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IMPACT OF AN EXPORT SUBSIDY ON THE DOMESTIC COTTON INDUSTRY

MICHAEL K. WOHLGENANT
ASSOCIATE PROFESSOR
DEPARTMENT OF AGRICULTURAL ECONOMICS
TEXAS A&M UNIVERSITY

Table of Contents

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Introduction

Since 1980, the U.S. cotton industry has experienced decreases in market prices as export demand has declined in response to worldwide recession and a strong U.S. dollar. Moreover, deficiency and other direct government payments have increased substantially as the gap between target and market prices has widened. In 1983, farm program costs for upland cotton were about $1.4 billion, which amounted to about one-half of the gross value of production (USDA, 1984). In light of these considerations, attention has focused on ways to expand export demand, including export subsidies.

This report presents quantitative estimates of likely effects of an export subsidy on the domestic cotton industry. The model used to quantify the effects is a linear elasticity model that includes relationships for the major markets affected by a subsidy. The objectives of the analysis are to: (a) provide quantitative estimates of expected changes in producer prices and quantities on the domestic market from export subsidies, (b) estimate the expected direct and indirect costs from export subsidies, and (c) estimate the distributional effects of subsidies on producers, consumers, and taxpayers.

Cotton is an interesting commodity to study because of the interrelationships between the markets for cotton and textiles. In particular, a significant proportion of increased cotton exports, resulting from a subsidy, could return to the United States as finished textiles, which would have adverse effects on domestic cotton producers. The claim has been made that this indirect effect would offset the direct effect of an export subsidy to such an extent that producers would gain little from an export subsidy. Whether or not this is the case is an empirical question. The empirical framework must be enlarged to account for possible indirect effects of an export subsidy on the domestic industry.

The next section provides a brief description of the cotton and textile industries, including a discussion of recent trends in prices and quantities and effects of recent agricultural policies. The model and empirical results of the effects of an export subsidy follow, including sensitivity analysis to particular parameter values and export subsidy amounts.

AN OVERVIEW OF THE COTTON AND TEXTILE INDUSTRIES

In 1982, cotton ranked fifth ($3.8 billion) among the major field crops in value of farm production (USDA, 1984). Cotton is produced in a number of states with major concentrations in the Delta region, Texas, Arizona, and California. Texas is the major producing state, accounting for over $1 billion of the total U.S. farm value of production in 1982.

Cotton fiber is used mainly in producing clothing and home furnishings, with smaller amounts used in producing industrial fabrics. Cotton seeds are crushed for oil and cotton seed meal is used for livestock feeding. About 99 percent of the cotton grown in the United States is American upland cotton. The remaining 1 percent is American-Pima, or extra-long staple, which is used chiefly in high-value products such as sewing thread and expensive apparel items.

Cotton is sold for domestic use and for use by foreign textile producers. Over time, domestic mill use of cotton has declined while export sales have increased (Table 1). From 1974-83, domestic mill use of cotton declined on average about 2 percent per year; exports increased on average about 5.5 percent per year (Firch, 1985). In recent years, exports have accounted for about 50 percent of U.S. cotton production. The major importing countries of U.S. cotton are Japan, Korea, Taiwan, Hong Kong, Indonesia, Thailand, and Canada. A large share of the cotton imported by these countries returns to the United States as textile imports. Townsend and Glade (1983) estimate that in 1982 abut 29 percent of imported textiles originated in the United States as cotton fiber. The United States and the Soviet Union are the two largest cotton exporting countries in the world with shares of 27 and 20 percent, respectively, in 1982. Other significant exporting countries include Egypt, Pakistan, Turkey, Sudan, Mexico, and Guatemala (USDA,1984).

Factors affecting declining domestic mill use of cotton include decreases in relative prices of manmade fibers and increases in textile imports. Foreign demand (export demand) for U.S. cotton has been influenced by a number of factors including: (a) foreign cotton production, (b) U.S. cotton price relative to cotton prices of competing exporters, (c) cotton price relative to other fiber prices, and (d) real incomes in foreign importing countries (USDA,1984).

International trade also is a significant aspect of the textile market. Imports have grown over time and now account for over 30 percent of all cotton used in the United States. Textile exports have grown slowly over time and account for about 10 percent of domestic production. The increase in the value of the dollar relative to foreign currencies since 1980 has contributed to the large increase in imports in recent years. However, lower real wages and productivity gains in foreign textile production have been the major contributing factors to long-term growth of textile imports. Current legislation limits the growth of textile imports. This also indirectly could limit the growth in U.S. cotton exports since a significant proportion of U.S. textile imports originates as U.S. produced cotton (USDA,1984).

U.S. farm programs have affected production and market prices for cotton. Prior to 1966, prices were supported through acreage allotments and marketing quotas. For most years, this caused the loan rate to serve as an effective floor on both U.S. and world cotton prices, and government stock levels to rise significantly. From 1956-65, a two-price system was in effect which provided for export subsidies ranging from 6 to 9 cents per pound (Anderson, 1983). This system was terminated in 1965 when the loan rate was reduced and market price of U.S. cotton was supported at no more than 90 percent of the world price level (USDA,1984).

Since 1966, market prices have generally exceeded support-price levels. In 1973, legislation was passed establishing target prices, which allowed for deficiency payments to producers when market prices fell below target prices. No deficiency payments were made from 1974-80. However, large deficiency payments were made during 1981-83 as market prices plummeted, mainly in response to reduced export demand. Government payments ranged from 12 to 39 percent of the total value of cotton production over this period. In 1983, the Payment-in-Kind (PIK) program was implemented to reduce large surpluses. In 1984, the PIK program was discontinued, but participating producers were required to reduce their acreage base and devote a portion of the planted acreage to conservation uses (USDA,1984). Trends in market prices, target prices, and loan rates for cotton since 1974 are shown in Table 2.

A number of issues relating to domestic and export markets are presently being debated in the U.S. Congress. One issue relates to providing export subsidies for cotton to reduce large surpluses and large treasury costs anticipated with the current target price-loan rate program. The following sections examine likely effects of export subsidies for the domestic cotton industry.

A Model of the Impact of an Export Subsity for Cotton

The economic effects of an export subsidy for cotton are illustrated in Figure 1. Domestic mill-level demand for cotton is represented by D, total demand for cotton (domestic plus exports) by D_T, and domestic supply by S. The United States accounts for a significant share of the world cotton trade (about 28 percent in 1982), and U.S. exports are not a perfect substitute for cotton from other countries. Thus, foreign demand for U.S. cotton -- the horizontal difference between D_T and D -- is hypothesized to be less than infinitely elastic.

