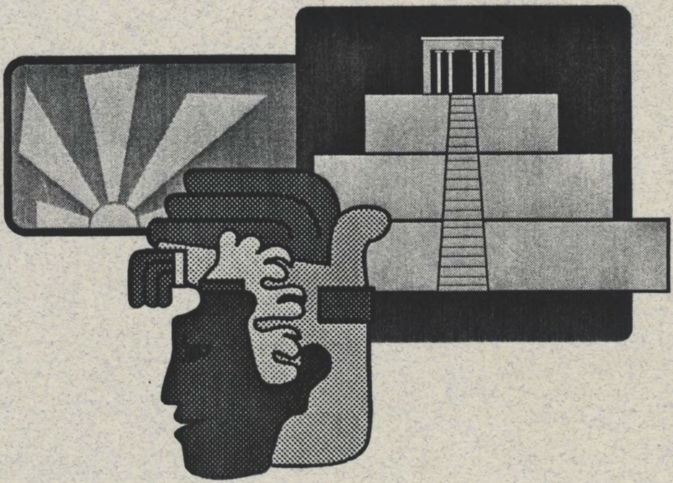
Agricultural Commodity Promotion Policies and Programs in the Global Agri-Food System

Proceedings from the NEC-63 Conference
Fiesta Americana❖Cancun, Mexico❖May 26-27, 1996

Edited by:

Jennifer L. Ferrero
Karen Z. Ackerman
John P. Nichols

Sponsored by and published with the support of:
The Research Committee on Commodity Promotion (NEC-63)
and
The National Institute for Commodity Promotion Research and Evaluation (NICPRE)



Nonprice Export Promotion with Market Distortions and Spillovers: The Case of IWS Wool Promotion in the United States

Henry W. Kinnucan
Lily Ding
Hui Xiao

Nonprice promotion as a means of expanding the demand for agricultural commodities in foreign markets is receiving increased attention in the wake of international trade agreements that lower or eliminate tariff and nontariff trade barriers. In the United States, for example, federal subsidies for nonprice promotion of U.S. agricultural products in export markets grew from $20 million in 1982 to $234 million in 1992 before declining to the 1995 level of $106 million (Kinnucan and Ackerman 1995, p.123). Yet, whether nonprice promotion pays depends fundamentally on the trade status of the promoted commodity and the policy instrument, if any, used to protect the industry in the domestic market. In a small, open-economy situation, for example, nonprice promotion of an unprotected commodity is futile from the industry perspective because increases in promotion affect quantity but not price (Alston, Carman, and Chalfant 1994). Moreover, a welfare loss occurs if demand does not increase sufficiently to offset the decrease in supply associated with the promotion levy.

A related issue is the effect of increased promotion on industries related to the promoted industry through consumer preferences or technology. If wool and cotton are substitutes, for example, a promotion-induced increase in the demand for wool may cause a decrease in the demand for cotton. If the market price of cotton falls as well, deficiency payments for cotton in the U.S. market would increase. In this case, the increased wool promotion generates a negative externality that must be taken into account in the benefit-cost analysis. Substitution-based spillovers in general diminish the quasi-rents generated by nonprice promotion (Kinnucan 1996).

The purpose of the research reported in this paper is to determine the effects of a cooperatively-funded nonprice export promotion effort in a market characterized by price distortions, spillovers, and a "small country" trade status. Specifically, the wool export promotion program in the United States funded by the International Wool Secretariat (IWS) is examined to determine its impact on: i) export earnings for IWS-member countries (Australia, New Zealand[1], South Africa, and Uruguay); ii) U.S. wool tariff revenues; and iii) U.S. treasury outlays for cotton deficiency payments. As a by-product of the analysis, we compare the relative impacts of an increase in wool promotion versus an increase in wool price on export earnings and net treasury income, an analysis made possible by the small-country trade status of the U.S. wool industry (Whipple and Menkaus 1988). A small-country trade status means that the price of wool from the U.S. perspective is exogenous.

The analysis proceeds by first specifying an equilibrium-displacement model of the U.S. wool and cotton industries that incorporates the important policy interventions and nonprice promotion. Comparative-static analysis is then performed to generate hypotheses about the effects of increased IWS wool promotion and wool price on equilibrium quantities and cotton price. The hypotheses are tested by first developing demand estimates for wool and cotton promotion utilizing an extended LA/AIDS of U.S. fiber demand. Based on the demand estimates, along with previous estimates of supply and cotton export demand elasticities, simulations are performed to determine whether the benefits from increased IWS wool promotion in the U.S. market exceed the incremental costs. A key question is whether promotion can be effective in a market where the

1 The New Zealand Wool Board withdrew from IWS on June 30, 1995. Australia is the major funding partner and leader of the IWS which promotes wool throughout the world under the Woolmark label.

trade status of the promoted commodity precludes price enhancement.

Model

The model consists of separate markets for wool and cotton connected through the cotton price, which is determined simultaneously in the two markets. Both markets are distorted via price policies designed to protect the domestic industry. In the wool market, producers receive incentive payments based on the difference between a parity-based support price and the market price.[2] By law, incentive payments cannot exceed tariff revenues on wool imports, which account for about 70 percent of domestic raw wool consumption at the mill level (USDA 1995). In this study, the tariff-revenue restriction is assumed to be binding, i.e., incentive payments are set equal to tariff revenues. The effective support price (per unit incentive payment plus market price) historically has been about three times the world price, so little production remains outside the program and increases in the domestic price have no effect on domestic production.

In the cotton market, producers are protected by a target price and deficiency payment scheme. Deficiency payments equal to the difference between the target price and the market price are paid to the producer for each unit of cotton sold, subject to eligibility restrictions. In addition to eligibility restrictions, some producers elect not to participate (the cotton program is less generous than the wool program), so some production remains outside the program. Because nonprogram cotton is paid the market price, production is responsive to price, and quantity supplied is endogenous.

The United States is a major producer and exporter of cotton, accounting for about 25 percent of world trade flows (USDA 1995). Accordingly, changes in supply or demand in the domestic market affect the world price of cotton, meaning cotton price is endogenous. For wool, the United States is a moderate consumer

---

[2] As of December 1995, the U.S. wool program ceased to exist.

