ECONOMIC EFFECTS of Generic Promotion Programs for Agricultural Exports

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Economic Effects of Generic Promotion Programs for Agricultural Exports

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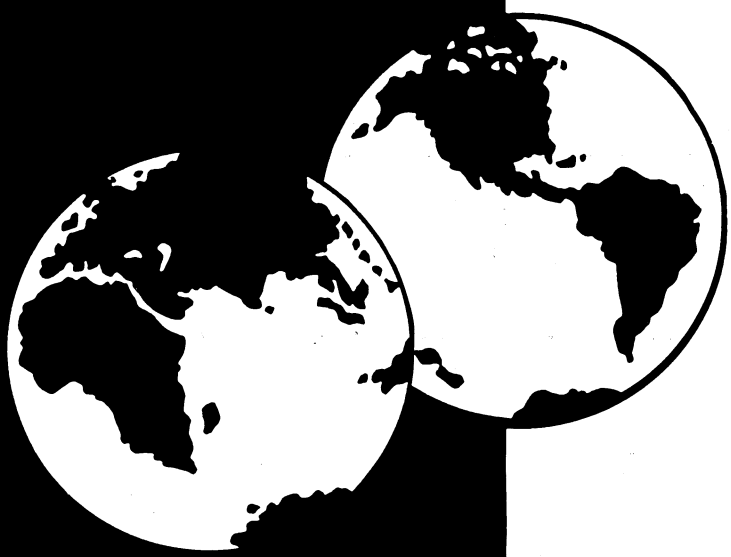
Papers Presented at a
Symposium on Evaluating Economic Effects
of Generic Promotion Programs for Agricultural Exports
Washington, D. C.
February 22-23, 1990

Sponsored by NEC-63 Committee on Commodity Promotion
Foreign Agriculture Service, USDA

Published in Cooperation With the Agricultural and Food Policy Center
Department of Agricultural Economics, Texas A&M University

August 1991

Part IV: Studies of Export Promotions



TWELVE

Effects of Export Promotion on Import Demand for U.S. Cotton in the Pacific Rim

Hosanna Solomon and Henry W. Kinnucan

International trade in agricultural commodities is constrained by government policy interventions at both the macro and micro levels. These interventions regulate the free flow of farm commodities across national borders. At the macro level such monetary and fiscal policies as foreign exchange control and domestic farm policies have direct and indirect effects on agricultural trade. At the micro level, tariff and non-tariff barriers are common, especially for farm commodities.

Many governments support export promotion programs in an effort to boost foreign exchange earnings and offset trade barriers imposed by other countries. Some now view export promotion as an integral part of international trade, a part through which markets are discovered, expanded, maintained, and defended from unfair competition or trade restrictions (McKinna, Spatz).

Despite the significant funds spent for export promotion, research on effectiveness is scant. Evaluation is a prerequisite for efficient allocation of promotion dollars among markets, commodities, and promotional activity.

The U.S. government has supported export promotion since 1955 when PL 480, Title I authorized the use of foreign currencies for market development purposes. The program, sponsored by the U.S. Foreign Agricultural Service (FAS), is designed to develop, maintain, and expand long-term agricultural export markets for U.S. farm products in several countries. Through the Cooperator Program, FAS works with U.S.-based non-profit organizations and with foreign governments or private firms to provide technical assistance and trade servicing (Kinnucan and Williams).

Despite the significant funds spent for export promotion, research on effectiveness is scant. The few studies that do exist are limited to citrus products, soybeans, poultry, and apples (Lee, Myers, and Forsee; Williams; Rosson, Hammig, and Jones). Although most governments

consider export promotion a public good and continue to finance such programs with tax dollars and even though the rationale for subsidizing export promotion appears sound and acceptable to society in general, there is a need to evaluate the effectiveness of these programs. Evaluation, *inter alia,* is a prerequisite for efficient allocation of promotion dollars among markets, commodities, and promotional activity (Kinnucan and Williams).

The objective of this paper is to evaluate the promotion of U.S. cotton in the Pacific Rim, (i.e., Japan, South Korea, Taiwan, Hong Kong, the Philippines, and Thailand). Cotton was one of the first commodities to receive export promotion assistance from the U.S. government and has been one of the largest recipients of such assistance. In spite of this, no rigorous econometric evaluation of effectiveness has been undertaken. Pacific Rim countries have been selected for study because they represent an important market for U.S. cotton (collectively accounting for about 60 percent of exports) and most government-subsidized cotton promotion is directed toward these counties.