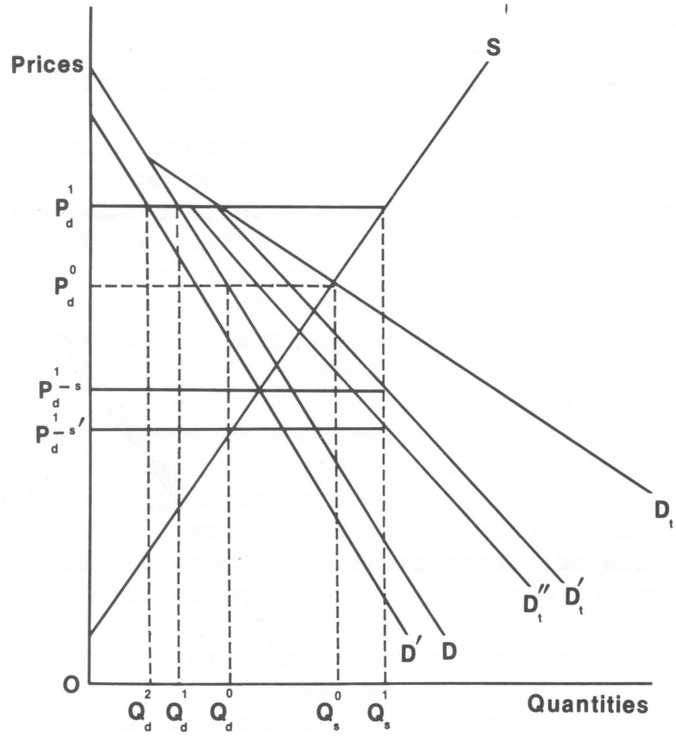

Figure 1. Impact of an export subsidy on cotton prices and quantities.

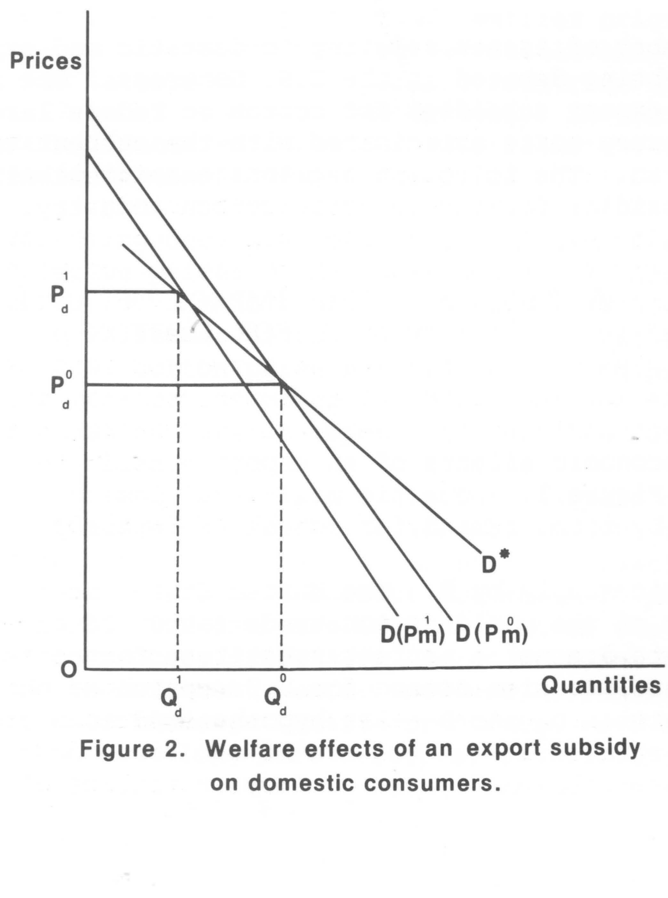

Figure 2. Welfare effects of an export subsidy on domestic consumers.

Suppose producers want to raise the domestic price from P_d^0 to P_d^1 through subsidizing exports. This would require a per unit subsidy of the amount s to reduce the export price to $P_d^1 - s$ where Q_s^1 intersects the demand curve D_T'. (The curve D_T' shows total quantity demanded at alternative export prices given the domestic price P_d^1, Gardner, 1983.) With this subsidy, the quantity sold on the domestic market would fall from Q_d^0 to Q_d^1 and exports would increase from $Q_s^0 - Q_d^0$ to $Q_s^1 - Q_d^1$.

When the price paid by foreigners falls, the costs of producing textile products in foreign countries decline. This would lower the foreign price of textiles relative to the domestic price of textiles. In the absence of restrictions on textile imports, this decline in the relative price of imports would cause domestic demand for cotton to fall to D' and total demand (given P_d^1) to fall to D_T''. As a result, a larger subsidy, s', would be required to keep the domestic price level at P_d^1. The new export price would be $P_d^1 - s'$, and quantities sold domestically and on foreign markets would change to Q_d^2 and $Q_s^1 - Q_d^2$, respectively.

This theoretical model indicates that the quantitative effect of an export subsidy for cotton depends on a number of parameters. These include: (a) price elasticity of domestic supply of cotton, (b) own-price elasticity of domestic demand for cotton, (c) cross-price elasticity of domestic demand for cotton with respect to price of imported textiles, (d) price elasticity of foreign demand for U.S. cotton, and (e) elasticity of imported textile price with respect to domestic price of cotton. The next two sections develop quantitative expressions for the effect of an export subsidy on prices, quantities, and economic surplus measures for consumers and producers.

Comparative Statics of an Export Subsidy

The model consists of a series of equations in linear log differential form representing demand, supply, and market-clearing relationships in the cotton market. These equations are obtained through total differentiation of the set of equations describing initial industry equilibrium. The endogenous variables of the model are:

domestic mill consumption of cotton (Q_d), domestic (mill-level) price of cotton (P_d), quantity of U.S. cotton exported (Q_x), domestic supply of cotton (Q_s), and price of imported textile products (P_m). The per unit subsidy is represented by s. All other determinants of demand and supply (consumer income, price of man-made fibers, wage rates, producer input prices, etc.) are assumed to be unaffected by the subsidy and are not included.

The equations are:

(1) $Q_d = f(P_d, P_m)$,

(2) $Q_x = g(P_d - s)$,

(3) $Q_s = h(P_d)$,

(4) $P_m = i(P_d - s)$,

(5) $Q = Q_s = Q_d + Q_x$.

The first equation is domestic demand for cotton, the second is export demand for cotton, the third is domestic supply of cotton, and the fourth equation specifies the price linkage between the price of imported textiles and the domestic price of cotton. Permanent stock levels of cotton are not likely to respond significantly to a subsidy.[1] Therefore, the fifth equation is taken to represent supply-demand equilibrium. Note that P_d is defined inclusive of the per unit subsidy so that $P_d - s$ is the net price paid by foreigners.