(about 12 percent of the world's wool) and a small producer (1 percent of world's wool), suggesting that changes in U.S. production or consumption have little or no effect on wool price, a result confirmed by Whipple and Menkaus (1988, p. 16, fn. 1). For expository purposes, the wool and cotton markets are discussed separately.

Wool Market

Initial equilibrium in the wool market is described by the following structural model:

(1)	$W_d = f(P_w^D, P_c, A_w)$	(domestic demand)
(2)	$W_s = g(P_w^S)$	(domestic supply)
(3)	$P_w^D = P_w + T$	(domestic mill price)
(4)	$P_w^S = P_w + IP - PD$	(farm price)
(5)	$W_d = W_s + W_m$	(market-clearing)

where W_s is domestic production, W_m is imports, and the remaining variables are as defined in Table 1. In the above system, policy interventions are specified via a mill-price equation that incorporates the wool tariff *T*, and a farm-price equation that incorporates the per unit incentive payment *IP*, net of the promotion deduction *PD*. Because the promotion deduction is modest and is used primarily to fund promotion or research aimed at middlemen (Courlis-Samuelson, 1996), it is not considered in this analysis. Owing to the exogeneity of wool price, promotion-induced increases in domestic wool demand have no effect on domestic production, so the extra demand is accommodated by an increase in imports. The effect of promotion on imports, therefore, is derived from the market-clearing condition (equation (5)).

Equations (1) - (5) contain six endogenous variables (W_d, W_s, W_m, P_w^D, P_w^S, and P_c) and five exogenous variables (T, IP, PD, A_w, and P_w). To balance the system, the endogenous cotton price, P_c, is treated as "conditionally exogenous" until the cotton market is introduced. The treatment of cooperative advertising expenditures as exogenous is consistent with Nerlove and Waugh's (1961) approach to the problem.

Changes in quantities can be approximated linearly by substituting (3) and (4) into (1) and (2) and totally differentiating the resulting system, which, when converted to elasticities and relative changes, yields:

$$(1') \qquad dlnW_d = -\phi_D N^{WW} dlnP_w + N^{WC} dlnP_c + B^{WW} dlnA_w$$
$$(2') \qquad dlnW_s = \phi_S E^W dlnP_w$$
$$(5') \qquad dlnW_d = k_d^W dlnW_s + k_m^W dlnW_m.$$

where $\phi_D = P_w/P_w^D$, $\phi_S = P_w/P_w^S$, and $dlnZ = dZ/Z$ denotes relative change in variable Z. In the above system, k_d^W represents the proportion of U.S. wool consumption produced domestically, and k_m^W represents the proportion of U.S. consumption that is imported. The N^{WW} parameter in (1') is the absolute value of the demand elasticity for wool; B^{WW} is the own-advertising elasticity; and N^{WC} is the cross-price elasticity. The own-advertising elasticitiy B^{WW} is assumed to be positive in sign. The cross-price elasticity N^{WC}, however, may be positive or negative depending on whether wool and cotton are substitutes or complements. The supply elasticity E^W in (2') is assumed to not be negative.

To focus on the policy variables of interest -- wool price and promotion -- changes in policy variables other than wool price and promotion are set to zero, i.e., $dlnIP = dlnPD = dlnT = 0$. The scaling parameters, ϕ_D and ϕ_S, which are less than one and approach one as the tariff and incentive payment approach zero, indicate the extent to which policy interventions blunt market forces.

Substituting (1') and (2') into (5'), the conditional reduced form for U.S. wool imports is:

$$(6) \qquad dlnW_m = -\Phi\, dlnP_w + (N^{WC}/k_m^W)\, dlnP_c + (B^{WW}/k_m^W)\, dlnA_w$$

where $\Phi = [(\phi_D/k_m^W) N^{WW} + (k_d^W/k_m^W)\, \phi_S E^W] > 0$ is interpreted as the import demand elasticity.[3] Equation (6) yields the hypothesis that a decrease in wool price or an increase in wool promotion always increases wool imports, *provided the price of cotton is fixed.* If cotton price is not fixed, promotion-induced shifts in the demand for wool will affect cotton price, and it is necessary to describe how cotton price is determined.

Cotton Market

Cotton price is assumed to be determined from the following structural model:

(7)	$C_d = f(P_c, P_w{}^D, A_w)$	(domestic demand)
(8)	$C_x = g(P_c)$	(export demand)
(9)	$C_s = h(^{PCs})$	(domestic supply)
(10)	$^{PCs} = \theta\, P^T + (1 - \theta)\, P_c$	(supply-inducing price)
(11)	$C_s = C_d + C_x$	(market-clearing)

where C_d is domestic cotton consumption, C_x is U.S. cotton exports, P_c^s is the "supply-inducing" price for cotton, and the other variables are as defined in Table 1. The supply-inducing price is defined as the weighted average of the target price P^T and the market price P_c, with weights corresponding to θ, the proportion of domestic production eligible for deficiency payments. The target price program is assumed to be binding, i.e., $P^T > P_c$, as the target price has been above the domestic market price for over a decade (USDA, 1995).

Substituting (3) and (10) into (7) and (9) and taking logarithmic total differentials yields:

$$(7') \qquad d\ln C_d = - N^{CC}\, d\ln P_c + \phi_D\, N^{CW}\, d\ln P_w + B^{CW}\, d\ln A_w$$

---

[3] To see this, let $\phi_D = \phi_S = 1$. The $\Phi = (W^d/W^m)\, N^{ww} + (W^s/W^m)\, E^{ww}$, which is identical to Tomek and Robinson's (1990, p. 272, fn.3) formula for the import demand elasticity.

$$(8') \qquad d\ln C_x = - N_x^C \, d\ln P_c$$

$$(9') \qquad d\ln C_s = \zeta \, E^C \, d\ln P_c$$

$$(11') \qquad d\ln C_s = k_d^C \, d\ln C_d + k_x^C \, d\ln C_x$$

where $\zeta = (1 - \theta)\, P_c/[\theta P^T + (1 - \theta)\, P_c] > 0$. The k_d^C and k_x^C parameters in (11') represent domestic and export shares, respectively, of the U.S. cotton crop. Given the negative signs in (7') and (8'), the domestic and export demand elasticities, N^{CC} and N_x^C, are defined to be positive. The supply elasticity E^C is defined to be non-negative. No *a priori* restrictions are placed on the cross-price elasticity N^{CW} or the cross-advertising elasticity B^{CW}, as cotton and wool may be complements or substitutes and wool advertising may increase or decrease the demand for cotton.

