subtracted from added net revenue of producers.
[3] Present value of added revenues/cost savings calculated using the Treasury bill rate in each year as the cost of capital.

Table 22: Importer Benefit-Cost Analysis, 1992/93-2004/05

	All Years of Expenditures (1992/93-2004/05)	
	Cumulative	**Annual Average**
	---- $ million ----	
Added Sales Revenue to Importers		
Cotton Fiber Textile Products	139,501.6	10,730.9
Man-Made Fiber Textile Products	118,060.0	9,081.5
Total	257,561.6	19,812.4
Added Importer Profit (5% of Revenue)	12,878.1	990.6
Total Cotton Check-off Expenditures[1] ($ million)	629.3	48.4
Importer BCR[2] ($ profit/$ spent)	19.5	
Discounted Importer BCR[2,3] ($ profit/$ spent)	14.4	
Added Sales Revenue as a Percent of Historical Retail Textile Product Sales Revenue		
Cotton Fiber Textile Products	9.1%	
Man-Made Fiber Textile Products	5.5%	
Total	7.0%	

[1] Non-agricultural research and marketing/promotion expenditures.
[2] Importer assessment has been subtracted from added profit.
[3] Present value of added profit calculated assuming a 5% cost of capital in each year.

Table 23: Financial Data of Eighteen Major Apparel and Home Furnishings Retailers, 1994-2003

Major Soft-Goods Retailers	Estimated Before Tax Profits as a Percent of Sales									
	1994	1995	1995	1997	1998	1999	2000	2001	2002	2003
	-- % --									
Federated Dept. Stores	4.0	1.3	2.9	6.1	7.3	7.6	0.6	5.0	6.8	7.1
Kohl's Dept. Store	7.6	8.4	7.2	7.7	8.6	9.2	9.8	10.7	11.3	9.2
Dillard's	7.1	4.4	5.9	6.0	2.7	3.2	1.6	1.3	2.6	0.2
May Dept. Stores	10.6	10.6	10.3	10.1	10.4	11.0	9.7	8.1	6.1	4.6
TJX Companies	3.7	2.4	5.5	7.1	8.9	9.7	9.0	8.2	7.8	8.0
Limited Brands	10.2	15.0	7.8	4.4	25.3	8.5	7.5	9.7	9.9	13.1
Abercrombie & Fitch	8.3	10.1	12.5	15.4	20.9	23.9	21.1	20.3	19.8	19.5
Nordstrom's	8.6	6.6	5.6	6.3	6.7	6.5	3.0	3.6	3.3	6.1
The Gap	14.2	13.3	14.2	13.1	14.6	15.3	10.1	1.7	5.5	10.6
Sears	3.1	4.9	5.5	5.1	4.6	5.9	5.4	3.0	5.9	13.3
J.C. Penney	8.1	5.3	3.8	3.0	3.1	1.5	-2.8	0.5	1.8	3.1
Target Stores	3.4	2.1	3.1	4.8	5.0	5.7	5.6	5.6	6.1	6.1
Wal-Mart	5.1	4.6	4.6	4.6	5.3	5.4	6.2	4.9	5.2	5.5
K-mart	0.5	-2.1	1.0	1.1	2.2	2.7	-1.0	-7.5	-9.5	2.3
Saks, Inc.	4.3	-0.3	3.7	3.9	1.1	4.9	1.8	-0.4	1.9	1.8
Ross Stores	4.9	5.1	8.0	9.8	10.1	10.0	9.2	8.5	9.4	9.6
Linens 'N' Things	6.6	0.2	3.7	5.1	5.6	6.5	6.7	2.7	5.1	5.1
Bed, Bath & Beyond	11.6	11.1	11.1	11.4	11.6	11.5	11.8	12.2	13.4	14.5
Total Major Retailers	4.8	4.2	4.7	4.9	5.8	5.8	4.4	3.5	4.6	5.5

Source: Cotton Incorporated.