The next step is to find the impact on equilibrium prices and quantities of an exogenous change in the per unit subsidy from its initial level of zero. Total differentiation of equations (1) - (5) yields:

(1') $d\ln Q_d = \eta_{dd} d\ln P_d + \eta_{dm} d\ln P_m$,

(2') $d\ln Q_x = \eta_x (d\ln P_d - \alpha)$,

(3') $d\ln Q_s = \epsilon d\ln P_d$,

(4') $d\ln P_m = \theta(d\ln P_d - \alpha)$,

(5') $d\ln Q = d\ln Q_s = k_d d\ln Q_d + k_x d\ln Q_x$,

where η_{dd} is the own-price elasticity of domestic demand for cotton, η_{dm} is the cross-price elasticity of domestic demand for cotton with respect to the price of imported textiles, η_x is the price elasticity of foreign demand for U.S. cotton (export demand elasticity), ϵ is the price elasticity of domestic supply of cotton, θ is the elasticity of price transmission of the imported textile price with respect to the domestic cotton price, and k_d and k_x are the quantity shares of domestic consumption and exports to production of all cotton, respectively. The parameter $a = (ds/P_d)$ is interpreted as the per unit subsidy as a share of the initial domestic price, since the initial subsidy level is zero.

These equations describe equilibrium displacement of the five endogenous variables (Q_d, Q_x, Q_s, P_d, P_m,). The only exogenous change considered is a, the percentage export subsidy. The solution to this system can be obtained in a number of ways. This method is in the spirit of the approach suggested by Muth (1964). An expression for the proportional change in total derived demand for cotton is obtained; then this equation together with the original equations is used to solve for proportional changes in prices and quantities as functions of the percentage subsidy.

The proportional change in total derived demand for cotton is obtained through substituting (4') into (1') and this result together with (2') into (5'). This equation is

$$\text{(6)} \qquad d\ln Q = \lambda d\ln P_d - (k_d\eta_{dm}\theta + k_x\eta_x)a,$$

where the price elasticity of total derived demand, λ, is defined as

$$\text{(7)} \qquad \lambda = k_d(\eta_{dd} + \eta_{dm}\theta) + k_x\eta_x.$$

Substituting (3') for $d\ln Q = d\ln Q_s$ in (6) and solving for $d\ln P_d$ gives

$$\text{(8)} \qquad d\ln P_d = \frac{-(k_d\eta_{dm}\theta + k_x\eta_x)\ a}{(\epsilon - \lambda)} = \phi a.$$

Given values for the elasticities, quantity shares, and percentage subsidy, equation (8) can be used to estimate the percentage change in the domestic cotton price from a given export subsidy or the percentage subsidy required to achieve a given percentage price increase. Expressions for proportional changes in quantities and the import price of textiles are obtained by substituting equation (8) into the relevant structural equation (1') - (4'). Formulas for these variables with equation (8) are presented in Table 3.

Welfare Effects

The final step is to obtain quantitative expressions for the impact of an export subsidy on taxpayers' costs and the economic welfare of producers and consumers. Direct subsidy costs to taxpayers are the product of the per unit subsidy and the quantity of exports. The increase in net returns or quasi-rents to producers is measured by the area above the supply curve between the initial price and new price resulting from the subsidy. Welfare effects on consumers are measured by the area under the demand curve between the two prices. These welfare effects, however, are more difficult to measure than producers' surplus.

The first consideration in measuring welfare effects on consumers is which demand curve to use, consumer demand or derived demand. Just, et al. (1982) claim that net welfare effects on consumers can be measured completely in the market for the product in question provided that the demand curve used considers all associated price adjustments in other markets. For cotton, the appropriate demand curve would be the derived demand curve for cotton which takes into account effects of changes in the domestic price of cotton on the prices for textiles, both domestic and imported.

Equation (1) gives the domestic derived demand curve for cotton for given import prices for textiles. When the domestic price changes, however, this demand curve shifts. This is because a higher domestic price, when achieved by an export subsidy, lowers the price to foreigners; therefore, the price of imported textiles and domestic demand for cotton is lowered. This is illustrated in Figure 2, which shows that the correct demand curve to use in this case is D*, which shows the net effect of changes in P_d on Q_d. The form of this demand curve is obtained by solving equations (1'), (2'), and (8) simultaneously to obtain

$$d\ln Q_d = \eta_d d\ln P_d$$

where

$$(9)\quad \eta_d = \eta_{dd} + \eta_{dm}\theta(1 - \phi^{-1})$$

is the total price elasticity of domestic demand for cotton which takes into account the influence of a change in domestic cotton price on all other variables in the markets for cotton and textiles.

All welfare measures of the impact of an export subsidy are derived using the trapezoidal rule based on linear demand and supply curves.[2] Formulas for the welfare effects, expressed as a proportion of the total value of cotton production, are shown in Table 4.

Parameter Values for the Simulation Model

The following information is required to determine the impact of an export subsidy on the domestic cotton industry: elasticities of demand and supply for domestically produced cotton, the cross elasticity of domestic demand with respect to the price of imported textiles, elasticity of export demand for U.S. cotton, and elasticity of price transmission of imported textile prices with respect to domestic cotton prices. This section discusses the procedures used to obtain ranges of the parameter values for a simulation model to be used for evaluating an export subsidy.

Domestic Demand and Supply Elasticities

Demand elasticities for domestically produced cotton are estimated with annual time series data from a regression equation in which the logarithm of mill consumption per capita (LPQC) is linearly related to the logarithm of lagged deflated cotton price (LDPCL), the logarithm of lagged deflated polyester price (LDPPRL), the logarithm of deflated prices of imported textiles (LDPM), and the logarithm of deflated income per capita (LPDY). This is a partially reduced form specification of derived demand as described in Foote (1958). Polyester is the main substitute fiber for cotton so this price is used to represent the impact of manmade fibers on cotton fiber use. The price of imported textiles and income per capita represent the effects of shifts in demand for domestic textiles on mill level demand for cotton. Textile goods are contracted for at least 12 months in advance (Stennis et al., 1983). Therefore, lagged rather than current year prices for cotton and polyester are used in the demand specification. Data used in the analysis include the 1965-66 through 1980-81 crop years and are reported in the Appendix.

The demand specification for mill consumption of cotton was estimated by ordinary least squares and the instrumental variable method. The price series used for imported textiles is the unit value of imported textiles, obtained by dividing the dollar value of imports by the total volume of textile imports, expressed in cotton equivalent units. Since this method may introduce measurement errors, the least squares estimator is inconsistent. The appropriate estimation method is instrumental variables (Kmenta, 1971). The instruments used in obtaining predicted values for the price variable should be uncorrelated (at least asymptotically) with the disturbance term in the demand equation and correlated with the import price variable. The instruments chosen were the logarithm of the real wage rate in Japanese manufacturing, the logarithm of lagged U.S. real cotton fiber price, and a linear trend variable. This specification was suggested by the structure of foreign textile manufacturing in which wage rates and labor productivity in foreign countries (particularly in the far east) were hypothesized to be important determinants of the price of imported textiles to the United States. The wage rate in Japanese manufacturing was used as a proxy for changes in wage rates in foreign textile manufacturing, while the trend variable accounts for labor productivity advances. The United States is the major supplier of cotton to the far east, so the U.S. cotton fiber price was used as a proxy for the effects of raw material prices on foreign produced textile products. This price was lagged 1 year to reflect production lags in textile manufacturing.