The supply-response scaling factor ζ in (9') represents the extent to which program provisions affect supply response. In particular, if all acres are eligible for deficiency payments, $\theta = 1$, and cotton supply is unresponsive to price. More generally, some producers elect not to participate and program provisions restrict eligibility, so $0 < \zeta < 1$ and supply is responsive to changes in market price.

The reduced form for cotton price is obtained by substituting (7') - (9') into (11'), which yields:

$$(12) \qquad d\ln P_c = [k_d^C \, \phi_D \, N^{CW} / D] \, d\ln P_w + [k_d^C \, B^{CW} / D] \, d\ln A_w$$

where $D = (\zeta \, E^C + k_d^C \, N^{CC} + k_x^C \, N_x^C) > 0$. Equation (12) indicates the effect of an increase in wool promotion or wool price on cotton price, taking into account supply response, price-induced changes in cotton exports, and fiber substitution. If an increase in wool promotion causes a downward shift in the demand schedule for cotton ($B^{CW} < 0$), as might be expected, equation (12) yields the hypothesis that an increase in wool promotion always decreases the cotton price. Similarly, if cotton and wool are substitutes ($N^{CW} > 0$), equation (12) suggests that an increase in wool price increases the cotton price; the opposite result obtains if cotton and wool are complements ($N^{CW} < 0$).

With the reduced-form for cotton price in hand, the true reduced form for wool imports can be obtained by substituting (12) into the quasi-reduced form (6), which yields:

$$(13) \qquad d\ln W_m = [(k_d{}^C \phi_D N^{CW} N^{WC} - k_m{}^W \Phi D)/k_m{}^W D]\, d\ln P_w + [(B^{WW} D + k_d{}^C B^{CW} N^{WC})/k_m{}^W D]\, d\ln A_w.$$

Comparing equations (13) and (6), it is apparent that endogenizing cotton price adds complexity to the analysis. In particular, it is no longer possible to predict, *a priori*, how an increase in wool price or wool promotion will affect U.S. wool imports without specific information on the signs and relative magnitudes of the cross-price and cross-advertising elasticities, N^{WC}, N^{CW}, and B^{CW}. Thus, the economic impact of IWS wool promotion is an empirical issue.

Estimation

Model

The foregoing analysis assumes that IWS wool promotion causes an upward shift in the U.S. demand schedule for wool. To test this assumption, and to provide empirical estimates of the cross-price and cross-advertising elasticities needed to operationalize the equilibrium-displacement model, we estimated a U.S. fiber demand model as follows (time subscripts suppressed):

$$(14) \qquad w_i = a_i + \Sigma_{j=1}{}^4\, b_{ij} \ln p_j + c_i \ln (x/P^*) + \Sigma_{k=1}{}^2\, d_{ik} \ln GW_k + u$$

where $i = 1, 2, 3, 4$ (for cotton, wool, polyester and rayon, respectively); w_i is the expenditure share for the *i*th fiber ($w_i = (p_i\, q_i)/(\Sigma_{i=1}{}^4\, p_i\, q_i)$) where q_i is the quantity of the *i*th fiber); p_j is the price of the *j*th fiber; x is total per capita expenditure for natural and manmade fibers ($x = \Sigma_{i=1}{}^4\, (p_i\, q_i)/pop$ where *pop* is U.S. population); P^* is Stone's price index ($= \Sigma_i\, w_i \ln p_i$); GW_k is the "goodwill" generated by U.S. cotton advertising ($k = 1$) and IWS wool advertising ($k = 2$) in the U.S. market; and u is a random error term. Equation (14) is based on the "price-deflator" version of the LA/AIDS model (Green, Carman and McManus 1991, p. 65, equation (8)).

An advantage of the extended LA/AIDS model as formulated in (14) is that the following general restrictions hold globally (Green, Carman, and McManus 1991, p. 65):

(15a) Adding-up: $\Sigma_i a_i = 1, \Sigma_i b_{ij} = \Sigma_i c_i = 0$,
(15b) Homogeneity: $\Sigma_j b_{ij} = 0$, and
(15c) Symmetry: $b_{ij} = b_{ji}$.

Equation (15a) is treated as a maintained hypothesis; equations (15b) and (15c) are imposed during estimation to test theory and improve the statistical precision of the estimated parameters.

The elasticities for the LA/AIDS model are computed using the formulae given by Green, Carman and McManus (1991, p. 65):

(16a) Income: $\Gamma_i = 1 + c_i / w_i$
(16b) Own-price: $\eta_{ii} = (b_{ii} - c_i w_i)/w_i$
(16c) Cross-price: $\eta_{ij} = 1 + (b_{ij} - c_i w_j)/w_i$
(16d) Advertising: $\beta_{ij} = d_{ij} / w_i$

An attractive feature of the extended LA/AIDS model is that advertising elasticities are inversely related to the budget share (see equation (16d)), which is consistent with Simon and Arndt's (1980) finding that advertising is subject to diminishing marginal returns.

The advertising goodwill variable is specified to represent the effect of current and past advertising outlays for cotton and wool on the demand for natural and manmade fibers. This specification is consistent with Nerlove and Arrow's (1962) interpretation of advertising as a demand-generating intangible asset that depreciates over time. The asset's value in time *t* is assumed to be governed by the following mechanism:

(17a) $GW_{kt} = \Sigma_{\iota=0}{}^{N}\, \omega_{k,t-\iota}\, A_{k,t-\iota}$

(17b) $\omega_{k,t-\iota} = \exp(\Lambda_{0k} + \Lambda_{1k}\,\iota + \Lambda_{2k}\,\iota^2)$

where $A_{k,t-\iota}$ is advertising expenditures for the *k*th commodity in time period t-ι; $\omega_{k,t-\iota}$ is the weight attached to that advertising expenditure in terms of its contribution to contemporaneous goodwill; and the $\Lambda_{\cdot k}$ terms are parameters of the weighing scheme.