Table 24: Sensitivity Analysis of Producer and Government BCR Calculations: Long-Run Marketing and Non-Agricultural Research Elasticities Set at One Standard Deviation Below and One-Half of Their Estimated Values, 1986/87-2004/05

	Marketing and Non-Ag Research Elasticities Set at:			
	One Standard Deviation Below Estimated Values		One-Half Their Estimated Values	
	Cumulative	Annual Average	Cumulative	Annual Average
Added Net Revenues to Cotton Producers ($ million)				
Non-Participants in Farm Program	398.2	21.0	290.4	15.3
Farm Program Participants	4,622.4	243.3	3,675.7	193.5
All Cotton Producers	5,020.5	264.2	3,966.1	208.7
Historical Cotton Producer Revenues ($ million)	88,946.1	4,681.4	88,946.1	4,681.4
Ratio of Added Net Revenues to Historical Revenues	5.6%		4.5%	
Farm Program Cost Savings ($ million)	7,095.1	373.4	6,131.6	322.7
Historical Cotton Farm Program Cost ($million)	29,553.4	1,555.4	29,553.4	1,555.4
Ratio of Cost Savings to Total Cotton Program Costs	24.0%		20.7%	
Ratio of Cost Savings to Total Cotton Producer Revenue	8.0%		6.9%	
Total Added Revenue (Producers + Government) ($ million)	12,115.7	637.7	10,097.7	531.5
Total Cotton Check-off Expenditures[1] ($ million)	769.6	40.5	769.6	40.5
Net Benefit-Cost Ratios ($ Added Net Revenue/$ Spent)				
Producer Net BCR (Added Net Revenue/$ Spent)[2]	5.5		4.2	
Government Net BCR (Cost Savings/$ Spent)	9.2		8.0	
Total Net BCR (Producers and Government)[2]	14.7		12.1	
Discounted Benefit-Cost Ratios ($ Added NR/$ Spent)[3]				
Producer Discounted BCR (Added NR/$ Spent)[2]	4.5		3.1	
Government Discounted BCR (Cost Savings/$ Spent)	6.7		5.3	
Total Discounted BCR (Producers and Government)[2]	12.1		9.1	

[1] Non-agricultural research and marketing/promotion expenditures.
[2] Producer assessment has been subtracted from added net revenue of producers.
[3] Present value of added revenues/cost savings calculated using the Treasury bill rate in each year as the cost of capital.

Table 25: Sensitivity Analysis of Importer BCR Calculations: Long-Run Marketing and Non-Agricultural Research Elasticities Set at One Standard Deviation Below and One-Half of Their Estimated Values, 1986/87-2004/05

	Marketing and Non-Ag Research Elasticities Set at:			
	One Standard Deviation Below Estimated Values		One-Half Estimated Values	
	Cumulative Effects	Annual Average	Cumulative Effects	Annual Average
	$ million			
Added Sales Revenue to Importers				
Cotton Fiber Textile Products	201,759.0	15,519.9	62,356.9	4,796.7
Man-Made Fiber Textile Products	65,198.4	5,015.3	49,294.1	3,791.9
Total	266,957.4	20,535.2	111,651.0	8,588.5
Added Importer Profit (5% of Revenue)	13,347.9	1,026.8	5,582.6	429.4
Total Cotton Check-off Expenditures[1]	629.3	48.4	629.3	48.4
Importer BCR[2] **($ profit/$ spent)**	20.2		7.9	
Discounted Importer BCR[2,3] **($ profit/$ spent)**	14.3		6.0	
Added Sales Revenue as a Percent of Historical Retail Textile Product Sales Revenue				
Cotton Fiber Textile Products	13.1%		4.1%	
Man-Made Fiber Textile Products	3.0%		2.3%	
Total	7.2%		3.0%	

[1] Non-agricultural research and marketing/promotion expenditures.
[2] Importer assessment has been subtracted from added profit.
[3] Present value of added profit calculated assuming a 5% cost of capital in each year.

Table 26: Incidence of the Cotton Producer and Importer Checkoff Assessments by Time Period

Assessments	Voluntary Period (1986/87-1991/92)	Mandatory Period (1992/93-2004/05)	Entire Period (1986/87-2004/05)
	---------------------------- average %	------------------------------	
Producer Assessment:			
U.S. Cotton Producer Share	67.1	54.0	58.1
U.S. and Foreign Cotton Buyer Share	32.9	46.0	41.9
Importer Assessment:			
U.S. Cotton Fiber Textile Consumer Share	--	49.0	49.0
Foreign Cotton Fiber Textile Seller Share	--	51.0	51.0

Table 27: Effects of Cotton Checkoff Agricultural Research Expenditures on Cotton Acreage and Yields, 1977/78-2004/05

Production Regions	Average Yield	Long-Run Elasticity[1]	Length of Time for Cumulative Effect
	lb/acre		
West	1,139	0.07	6 years
Southwest			
- Irrigated	572	0.18	8 years
- Dryland	333	0.04	10 years
Southeast	599	0.08	9 years
Delta	683	0.11	9 years

[1] Percentage change in yields due to a 1% change in cotton checkoff agricultural research expenditures.