The results for the demand specification estimated by ordinary least squares (standard errors in parentheses) are:[3]

$$\underset{}{LPQC} = \underset{(4.313)}{15.001} - \underset{(0.070)}{0.260}\cdot(LDPCL-LDPPRL) + \underset{(0.122)}{0.253}\cdot LDPM - \underset{(0.570)}{0.544}\cdot LPDY,$$

$$R^2 = 0.94,\ \text{Durbin-Watson} = 1.57.$$

The results for the demand specification estimated by the instrumental variable method are:

$$LPQC = \underset{(5.092)}{10.520} - \underset{(0.078)}{0.297}\cdot(LDPCL-LDPPRL) + \underset{(0.166)}{0.472}\cdot LDPM + \underset{(0.669)}{0.0225}\cdot LPDY.$$

Both estimation methods yield comparable own-price elasticities, -0.260 versus -0.297. These elasticities also are in close agreement with estimates by Lowenstein (1952) and Waugh (1964). However, the estimates for cross-price elasticity with respect to imported textiles are quite sensitive to the estimation method. This suggests that there are significant errors of measurement in the unit value price series for imports and that the instrumental variable method is preferred. Elasticity estimates of -0.3 and 0.5 for own and cross-elasticities of demand for cotton are used in the simulation model.

The price elasticity of supply for domestic cotton is assumed to be 0.2 (Saez and Shumway, 1983). This elasticity also is in close agreement with estimates by Tomek (1972) and Gardner (1976).

Export Demand Elasticity

One of the most important, yet elusive, parameters for the simulation model is the elasticity of foreign demand facing the U.S. cotton industry. Conceptually, this elasticity depends on foreign demand and supply elasticities, foreign consumption and production relative to U.S. exports, and elasticities of price transmission between other countries and the United States (Floyd, 1965). The equation for export demand elasticity is:

$$(10)\ \eta_x = \sum_i e_i[(Q_{di}/Q_x)\eta_{di} - (Q_{si}/Q_x)\epsilon_i],$$

where η_x = elasticity of export demand facing the United States,

η_{di} = elasticity of demand for cotton in country i,

ϵ_i = elasticity of supply of cotton in country i,

Q_{di} = demand for cotton in country i,

Q_{si} = production of cotton in country i,

Q_x = U.S. exports of cotton to all countries, and

e_i = elasticity of price transmission in country i (response of ith country's price to U.S. price change).

As Alston (1985) indicates, if there are wedges between consumer and producer prices in a particular country, one might include separate transmission elasticities for supply and demand in that particular country. In general, price transmission elasticities are likely to be less than one because of transport costs, other trade barriers, and quality differences of the product. For some trade flows, the transmission elasticities could be zero, reflecting prohibitive trade barriers (Bredahl et al., 1979). Assuming that the supply and demand elasticities are equal among all countries except the United States and aggregating across all countries except the United States, equation (10) simplifies to

$$(11)\ \eta_x = e[(Q_{dr}/Q_x)\ \eta_{dr} - (Q_{sr}/Q_x)\epsilon_r]\ \text{(Alston, 1985)}$$

where Q_{dr} = demand for cotton in the rest of the world,

Q_{sr} = production of cotton in the rest of the world,

η_{dr} = elasticity of demand for cotton in the rest of the world,

ϵ_r = elasticity of supply of cotton in the rest of the world, and

e = overall elasticity of price transmission, a weighted average of individual countries' price transmission elasticities.

U.S. cotton exports for the crop years 1980-82 averaged 5.9 million bales while total foreign production of cotton averaged 54.8 million bales (USDA,1984). This implies that foreign consumption of cotton averaged about 60.7 million bales. Using this data, an overall price transmission elasticity of 1.0, and demand and supply elasticities for the rest of the world of -0.2 and 0.2, respectively (Johnson, 1977), the implied export demand elasticity for cotton facing the United States is -3.9. This estimate, however, is probably large because it assumes no trade barriers and homogenous product quality. A more plausible estimate can be obtained by eliminating production and consumption in the U.S.S.R., the People's Republic of China, and the Eastern European countries. This is equivalent to assuming the elasticity of price transmission is zero for each of these countries. In recent years, these Communist-bloc countries have accounted for slightly more than one-half of total foreign cotton production. Eliminating this total from Q_{sr} and recomputing equation (11), the implied export demand elasticity declines to about -2.0. This estimate could be obtained by assuming an elasticity of price transmission of about 0.5, since (0.5)(-4.0)=-2.0. Even this estimate, however, seems large because it assumes all non-Communist countries practice free trade and that U.S. cotton is a perfect substitute for cotton produced in other countries. For this reason, three different export demand elasticities of -0.4, -1.2, and -2.0 (corresponding to elasticities of price transmission of 0.1, 0.3, and 0.5, respectively), are used in the simulation model. The lower bound estimate of -0.4 is the minimum restricted trade value computed by Bredahl et al. (1979).

As a check on these elasticity assumptions, time series data for 1965-66 through 1980-81 were used to estimate an equation for U.S. cotton. The estimated equation is:

$$\underset{}{LQX} = \underset{(1.210)}{5.367} - \underset{(1.351)}{2.242}\cdot LDPC + \underset{(1.538)}{3.159}\cdot LDWPC - \underset{(0.073)}{0.179}\cdot T + \underset{(0.004)}{0.010}\cdot T^2,$$

$$R^2 = 0.70, \text{ Durbin-Watson} = 1.89,$$

where LQX is the logarithm of U.S. cotton exports in thousand bales, LDPC is the logarithm of the deflated U.S. cotton price, LDWPC is the logarithm of the deflated world cotton price ("A" index divided by the U.S. consumer price index), and T is the trend variable (for 1965-66 the trend variable is one). This equation implies an own-price elasticity of export demand facing the United States of -2.2. This is an upper bound estimate because it is calculated holding the world average price of cotton constant.

Elasticity of the Price Transmission of Imported Textiles with Respect to Domestic Cotton

Another difficult parameter to quantify is the elasticity of the price of imported textiles with respect to the price of domestic cotton. Knowledge of this elasticity requires information on the behavior of the U.S. cotton-foreign textile price spread. Assuming this margin is a constant absolute amount, the elasticity can be approximated by the cost share of U.S. produced cotton in imported textiles. This assumption is equivalent to assuming constant returns to scale in foreign textile manufacturing and no limiting specialized factors other than cotton.