The weighing scheme (equation (17b)) is a quadratic exponential first proposed by Cox (1992) for goodwill measurement. It permits a variety of decay patterns while maintaining parsimony in parameter specification. Following Cox (1992, p. 149), we restrict the weighing period to five calendar quarters (N = 5); the terminal weight is assumed to be zero, i.e., $\omega_{k,t-5} = 0$; and the weight in the first period ($\iota = 0$) is assumed to be one, i.e., $\omega_{k,t} = 1$. The latter normalization fixes the scale of measurement for the advertising stock GW_{kt}. With these restrictions, (17b) reduces to a function of the single parameter Λ_{2k}:

(17c) $\omega_{k,t-\iota} = \exp\,(-\,4.0\,\iota + \Lambda_{2k}\,(\iota^2 - 5\,\iota))$.

Data

Equations (14), (17a) and (17c) were estimated using quarterly data for the period 1976-93. The price and quantity data in general were obtained from Tables 5, 7, 15, 23, and 26 of USDA's *Cotton and Wool: Situation and Outlook Report* (*C & W*). All quantities refer to mill consumption and all prices are raw-fiber equivalent prices. The quantity data for polyester are adjusted for its share in the noncellulosic category utilizing share data from Table 5 of *C & W*. Price data for wool were obtained from the USDA's *Agricultural Prices: Annual Price Summary*. Price and advertising data were deflated by the consumer price index (CPI - all urban consumers, 1982-84= 100). The CPI and population data -- used to deflate total fiber expenditures -- were obtained from Tables b-22 and b-59 of the *Economic Report to the President* (Council of Economic Advisors).

Advertising expenditures for wool and cotton were obtained from quarterly issues of *AD$Summary* (Leading National Advertisers), a publication by a private firm that tracks the advertising expenditures of major brands. The advertising data for wool are recorded under the brand category "Wool Bureau, Inc.," or, alternatively, "International Wool Secretariat." The cotton advertising expenditures are under "Cotton Incorporated," the industry marketing organization responsible for cotton promotion in the domestic market. Three observations for 1989 were missing from the LNA source. The missing values were replaced with average expenditures for the corresponding quarters in the preceding five years. The replacement procedure should be innocuous because advertising expenditures for both cotton and wool exhibited a distinct seasonal pattern.

Results

The parameter estimates of (14) and (17c) are provided in Table 2. The estimates are based on 67 observations (the first five observations are lost due to the lag structure). The estimates were obtained via a two-step procedure. In the first step, the lag structures for cotton and wool advertising appropriate for each demand equation were determined by performing a grid search on Λ_{21} and Λ_{22} to determine the parameter values that maximizes equation (14)'s R^2.

In the second step, the demand equations were re-estimated as a system utilizing the "optimal" lag structures determined in the first step. The system estimation was performed utilizing seemingly unrelated regressions (SUR) with and without the homogeneity and symmetry conditions ((15b) and (15c)) imposed. The SUR estimates in each case were corrected for first-order serial correlation. To prevent singularity in the variance-covariance matrix, the rayon equation was deleted from the system and the adding-up condition (equation (15a)) was used to recover the rayon demand parameters.

Although the data reject homogeneity and symmetry (the computed chi-square is 36.73, and with six degrees of freedom, is large enough to reject the restrictions at the 1 percent level), we report the restricted estimates in Table 2, as they differ little from the unrestricted estimates (with one notable exception, to be discussed later). The estimates are satisfactory in that the R^2s for the estimated equations all exceed 0.90, and most of the coefficients are significant at the 1 percent level or lower. Five of the eight goodwill coefficients are significant at the 5 percent level or lower. For cotton and wool, the commodities of chief interest in this study, three of the four estimated goodwill coefficients reported in Table 3 are significant at the 1 percent level. For the unrestricted estimates (not reported), all four of the goodwill coefficients in the cotton and wool equations are significant at the 5 percent level or lower (this is the significant exception). Thus, it appears that wool (and cotton) promotion have indeed affected the demand for fibers.

The goodwill decay functions for cotton and wool advertising are relatively stable across the equations, but differ in their respective decay patterns. In particular, the wool decay parameter (Λ_{i2}) is uniformly greater than one in absolute value, while the cotton decay parameter (Λ_{i1}) is uniformly less than one (Table 2). Because larger decay parameters imply slower decay rates (see Cox 1992, p. 162), these results suggest that wool goodwill decays more slowly than cotton goodwill. The apparent greater durability of wool advertising may be due to differences in consumer exposure and associated satiation effects (e.g., see Kinnucan, Chang, and Venkateswaran 1993), as cotton out-spent wool about 15:1 over the sample period.

Advertising and price elasticities for cotton and wool, computed using (16b) - (16d) with budget shares set to sample means, are presented in Table 3. For comparative purposes, elasticities are provided for both the restricted and unrestricted LA/AIDS. The elasticities indicate that the mill demand for cotton and wool is price inelastic and that cotton and wool are complements. The own-price elasticities for cotton from the restricted and unrestricted models, respectively, are -0.924 and -0.871; the corresponding estimates for wool are -0.027 and -0.044. By comparison, Shui, Beghin, and Wohlgenant's (1993, p. 639) estimates of the own-price elasticity for natural fibers (cotton and wool combined) range from -

0.603 to -1.269.

The highly inelastic derived demand for wool in the U.S. market is intuitively appealing in that wool's cost share (0.027) is modest, and much smaller than cotton's cost share of 0.74. Marhall's third law of derived demand implies that inputs with smaller cost shares will have less elastic derived demands, *ceteris paribus*.[4]

The own-advertising elasticities are positive, as expected, indicating that increases in cotton or wool advertising cause upward shifts in the respective demand schedules. The own-advertising elasticity estimates for wool (0.0196 and 0.0232) are larger than for cotton (0.0100 and 0.0082), perhaps reflecting the larger advertising expenditures for cotton and the consequent effects of diminishing returns. The estimated advertising elasticity for cotton is smaller than Ding and Kinnucan's (1996) estimate of 0.066 based on a double-log model. Similarly, the wool advertising elasticity estimated in this study (0.02) is smaller than Dewbre, Richardson, and Beare's (1987, p. 11) 0.086 estimate for apparel wool in the United States. The smaller elasticities estimated in this study may be due to the systems approach to demand estimation, differences in lag specification or functional form, differences in the market level in which measurements are taken (retail versus mill), structural changes in the market response to IWS promotion (e.g., see Kinnucan and Venkateswaran 1994), or some combination of the above. Perhaps the best argument for accepting the present estimates is that they are based on a theoretically sound model.

The cross-advertising elasticity estimates are negative, indicating that increases in wool or cotton advertising decrease the demand for the related product.

---

4 Marshall's third law of derived demand states "The demand for anything is likely to be less elastic, the less important the part played by the cost of that thing in the total coast of some other thing, in the production of which it is employed" (quoted from Bronfenbrenner 1961, p. 255). Bronfenbrenner (1961) shows that the law holds unequivocally only if retail demand is more elastic than input substitution.

The cross effect of cotton promotion on wool demand (-0.06) is much larger in absolute value than the cross effect of wool promotion on cotton demand (-0.003), which might be expected given cotton's larger cost share and advertising dominance.

Simulation

The LA/AIDS demand elasticities listed in Table 3 (unrestricted estimates) were combined with previous estimates of supply and export demand elasticities as indicated in Table 1 to simulate the equilibrium-displacement model. The purpose of the simulations is to determine the impact of isolated increases in IWS wool promotion and wool price on the endogenous variables. The simulations are based on policy parameters in effect during 1990-94, prior to the demise of the wool program. The simulations were accomplished by substituting the parameter values listed in Table 1 into equations (12) and (13) and computing the effect of isolated 10 percent increases in the wool price and wool promotion on cotton price and wool imports. The associated impacts on the remaining endogenous variables were obtained through back substitution utilizing equations (1'), (2'), (7'), (8') and (9').

The price and quantity impacts of increased wool promotion and increased wool price are given in Table 4. The "short run" simulations indicate the price and quantity impacts when supply elasticities are set to zero; the "long run" simulations pertain to the supply elasticities given in Table 1 (0.35 for wool and 0.30 for cotton). A general conclusion from Table 4 is that neither policy instrument has much effect on wool and cotton markets in the United States. That is, increases in either wool promotion or wool price induce very modest changes in trade flows, and have minimal impact on cotton price.

The most sensitive variable is U.S. wool production, which increases 1.2 percent in the "long run" when wool price increases 10 percent. The effect of an increase in wool price on cotton price, albeit modest, is negative suggesting a negative impact on the U.S. treasury. That is, an increase in wool price will cause cotton deficiency payments to increase. Importantly, a 10 percent increase in wool price reduces U.S. wool imports a mere 0.78 percent in the long run, which indicates that the U.S. import demand for wool is price inelastic.

The actual U.S. treasury and import expenditure impacts are given in Table 5. To gauge the effect of market distortions on these variables, three scenarios were considered: a baseline scenario with all distortions in place; an "absent wool distortions" scenario that eliminates the wool tariff, incentive payment, and promotion deduction; and an "absent wool and cotton distortions" scenario that combines the free market scenario for wool with a nonbinding target price for cotton.

The results indicate that regardless of policy scenario, an increase in wool price has a larger impact on treasury revenues and import expenditures than an equivalent percentage increase in wool promotion (Table 5). For example, a 10 percent increase in wool promotion induces a mere 0.33 percent increase in wool import expenditures, whereas a similar percentage increase in wool price induces a much larger 8.0 percent to 9.75 percent increase. The positive relationship between wool price and import expenditures is consistent with the inelastic import demand reported earlier.

Unlike an increase in wool promotion, an increase in wool price generates a negative *net* externality for the U.S. government. That is, the combined reduction in wool tariff revenue and increase in cotton deficiency payments associated with an increase in wool price results in a net loss to the U.S. treasury. An increase in wool promotion, on the other hand, increases tariff revenue while having a negligible effect on cotton deficiency payments resulting in a net gain to the treasury. The positive fiscal impact of promotion, however, is contingent upon the presence of the wool tariff. If the wool tariff is eliminated, an increase in wool promotion would no longer generate treasury income to offset the increase in cotton deficiency payments. The net treasury loss in this case, however, is slight with about 0.007 percent per 10 percent increase in promotion expenditures (Table 5).

Benefit-Cost Analysis

Benefit-cost analysis was performed by simulating the model for a 20 percent ($1.2 million) increase in IWS wool promotion and observing the affect on U.S. taxpayers and IWS member countries. The IWS member country impact assumes that promotion-induced export earnings accrue to IWS member countries alone, and not to other countries that may supply wool to the U.S. market. The assumed absence of competitors' free-riding will cause IWS benefits to be overstated if in fact free-riding occurs, so the estimates must be interpreted as an *upper bound* on actual returns. The U.S. impact measures the effect of the increased IWS promotion on net treasury income, i.e., net of the increased outlays for deficiency payments.

To gauge the sensitivity of results to the estimated promotion responses, simulations were performed with the wool promotion elasticity set to this study's estimate, 0.023 and alternatively to 0.086, Dewbre, Richardson, and Beare's (1987) estimate. Similarly, the effects of spillover on estimated returns were examined by setting cross-advertising and cross-price elasticities to zero.

Results indicate that an increase in IWS promotion has a positive net effect on U.S. taxpayers, but whether the incremental promotion pays depends critically on the wool promotion elasticity (Table 6). If $B^{WW} = 0.086$, the estimate based on earlier work, marginal returns exceed marginal costs (B-C ratio of 2.67:1), and the incremental expenditure is deemed profitable. If, however, the promotion elasticity estimated in this study ($B^{WW} = 0.023$) is used, the simulated marginal return is less than the incremental outlay (B-C ratio of 0.72:1) and the incremental expenditure is unprofitable from the IWS perspective. These results are not much affected by assumptions about cross-elasticities, as the measured spillover effects are negligible.