About 29 percent of imported textiles in 1982, on a raw fiber equivalent basis, originated in the United States as cotton and cotton textile exports. In 1980, the most recent year in which data on the value of imports were available, the unit value of textile imports on a cotton equivalent basis was $3.07 per pound. In the same year, the season average price of U.S. cotton (Strict Low Middling, 1 1/16") was 83 cents per pound. This implies a cost share of domestic cotton in imported textiles of about 8 percent (0.29 X 0.83 ÷ 3.07). This estimate, however, understates the impact of domestic cotton prices on the price of imported textiles because the estimate does not take into account the effect of changes in U.S. cotton prices on export prices for cotton in other countries. If the U.S. price was perfectly correlated with cotton prices in other countries, then the elasticity would be 0.27 (0.83 ÷ 3.07) rather than 0.08. The "true" value lies somewhere between these two extremes since U.S. produced cotton is not a perfect substitute for cotton produced in other countries. To reflect this uncertainty, and at the same time uncertainty about the effectiveness of import quotas for textiles, three different values are selected for this elasticity: 0.0, 0.1, and 0.3. These values also reflect the uncertainty about the magnitude of the cross elasticity of domestic demand for cotton with respect to the price of imported textiles since this elasticity and the elasticity of price transmission enter the model in a multiplicative way (Table 3).

SIMULATION RESULTS FOR THE EFFECTS OF ALTERNATIVE EXPORT SUBSIDIES

This section presents simulation results for the effects of alternative export subsidies on domestic cotton prices and quantities and welfare measures of producers and consumers. The effects of three different export subsidies are analyzed: 20,35, and 50 percent. The 20 percent value is in the range of the subsidy that was in effect from the middle 1950's to the middle 1960's. The range of the parameter values used in the simulations are shown in Table 5. The formulas used to compute percentage changes in prices and quantities are shown in Table 3. Table 4 gives formulas for the welfare effects. Simulation results for the three alternative subsidy amounts are presented in Tables 6 through 8.

ESTIMATED EFFECTS ON U.S. PRICES AND QUANTITIES

The effects of alternative export subsidies on the domestic cotton price, mill consumption of cotton, and cotton exports for alternative combinations of export demand elasticity and elasticity of price transmission of imported textiles are shown in the first three rows of Tables 6 through 8. These estimated percentage changes are sensitive to the combination of elasticities chosen, especially the export demand elasticity η_x. For example, for a 20 percent

subsidy with a zero elasticity of price transmission ($\theta = 0$) the percentage change in the price of cotton ranges from about 15 percent with an export demand elasticity of -2 to about 7 percent with an export demand elasticity of -0.4.

The estimated effects on prices and quantities are less sensitive to the elasticity of price transmission when export demand is elastic, $\eta_x = -1.2$ or -2.0, especially for domestic cotton price.

For an export subsidy of 50 percent and an export demand elasticity of -1.2, the percentage change in the price of cotton would only range from about 32 percent to 30 percent as the elasticity of price transmission is varied from 0.0 to 0.3. This difference is small because exports are a large share of domestic production (50 percent) so total demand for cotton, and therefore domestic price, is relatively insensitive to a decline in domestic demand when export demand is elastic. Since export demand is relatively elastic, at least long enough for importers of U.S. cotton to respond to price, the indirect effects of an export subsidy on domestic price through increased textile imports is expected to be negligible.

For the most likely range of export demand elasticities (-1.2 to -2.0), the domestic price of cotton would be expected to increase from 12 to 15 percent for a 20 percent subsidy, from 21 to 26 percent for a 35 percent subsidy, and from 30 to 37 percent for a 50 percent subsidy. In all cases, the percentage increase in price would be less than the actual subsidy. This is because U.S. producers face a less than infinitely elastic foreign demand curve for cotton so that domestic price must rise proportionately less than the subsidy in order to sell more in foreign markets.

With a relatively elastic export demand for U.S. cotton, U.S. mill consumption would be expected to decline from 4 to 5 percent for a 20 percent subsidy, from 7 to 9 percent for 35 percent subsidy, and from 10 to 13 percent for a 50 percent subsidy. Exports would be expected to increase from 9 to 11 percent for a 20 percent subsidy, from 16 to 19 percent for a 35 percent subsidy, and from 22 to 28 percent for a 50 percent subsidy. With the current volume of exports in the range of 5 million bales, it would take about a 50 percent subsidy to increase exports by a million bales.

ESTIMATED WELFARE EFFECTS

The last four rows of Tables 6 through 8 show estimated welfare effects of alternative export subsidies on domestic producers, consumers, and taxpayers. The change in producers' surplus is a measure of the increase in net revenue of cotton producers, the change in consumers' surplus is a monetary measure of the losses to consumers, and direct subsidy cost is a measure of the costs to taxpayers for financing the subsidy. The last row of Tables 7 through 9 is the ratio of the change in producers' surplus to the sum of the absolute values of the change in consumers' surplus and direct subsidy cost. As indicated by Gardner (1983), this is a measure of the total redistribution costs of transferring resources from consumers and taxpayers to producers. In all cases, this value is less than 100 because of deadweight losses and transfers to foreigners from an export subsidy. In general, the larger this ratio, the smaller the redistribution costs of a subsidy.

Gains to producers from alternative export subsidies, as measured by percentage change in producers' surplus, are roughly equal to the percentage change in domestic price of cotton. This is because of the small supply elasticity of 0.2. For an elastic export demand (η_x = -1.2 or -2.0), gains to producers would be expected to range from 12 to 15 percent of the value of production for a 20 percent subsidy, from 21 to 27 percent for a 35 percent subsidy, and from 31 to 38 percent for a 50 percent subsidy. With the total farm value of production (excluding government payments) in the range of $3 billion, this means it would take a 50 percent export subsidy to increase producer net returns by $1 billion.

The loss in consumers' surplus would be expected to range from 6 to 7 percent of the value of production for a 20 percent subsidy, from 10 to 12 percent for a 35 percent subsidy, and from 14 to 18 percent for a 50 percent subsidy.

Direct subsidy costs, or the direct costs to taxpayers from subsidies, would be expected to be about 11 percent of the value of production for a 20 percent subsidy, from 20 to 21 percent for a 35 percent subsidy, and from 31 to 32 percent for a 50 percent subsidy. With a total farm value of production of $3 billion, this implies direct subsidy costs of at least $330 million for a 20 percent subsidy, $600 million for a 35 percent subsidy, and $930 million for a 50 percent subsidy.