Returning to the treasury impact, an increase in IWS promotion has only a modest effect on cotton deficiency payments, so the increased revenue from the wool tariff dominates, resulting in a net gain to the U.S. taxpayer. The treasury benefit per incremental IWS dollar, termed here the "free-rider ratio" as the United States bears none of the incremental cost, ranges from 0.56 to 2.36 depending on the advertising elasticity for wool. As before, the spillover effect is negligible. Thus, it appears that the primary beneficiary of increased IWS promotion expenditure is the American taxpayer.

The foregoing analysis assumes that the wool tariff remains in place at present levels. If the wool tariff were eliminated, for example, increased IWS wool promotion would increase cotton deficiency payments with no offsetting increase in tariff revenue. In this case, increased IWS wool promotion in the U.S. market would generate losses for both the U.S. taxpayer and IWS member countries, and would be inadvisable.

Concluding Comments

The basic theme of this paper is that market distortions, spillovers, and trade status condition the economic impacts of cooperative promotion ventures. A small-country trade status, for example, implies that price is exogenous meaning that promotion can affect quantity but not price. Without price enhancement, producer benefits from promotion are problematic unless market distortions permit rent seeking. Rents in the form of increased incentive payments, for example, may provide an incentive for U.S. wool producers to invest in promotion, especially if tariff revenues are binding, i.e., restrict the actual level of government payments to producers. With the recent demise of the U.S. wool program, however, domestic producers have little incentive to promote, as trade exposure renders the U.S. wool price exogenous.

Price exogeneity need not be detrimental to the efforts of global marketing organizations such as the International Wool Secretariat. Whether cooperative nonprice export promotion pays in a particular market depends chiefly on the extent to which the promotion increases member-country total exports and the opportunity cost of investing the funds in alternative markets. This, in turn, depends on the magnitude of the export promotion elasticity in the targeted market and the targeted market's trade share (Ding and Kinnucan 1996). In the case of IWS wool promotion in the United States, it appears that the U.S. market is not sufficiently responsive to the promotion effort to justify increased promotional expenditures.

As an alternative to increased promotion, the IWS might wish to consider price-based marketing strategies as a means to increase export earnings. A price-based marketing strategy, however, would involve raising (not lowering) wool price in the U.S. market because U.S. import demand is price inelastic. Unlike nonprice promotion, such a strategy would result in a welfare loss to U.S. wool consumers, and may intensify competition from wool suppliers outside the IWS, including U.S. producers. The complementary relationship between wool and cotton in the U.S. market suggests that any increases in wool price would decrease the demand for cotton and increase cotton deficiency payments. Still, from the IWS member country perspective, if the goal is to enhance export earnings from the U.S. market, it appears that price increases would be more effective than promotion increases.

A caveat in interpreting our results is that they are sensitive to estimated promotion responses, which themselves are susceptible to the well-known Lucas critique (Kinnucan and Venkateswaran 1994). For example, the IWS could potentially enhance promotion-response coefficients through changes in promotion strategy (e.g., adjustments in advertising copy, target audience, media mix) or through research to improve wool quality. Then, too, response coefficients might increase with increases in promotional spending, especially if the increased spending permits scale-based efficiencies in promotion execution or design (Ward and Dixon 1989). The point here is not that the present results should be discounted, but rather that promotion evaluation is too complex a task to pretend that any single study is definitive.

Table 1. Model Parameters and Baseline (1990-1994) Values U.S. Wool and Cotton Industries

Mkt/ Item	Definition	Source	Value
Wool:[a] IP	Incentive payment (\$/lb) [b]	Amer. Sheep Ind. Assoc.	2.58
PD	Promotion deduction (\$/lb) [c]	Amer. Sheep Ind. Assoc.	0.16
P_w	Domestic market price (\$/lb.)	USDA, ERS, CWS-95, p. 50	1.28
T_w	Import tariff (\$/lb.) [d]	Computed	1.13
W_d	Domestic consumption (mil. lbs.) [e]	USDA, ERS, CWS-95, p.46	140.9
$k_m{}^W$	Import share (proportion)	USDA, ERS, CWS-95, p. 46	0.70
N^{WW}	Demand elasticity (abs. val.)	This study	0.044
N^{WC}	Demand elast. w.r.t. cotton price	This study	- 0.710
B^{WW}	Advertising elasticity	This study	0.0232
E^W	Supply elasticity [f]	Whipple and Menkhaus, 1989	0.35
A_w	IWS advertising exp. (mil. dol.) [g]	Leading National Advertisers	5.8
Φ_S	Supply-response scaling factor ($= P_w/(P_w + IP - PD)$)	Computed	0.346
Φ_D	Demand-response scaling factor ($= P_w/(P_w + T_w)$)	Computed	0.531

[a] All prices and quantities are on a clean wool basis. The greasy to clean wool conversion factor is 0.528.

[b] Average annual total incentive payment for shorn wool and unshorn lamb (\$111.1 million) divided by average annual domestic production (43.1 million lbs).

[c] Average annual total deduction from shorn wool and unshorn lamb (\$7.0 million) divided by average annual domestic production.

Table 1 (Continued).

Mkt/ Item	Definition	Source	Value
<u>Cotton:</u> P^T	Target price ($/lb.)	USDA, ERS, CWS-95, p. 29	0.729
P_C	Domestic market price ($/lb.) [h]	USDA, ERS, CWS-95, p. 29	0.615
DP	Deficiency payments (mil. dol.)	USDA, ERS, CWS-95, p. 29	660
C_s	Domestic production (mil. lbs.)	USDA, ERS, CWS-95, p. 19	8,170
k_x^C	Export share (proportion)	USDA, ERS, CWS-95, p. 19	0.42
θ	Prod. eligible for def. payment [i]	USDA, ERS, CWS-95, p. 29	0.70
ζ	Supply-response scaling factor (= $(1 - \theta)P_c / (\theta P^T + (1 - \theta)P_c)$)	Computed	0.266
E^C	Domestic supply elasticity	Kinnucan, Duffy, and Ackerman	0.30
N_x^C	Export demand elasticity (abs. val.)	Duffy, Wohlgenant, Richardson	2.00
N^{CC}	Domestic demand elast. (abs. val.)	This study	0.871
N^{CW}	Dom. demand elas. w.r.t wool price	This study	- 0.033
B^{CW}	Adv. elasticity w.r.t. wool adv.	This study	- 0.0030

[d] Assumes tariff revenue equals incentive payments. Computed as the average annual incentive payment ($111.1 million) divided by average annual imports (98.6 million lbs).
[e] Domestic production plus net imports (including "unaccounted" supply).
[f] Corresponds to three-year time horizon.
[g] Annual average expenditures for 1990-93, undeflated.
[h] Seasonal average price received by farmers, net-weight.
[i] Defined as total outlays for deficiency payments ($660 million) divided by DP x C_s.

Table 2. Estimated Parameters and *t*-ratios for SUR Estimation of Extended LA/AIDS of Mill Demand for Natural and Manmade Fibers, United States, 1977.2--1993.4 Quarterly Data[a]

Share	d_{i1}	d_{i2}	b_{i1}	b_{i2}	b_{i3}	b_{i4}
Cotton	0.0070 (3.8)[a]	-0.0012 (1.2)	0.127 (10.7)	-0.022 (8.2)	-0.092 (11.4)	-0.013 (1.8)
Wool	-0.0019 (3.3)	0.0005 (2.5)	--	0.027 (24.0)	-0.011 (3.9)	0.006 (2.63)
Polyester	-0.0080 (5.0)	0.0005 (0.6)	--	--	0.162 (11.9)	-0.060 (7.2)
Rayon	0.0025 (1.8)	0.0004 (0.6)	--	--	--	0.038 (6.0)

[a] Estimates are corrected for first-order serial correlation with symmetry, homogeneity, and adding-up imposed. The *t*-ratios are in parentheses. The means of expenditure shares for cotton, wool, polyester and rayon, respectively, are 0.741, 0.028, 0.162, and 0.069.

Table 2 (Continued).

Share	c_i	Λ_{i1}	Λ_{i2}	a_i	ρ	*DW*	R^2
Cotton	0.095 (7.0)	-0.6	-1.5	0.287 (4.6)	0.391	1.22	0.918
Wool	-0.004 (1.2)	-0.6	-2.9	0.047 (3.1)	0.150	1.70	0.918
Polyester	-0.054 (6.1)	-0.7	-1.4	0.450 (11.4)	0.324	1.35	0.935
Rayon	-0.034 (4.9)	-0.8	-1.6	0.205 (6.4)	--	--	--

Table 3. Advertising and Price Elasticities for Cotton and Wool from the Restricted and Unrestricted Linear Approximate AIDS[a]

	Advertising		Price	
Commodity	β_{i1}	β_{i2}	η_{i1}	η_{i2}
	Restricted Estimates (Symmetry and Homogeneity Imposed)			
Cotton	0.0100 (3.8)[b]	-0.0016 (1.2)	-0.924	-0.033
Wool	-0.0691 (3.3)	0.0196 (2.5)	-0.679	-0.027
	Unrestricted Estimates (Symmetry and Homogeneity Not Imposed)			
Cotton	0.0082 (3.0)	-0.0030 (2.2)	-0.871	-0.033
Wool	-0.0616 (2.9)	0.0232 (2.9)	-0.710	-0.044

[a] Elasticities are evaluated at sample means of the budget shares.

[b] Figure in parentheses is the asymptotic *t*-ratio with the endogenous budget share w_i treated as a fixed constant. Because the formulae for the price elasticities (see text equations (16b) and (16c)) involve more than one regression parameter, *t*-ratios are not reported for the price elasticities.

Table 4. Price and Quantity Impacts of Isolated 10% Increases in IWS Wool Promotion and Wool Price United States, 1990-94 Average

Item	10% ↑ in Wool Promotion		10% ↑ in Wool Price	
	Short Run	Long Run	Short Run	Long Run
	<——— Percent Change ———>			
U.S. Wool Imports ($dlnW_m$)	0.333	0.333	-0.257	-0.780
U.S. Wool Consumption ($dlnW_d$)	0.232	0.233	-0.180	-0.183
U.S. Wool Production ($dlnW_s$)	0.0	0.0	0.0	1.21
U.S. Cotton Exports ($dlnC_x$)	0.003	0.002	0.151	0.143
U.S. Cotton Consumption ($dlnC_d$)	-0.002	-0.002	-0.109	-0.113
U.S. Cotton Production ($dlnC_s$)	0.0	-0.000	0.0	-0.006
U.S. Cotton Price ($dlnP_c$)	-0.001	-0.001	-0.076	-0.071

Table 5. Impacts of Isolated 10% Increases in Wool Promotion and Wool Price on U.S. Expenditures for Wool Imports ($dlnP_wW_m$), U.S. Wool Tariff Revenue ($dlnT_wW_m$), and U.S. Government Outlays for Cotton Deficiency Payments ($dlnDP$) With and Without Market Distortions United States, 1990-94 Annual Average

Item	10% ↑ in Wool Promotion		10% ↑ in Wool Price	
	Short Run	Long Run	Short Run	Long Run
	With Market Distortions			
$dlnP_wW_m$	0.333	0.332	9.75	9.22
$dlnT_wW_m$	0.333	0.333	-0.26	-0.78
$dlnDP$	0.007	0.007	0.42	0.38
	Absent Wool Distortions ($IP = T_w = PD = 0$)			
$dlnP_wW_m$	0.333	0.333	9.52	8.01
$dlnT_wW_m$	-100	-100	-100	-100
$dlnDP$	0.007	0.007	0.76	0.73
	Absent Wool and Cotton Distortions ($IP = T_W = PD = 0; P^T \leq P_C$)			
$dlnP_wW_m$	0.333	0.333	9.52	7.99
$dlnT_wW_m$	-100	-100	-100	-100
$dlnDP$	0	0	0	0