The sum of direct subsidy costs and loss in consumers' surplus would amount to at least 17 percent of the value of production for a 20 percent subsidy, 30 percent for a 35 percent subsidy, and 45 percent for a 50 percent subsidy. For a 35 percent subsidy, these direct and indirect costs would amount to at least $930 million for a farm value of production of $3 billion. To put this number in perspective, it is about 1.5 times the sum of deficiency, diversion, and disaster payments to cotton producers in 1982 (USDA, 1984).

For an elastic export demand, the gain to producers per dollar transferred from consumers and taxpayers would range from 72 to 82 cents for a 20 percent subsidy, from 70 to 80 cents for a 35 percent subsidy, and from 69 to 78 cents for a 50 percent subsidy. Note that the gain per dollar transferred declines as the subsidy increases. This occurs mainly because of increased transfers to foreigners as the subsidy is increased.

Conclusions

There is little doubt that an export subsidy would result in higher prices and income for cotton producers in the short run. The results indicate that for an elastic export demand, offsetting indirect effects (through increased textile imports) would be negligible compared to the direct effects of an export subsidy. An export subsidy could be effective in adjusting to past policy mistakes caused by setting support prices too high which leads to an unanticipated buildup of stocks (Gardner, 1983).

An export subsidy, however, would appear to be a costly way to permanently increase producer prices and income. Export subsidies entail transfers to foreigners. The domestic market price would rise by no more than 70 percent of the actual subsidy, implying a proportionately larger subsidy would be required to achieve a given desired price increase. For a price increase of 35 percent from the present 60 cents per pound to the target price of 81 cents per pound, it would take at least a 50 percent export subsidy.

An export subsidy would have the same economic effects as a tax on domestic consumers. This tax would be more than one-half the direct treasury costs of financing the subsidy. For a 35 percent subsidy, which would raise producer prices no more than 26 percent, the sum of direct subsidy costs and losses to consumers would amount to almost $1 billion for a crop with a current value of production of $3 billion.

The results of the simulations in this study were generated assuming that other countries would not retaliate with countervailing duties or import restraints. If retaliation occurred, the effectiveness of an export subsidy would be diminished. The effects of retaliation would likely be reflected in a lower export demand elasticity. Other things being equal, a larger export subsidy would be required in order to increase producer price by a desired amount. And, as the export demand elasticity declines, the offsetting indirect effects of an export subsidy on domestic price would be much greater than in the absence of retaliation. Thus the effectiveness of an export subsidy could be greatly diminished in the presence of retaliation by other countries. The situation is further exacerbated because an export subsidy program could be considered a violation of the General Agreement of Trade and Tariffs (GATT), and retaliation could be sanctioned under international law.

In the final analysis, whether an export subsidy program is adopted will depend on how policymakers perceive the reaction of other countries and the weights they attach to producers relative to consumers (processors) and taxpayers (Paarlberg, 1984). The present study, while not advocating any particular policy, provides information that can be used to estimate costs and benefits of adopting an export subsidy program for cotton.

TABLE 1. TRENDS IN U.S. MILL USE AND EXPORTS FOR UPLAND COTTON, 1965-83

Crop Year	Mill Use	Exports
	1,000 bales[a]	
1965	9,454	3,029
1966	9,438	4,819
1967	8,948	4,316
1968	8,204	2,186
1969	8,001	2,863
1970	8,105	3,885
1971	8,163	3,376
1972	7,670	5,306
1973	7,384	6,111
1974	5,797	3,914
1975	7,138	3,300
1976	6,596	4,779
1977	6,415	5,459
1978	6,285	6,150
1979	6,440	9,177
1980	5,828	5,893
1981	5,214	6,555
1982	5,214	5,194
1983[b]	5,750	6,764

[a] 480 pound net weight bales.

[b] Preliminary estimates.

Source: U.S. Dept. of Agriculture. *Cotton: Background for 1985 Farm Legislation,* Agri. Information Bulletin No. 476, September 1984, Washington.

TABLE 2. SEASON AVERAGE PRICES AND AVERAGE PRICE LEVELS FOR UPLAND COTTON, 1974-83

Crop Year	Season Average Price[a]	Loan Rate[b]	Target Price
		Cents per pound	
1974	42.7	27.06	38.00
1975	51.1	36.12	38.00
1976	63.8	38.92	43.20
1977	52.1	44.63	47.80
1978	58.1	48.00	52.00
1978	62.3	50.23	57.70
1980	74.4	48.00	58.40
1981	54.0	52.46	70.87
1982	59.1	57.08	71.00
1983	66.1[c]	55.00	76.00

[a]Net-weight basis.

[b]Base loan rates for Strict Low Middling, 1 1/16 inch cotton (micronaire 3.5-4.9) at avarage location, net weight.

[c]Preliminary estimate.

Source: U.S. Dept. of Agriculture. *Cotton: Background for 1985 Farm Legislation,* Agri. Information Bulletin No. 476, Sept. 1984, Washington.

TABLE 3. COMPARATIVE STATIC FORMULAS FOR IMPACT OF EXPORT SUBSIDY ON COTTON INDUSTRY

$$dlnP_d = \phi a$$

$$dlnQ_d = [(\eta_{dd} + \eta_{dm}\theta)\phi - \eta_{dm}\theta]a$$

$$dlnQ_x = -\eta_x(1 - \phi)a$$

$$dlnQ_s = \epsilon\phi a$$

$$dlnP_m = -\theta(1 - \phi)a$$

Note: These formulas are approximate percentage changes in prices and quantities for given percentage export subsidy, a, and given demand and supply elasticities. The parameter ϕ is defined in equation (8). The remaining formulas are obtained by substituting equation (8) into equations (1') - (4').

TABLE 4. FORMULAS FOR WELFARE EFFECTS OF EXPORT SUBSIDY

1. Welfare Gains to U.S. Producers

$$\Delta P_d/P_d^{\circ} + (1/2)\epsilon(\Delta P_d{}^2/P_d^{\circ})$$

2. Net Welfare Loss to all U.S. Consumers

$$[-\Delta P_d/P_d^{\circ} + (1/2)\eta_d(\Delta P_d{}^2/P_d^{\circ})]k_d^{\circ}$$

3. Direct Subsidy Costs

$$[1 + \eta_x(\Delta P_d/P_d^{\circ} - a)]ak_x^{\circ}$$

Note: All welfare measures are expressed as a proportion of initial value of production, $P_d^0 Q_s^0$. All zero superscripts refer to the initial equilibrium values of the variables.

TABLE 5. DEFINITIONS OF SYMBOLS AND VALUES USED IN SIMULATIONS

Symbol	Definition	Values
η_{dd}	Own-price elasticity of domestic demand for cotton	-0.3
η_{dm}	Cross-price elasticity of domestic demand for cotton with respect to the price of imported textiles	0.5
η_x	Price elasticity of foreign demand for U.S. cotton (export demand elasticity)	-0.4, -1.2 or -2.00
ε	Price elasticity of domestic supply of cotton	0.20
θ	Elasticity of price transmission of imported textiles price with respect to domestic cotton price	0.0, 0.1 or 0.3
k_d	Quantity share of domestic cotton purchased by U.S. cotton mills	0.5

TABLE 6. PERCENTAGE EQUILIBRIUM DISPLACEMENT FROM A 20 PERCENT EXPORT SUBSIDY FOR COTTON

	Displacement of Equilibrium Values from Export Subsidy								
	$\eta_x = -2.0$			$\eta_x = -1.2$			$\eta_x = -0.4$		
Endogenous Variable	θ=0.0	0.1	0.3	θ=0.0	0.1	0.3	θ=0.0	0.1	0.3
	(%)								
Price of Cotton	14.8	14.7	14.5	12.6	12.4	12.0	7.2	6.7	5.3
Mill Consumption of Cotton	-4.4	-4.7	-5.2	-3.8	-4.1	-4.8	-2.2	2.7	-3.8
Cotton Exports	10.4	10.6	11.0	8.8	9.2	9.6	5.1	5.3	5.9
Change in Surplus as a Percent of Value of Production:									
Producers' Surplus	15.0	14.9	14.7	12.8	12.6	12.1	7.3	6.7	5.3
Consumers' Surplus	-7.2	-7.2	-7.1	-6.2	-6.1	-5.9	-3.6	-3.3	-2.6
Direct Subsidy Cost	11.0	11.1	11.1	10.9	10.9	11.0	10.5	10.5	10.6
Gain to Producers in Cents per Dollar Transferred from Consumers and Taxpayers	(¢)								
	82	82	81	75	74	72	52	49	40

TABLE 7. PERCENTAGE EQUILIBRIUM DISPLACEMENT FROM A 35 PERCENT EXPORT SUBSIDY FOR COTTON

	Displacement of Equilibrium Values from Export Subsidy								
	$\eta_x = -2.0$			$\eta_x = -1.2$			$\eta_x = -0.4$		
Endogenous Variable	θ=0.0	0.1	0.3	θ=0.0	0.1	0.3	θ=0.0	0.1	0.3
	- - - - - -	- - - - -	- - - - -	- - - - -	(%)	- - - - -	- - - - -	- - - - -	- - - - -
Price of Cotton	25.9	25.8	25.4	22.1	21.8	21.0	12.7	11.7	9.2
Mill Consumption of Cotton	-7.8	-8.2	-9.1	-6.6	-7.2	-8.4	-3.8	-4.7	-6.6
Cotton Exports	18.1	18.5	19.2	15.5	15.9	16.8	8.9	9.3	10.3
Change in Surplus as a Percent of Value of Production:									
Producers' Surplus	26.8	26.6	26.4	22.6	22.2	21.4	12.9	11.8	9.3
Consumers' Surplus	-12.5	-12.4	-12.1	-10.7	-10.5	-10.1	-6.2	-5.7	-4.5
Direct Subsidy Cost	20.7	20.7	20.9	20.2	20.3	20.4	19.1	19.1	19.3
Gain to Producers in Cents per Dollar Transferred from Consumers and Taxpayers	- - - - - -	- - - - -	- - - - -	- - - - -	(¢)	- - - - -	- - - - -	- - - - -	- - - - -
	80	80	79	73	72	70	51	48	39

TABLE 8. PERCENTAGE EQUILIBRIUM DISPLACEMENT FROM A 50 PERCENT EXPORT SUBSIDY FOR COTTON

Endogenous Variable	Displacement of Equilibrium Values from Export Subsidy								
	η_x = 2.0			η_x = -1.2			η_x = 04.0		
	θ=0.0	0.1	0.3	θ=0.0	0.1	0.3	θ=0.0	0.1	0.3
	(%)								
Price of Cotton	37.0	36.8	36.3	31.6	31.1	30.0	18.2	16.7	13.2
Mill Consumption of Cotton	-11.1	-11.7	-12.9	-9.5	-10.3	-12.0	-5.5	-6.7	-9.5
Cotton Exports	25.9	26.4	27.5	22.1	22.7	24.0	12.7	13.3	14.7
Change in Surplus as a Percent of Value of Production:									
Producers' Surplus	38.4	38.1	37.6	32.6	32.0	30.9	18.5	16.9	13.3
Consumers' Surplus	-17.5	-17.3	-17.0	-15.0	-14.7	-14.1	-8.8	-8.1	-6.3
Direct Subsidy Cost	31.5	31.6	31.9	30.5	30.7	31.0	28.2	28.3	28.7
Gain to Producers in Cents per Dollar Transferred from Consumers and Taxpayers	(¢)								
	78	78	77	71	71	69	50	47	38

APPENDIX. DATA USED IN DEMAND ESTIMATIONS

The data listed in the Appendix are the actual data used to estimate U.S. mill consumption of cotton and export demand for U.S. cotton. Quantity data for cotton and price data for cotton and polyester came from selected issues of *Agricultural Statistics* (USDA, 1965-1980) and *Cotton and Wool Outlook Situation* (USDA, 1965-80). Price data for textile imports were derived by dividing the current dollar value of imports by the quantity series of textile imports, expressed in cotton equivalent units. Data on dollar value of imports came from selected issues of *Survey of Current Business* and *Business Statistics* (U.S. Dept. of Commerce, 1965-80). Population, personal consumption expenditures, and consumer price index for the United States were obtained from the *Economic Report of the President* (U.S., Govt. 1980). Data for wage rates and the consumer price index in Japan were obtained from the U.N. publication, *Statistical Yearbook for Asia and the Pacific* (U.N., 1965-80).

APPENDIX. SELECTED VARIABLES FOR U.S. COTTON DEMAND MODELS

Crop Year	Mill use per capita[a] (lb/1,000 persons)	Cotton exports[a] (1,000 bales)	Deflated U.S. cotton fiber price[b] (cents/lb)	Deflated U.S. polyester fiber price (dollars/lb)	Deflated personal consumption expenditures per capita (dollars/person)	Deflated U.S. price imported textiles (dollars/lb)	Deflated world average price of cotton[c] (cents/lb)	Deflated index japanese manufacturing wage rates[d] (1970=100)
1964			34.5200	1.11111				
1965	23,562.6	2,942	32.5820	0.94180	2,375.98	2.34810		64.935
1966	23,235.6	4,669	24.5062	0.85391	2,472.54	1.83162	29.0844	69.136
1967	22,059.8	4,206	30.0100	0.65000	2,511.01	1.82234	31.2100	76.190
1968	19,823.2	2,731	24.5585	0.55662	2,609.33	1.94918	27.5912	82.955
1969	19,103.1	2,768	21.9763	0.42805	2,651.73	1.90088	25.4736	91.398
1970	19,107.5	3,740	21.8315	0.36113	2,635.33	2.10758	26.7326	100.000
1971	18,677.1	3,229	27.1723	0.32152	27,04.55	2.32839	30.6183	107.547
1972	17,423.2	5,000	28.4038	0.28731	2,835.03	1.99501	33.5275	118.919
1973	16,298.7	5,746	50.4132	0.28550	2,910.63	2.10621	57.3403	131.452
1974	12,664.4	3,746	28.2261	0.32498	2,841.62	2.17481	35.5315	133.766
1975	15,584.3	3,178	35.9739	0.31017	2,833.06	1.51319	40.4839	133.140
1976	14,324.0	4,565	41.5718	0.32258	2,945.59	1.35321	47.9120	136.702
1977	13,656.3	5,219	29.0579	0.30854	3,042.56	1.45892	35.8127	138.424
1978	13,445.0	5,850	31.5148	0.32242	3,125.17	1.33182	38.9304	141.981
1979	13,359.7	8,779	32.8795	0.354186	3,108.90	1.36639	39.3652	145.662
1980	11,998.1	5,639	33.6264	0.356564	2,995.97	1.24579	38.1321	145.339