Table 6. Benefit-Cost Analysis of a 20% Increase in IWS Promotional Expenditures in the United States for Alternative Values of the Wool Promotion Elasticity (B^{WW}) With and Without Spillovers 1990-1994

Item	With Spillovers[a]		Without Spillovers[b]	
	B^{WW} =.023	B^{WW} =.086	B^{WW} =.023	B^{WW} =.086
U.S. Taxpayer Impact:	<———— **Million Dollars** ————>			
Increased Wool Tariff Revenue	0.74	2.74	0.74	2.74
Increased Cotton Def. Payment	0.09	0.09	0.0	0.0
Net U.S. Impact	0.66	2.65	0.74	2.74
F-R Ratio[c]	0.56	2.28	0.64	2.36
IWS Member-Country Impact:				
Increased Export Earnings	0.84	3.11	0.84	3.10
Increased Promotion Expenditure	1.16	1.16	1.16	1.16
B-C Ratio[d]	0.72	2.68	0.72	2.67

[a] Cross-price and cross-advertising elasticities set to values given in Table 1.

[b] Cross-price and cross-advertising elasticities set to zero.

[c] The Free-Rider Ratio is defined as net U.S. impacts divided by the incremental IWS expenditure.

[d] The Benefit-Cost Ratio is defined as increased IWS export earnings divided by incremental IWS expenditure.

References

Alston, J., Carman, H., and Chalfant, J. (1994). "Evaluating Primary Product Promotion: The Returns to Generic Advertising by a Producer Cooperative in a Small, Open Economy," in Promotion in the Marketing Mix: What Works, Where and Why. Goddard, E. W. and Taylor, D. S. (eds.). Guelph: Department of Agricultural Economics and Business, University of Guelph.

Bronfenbrenner, M. (1961). "Notes on the Elasticity of Derived Demand," *Oxford Economics Papers* 13, 254-61.

Courlis-Samuelson, R. (1996). Personal communication. American Sheep Industry Association, Englewood, Colorado.

Council of Economic Advisors. (1976-94 various issues). *Economic Report to the President*. Washington Printing Office.

Cox, T. L. (1992). "A Rotterdam Model Incorporating Advertising Effects: The Case of Canadian Fats and Oils," in Kinnucan, H. W., Thompson, S. R., and Chang, H.-S. (eds.) Commodity Advertising and Promotion, Ames: Iowa State University Press, Chapter 9.

Dewbre, J, Richardson, R. and Beare, S. (1987). *Returns from Wool Promotion in the United States*. Australian Bureau of Agricultural and Resource Economics. Occasional Paper 100. Canberra: Australian Government Publishing Service.

Ding, L. and Kinnucan H. W. (1996). "Market Allocation Rules for Nonprice Promotion with Farm Programs: U.S. Cotton," *Journal of Agricultural and Resource Economics*. 21, forthcoming.

Duffy, P., Wohlgenant, M. K., and Richardson, J. W. (1990). "The Elasticity of Export Demand for U.S. Cotton," *American Journal of Agricultural Economics* 72 (2) 468-74.

Green, R. D., Carman, H. F., and McManus, K. (1991), "Some Empirical Methods of Estimating Advertising Effects in Demand Systems: An Application to Dried Fruits," *Western Journal of Agricultural Economics* 16, 63-71.

Kinnucan, H. W. (1996), "A Note on Measuring Returns to Generic Advertising in Interrelated Markets," *Journal of Agricultural Economics* 47, forthcoming.

Kinnucan, H. W., and Ackerman, K. A. (1995). "Public Funding of Foreign Market Development Programs," in Public Policy in Foreign and Domestic Market Development, Padberg, D. I. (ed.). College Station: Texas A&M University.

Kinnucan, H. W., Duffy, P. A. and Ackerman, K. Z. (1995). "Effects of Price versus Nonprice Export Promotion: The Case of Cotton," *Review of Agricultural Economics* 17, 91-100.

Kinnucan, H. W., Chang, H.-S. and Venkateswaran, M. (1993). "Generic Advertising Wearout," *Review of Marketing and Agricultural Economics* 61, 401-15.

Kinnucan, H. W., and Venkateswaran, M. (1994). "Generic Advertising and the Structural Heterogeneity Hypothesis," *Canadian Journal of Agricultural Economics* 42, 381-96.

Leading National Advertisers. (1976-94). *AD $ SUMMARY*. New York. Various issues.

Nerlove, M. and Arrow, K. J. (1962). "Optimal Advertising Policy under Dynamic Conditions," *Economica* 29, 129-42.

Nerlove, M. and Waugh, F. V. (1961). "Advertising without Supply Control: Some Implications of a Study of the Advertising of Oranges," *Journal of Farm Economics* 43, 813-37.

Shui, S., Beghin, J. C., and M. Wohlgenant, M. (1993). "The Impact of Technical Change, Scale Effects, and Forward Ordering on U.S. Fiber Demands," *American Journal of Agricultural Economics*. 75, 632-41.

Simon, J. L., and Arndt, J. (1980). "The Shape of the Advertising Response Function," *Journal of Advertising Research*, 4, 11-28.

Tomek, W. G. and Robinson, K. L. (1990), Agricultural Product Prices (third ed.). Ithaca: Cornell University Press.

USDA. (1977-94). *Agricultural Prices: Annual Price Summary*. Agricultural Statistics Board, NASS, Various Issues.

USDA. ERS. (1995). *Cotton and Wool Situation and Outlook Report*. CWS-1995. November 1995.

Ward, R. W. and Dixon, B. L. (1989). "Effectiveness of Fluid Milk Advertising since the Dairy and Tobacco Adjustment Act of 1983," *American Journal of Agricultural Economics* 71, 730-49.

Whipple, G. D. and Menkhaus, D. J. (1988). "Effects of the Wool Act on the U.S. Sheep Industry," *SID Research Journal*. 15-20.

Whipple, G. D. and Menkhaus, D. J. (1989). "Supply Response in the U.S. Sheep Industry," *American Journal of Agricultural Economics*, 71, 126-35.