[a]Sum of upland and American-Pima (extra long staple) cotton for 480-pound bales.

[b]Strict Low Middling, 1 1/16 inch.

[c]"A" index divided by U.S. consumer price index.

[d]Index of wage rates in all Japanese manufacturing divided by Japanese consumer price index.

ENDNOTES

[1]This ignores one aspect of the present target price-loan rate program. If the loan rate were the effective floor for the domestic market price, then unanticipated government stocks could be eliminated through an export subsidy program. This could significantly reduce government costs in the first years of the program, but storage cost savings would not be obtainable in future years so long as the support price is pegged at the world average price level. The present analysis of export subsidies assumes a time period long enough so that stock adjustment is not significant.

[2]Welfare measures based on linear demand and supply relationships can be approximated by constant elasticities and value shares only for small changes in prices and quantities. Some of the export subsidies analyzed in this study are not small so one might view the assumption of constant elasticities with welfare measures based on linear demand/supply relationships as suspect. However, welfare estimates based on constant elasticity relationships yielded virtually the same estimates as those based on linear relationships, suggesting the error of approximation for this application is negligible.

[3]In the mill-level demand specifications, the coefficient of LDPPRL was restricted to be equal but of the opposite sign to the coefficient of LDPCL. This restriction was tested and not rejected in either model. Justification for this specification is that cotton input price changes mainly reflect substitution in production between cotton and polyester. At the industry level, the output effect from an input price change is determined as the product of the input cost share and price elasticity of demand for the product (Allen, 1938). Cotton accounts for much less than 10 percent of the retail cost of clothing (USDA, 1984) and the price elasticity of demand is about -0.5 (Blanciforti and Green, 1983). Thus the output effect from a 1 percent change in the price of cotton on the quantity of cotton purchased domestically is no more than -0.05, which is negligible compared to substitution effects in production.

References

Allen, R.G.D. Mathematical Analysis for Economists. New York: St. Matrin's Press Inc., 1938.

Alston, J. The Effects of the European Community's Common Agricultural Policy In International Markets for Poultry Meat. North Carolina Agricultural Research Service Bulletin 471, North Carolina State University, Raleigh, March 1985.

Anderson, C. "An Historical Overview of Federal Cotton Programs", unpublished paper, Department of Agricultural Economics, Texas A&M University, April 1983.

Blanciforti, L. and R. Green, "An Almost Ideal Demand System Incorporating Habits: An Analysis of Expenditures on Food and Aggregate Commodity Groups". Review of Economic and Statistics 65(1983): 511-15.

Bredahl, M., W. Myers, and K. Collins. "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity." American Journal of Agricultural Economics 61(1979): 58-63.

Firch, R. "Cotton." Alternative Agricultural and Food Policies and the 1985 Farm Bill, ed. G.C. Rausser and K.R. Farrell. Berkeley, CA.: University of California Press, 1985.

Floyd, J. "The Overvaluation of the Dollar: A Note on the International Price Mechanism." American Economic Review 55(1965): 95-107.

Foote, R. Analytical Tools for Studying Demand and Price Structures. pp. 100-110. USDA Agricultural Handbook No. 146, 1958.

Gardner, B. "Futures Prices in Supply Analysis." American Journal of Agricultural Economics 58(1976): 81-84.

Gardner, B. "Efficient Redistribution through Commodity Markets." American Journal of Agricultural Economics 65(1983): 225-234.

Johnson, P. "The Elasticity of Foreign Demand for U.S. Agricultural Products." American Journal of Agricultural Economics 59(1977): 735-736.

Just, R., D. Hueth, and A. Schmitz. Applied Welfare Economics and Public Policy. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982.

Kmenta, J. Elements of Econometrics. New York: Macmillan Publishing Co., Inc., 1971.

Lowenstein, F. "Factors Affecting the Domestic Mill Consumption of Cotton." Agricultural Economics Research 4(1952): 44-51.

Muth, R. "The Derived Demand for a Productive Factor and the Industry Supply Curve." Oxford Economic Papers 16(1964): 221-234.

Paarlberg, P. "When are Export Subsidies Rational?" Agricultural Economics Research 36(1984): 1-7.

Saez, R. and R. Shumway. "U.S. Agricultural Product Supply and Input Demand Relationships Derived from Regional Estimates." American Journal of Agricultural Economics 65(1983): 1187 (Abstract).

Stennis, E., M. Pinar, and A. Allen. "The Futures Market and Price Discovery in the Textile Industry." American Journal of Agricultural Economics 65(1983): 308-310.

Tomek, W. "Distributed Lag Models of Cotton Acreage Response: A Further Result." American Journal of Agricultural Economics 54(1972): 108-110.

Townsend, T. and E. Glade, Jr. "Measuring the U.S. Cotton Content of Textile Imports." Cotton and Wool Outlook Situation USDA, Economic Research Service, Washington DC, September 1983.

U.N., Statistical Yearbook for Asia and the Pacific. Bangkok, Thailand, (all years 1965-80).

U.S. Department of Agriculture. Agricultural Statistics. Washington DC, (all years 1965-80).

U.S. Department of Agriculture. Cotton and Wool Outlook Situation. Washington DC, (all years 1965-80).

U.S. Department of Agriculture. Cotton: Background for 1985 Farm Legislation. Washington DC, Agriculture Information Bulletin 476, September 1984.

U.S. Department of Commerce. Business Statistics. Washington DC, (all years 1965-80).

U.S. Department of Commerce. Survey of Current Business. Washington DC, (all years 1965-80).

U.S. Government, Economic Report of the President. Washington DC, (all years 1965-80).

Waugh, F. V. Demand and Price Analysis: Some Examples from Agriculture. USDA Tech. Full. No. 1316, 1964.

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2M—4-86