Results from this study should be useful to cotton producers, exporters, and promotion program managers. Knowledge of effectiveness is important for these groups because each is involved, either directly or indirectly, in financing export promotion activities. Then, too, the general public wants to know whether tax dollars used for export promotion are accomplishing the intended purpose of expanding trade in U.S. agricultural commodities.

In this study, an extended Armington trade model in a partial equilibrium setting is used to estimate export promotion parameters. Although previous studies have used Armington's model to estimate export demand for several U.S. farm commodities, including cotton (Duffy, Wohlgenant, and Richardson; Babula; Sirhan and Johnson; Figueroa), no attempt has been made to incorporate export promotion into the demand specification. A methodological innovation of this study, therefore, is the extension of the Armington model to include export promotion. U.S. cotton export promotion expenditures, along with bilateral exchange rates and relative prices, are used to evaluate forces affecting the U.S. market share of cotton in Pacific Rim countries.

THEORY

Empirical models of international trade treat the individual nation as the unit of investigation. *Ad hoc* specifications typically measure trade flows in physical quantities leading to an unduly large number of explanatory variables (Sirhan and Johnson). These variables might include population, age, cultural differences, income, prices, distance, product quality, distribution systems, transportation, promotions, exchange rates, foreign exchange reserves, and interest rates. Obviously, multicollinearity and degrees of freedom problems pose significant obstacles

to estimating parameters for such a large number of variables. Moreover, the *ad hoc* models assume homogeneous products and a single price with the implicit assumption of perfect substitutability among commodities produced by different countries. But quality differences and other factors make the assumption of product homogeneity untenable. Finally, the *ad hoc* models implicitly treat export demand as a residual that bridges the gap between domestic production and consumption but does not adequately account for cross price effects (Chambers and Just).

An alternative to the *ad hoc* models is the Armington model. This model, based on the utility maximization of a nation, distinguishes commodities by place of production. Commodities from different countries are considered close but not perfect substitutes. For example, Japan might consider cotton from the United States and Egypt as imperfect substitutes in the demand for cotton in general. Thus, the utility function of a purchaser would include qualities of cotton that are identifiable by the country of production (Armington; Sarris).

Cotton was one of the first commodities to receive export promotion assistance from the U.S. government and has been one of the largest recipients of such aid. In spite of this, no rigorous econometric evaluation of effectiveness has been undertaken.

In practice the Armington model is a two-stage allocation model. The first stage involves determining a country's total demand for a particular commodity from all sources. In the second stage this market demand is independently allocated among competing sources of supply, including domestic supply.

To simplify the model and provide a parsimonious specification for empirical work, Armington assumed a separable utility function and added two restrictions to the product demand functions: (i) elasticities of substitution in each market are constant; (ii) the elasticity of substitution between any two products competing in a market is the same as that of any other pair of products competing in the same market.

These restrictions lead to the basic demand specification:

$$(1) \qquad MS_{ij} = b_{ij}^{\sigma_i} (P_{ij}/P_i)^{-\sigma_i}$$

where MS_{ij} is the market share of country j in country i, P_{ij} is the price of the commodity from country j in country i, P_i is the average world price of the commodity in country i, σ_i are country-specific elasticities of substitution between the commodity from country j and the same commodity from other exporters, and b_{ij} are country-specific constants. Thus, Armington's trade model simplifies the import demand equation to one consisting of relative prices and the specific-source constant b_{ij}.

Note the Armington model as represented by equation (1) dovetails nicely with the intent of U.S. export promotion, which is to differentiate U.S. cotton from other sources. Also, the demand for cotton

is a derived demand for textile products. Yarn qualities depend on fiber properties of the lint such as length, strength, fineness, and texture (Jones-Russell). The physical characteristics of the fiber, in turn, are a function of the variety's genetic characteristics and other factors including weather, soil type, and agronomic practices from planting to harvesting. These conditions vary within and across production regions, making cotton a differentiable product. Therefore, because of the emphasis placed on competition among alternative sources of supply, the Armington approach appears especially appropriate for evaluating export promotion.

EMPIRICAL SPECIFICATION

Previous studies employing the Armington model have incorporated non-price variables by specifying b_{ij} to be a function of time or other shift variables of interest (Duffy, Wohlgenant, and Richardson; Babula; Sirhan and Johnson; Figueroa). We take a similar approach in that b_{ij} is specified as follows:

$$(2) \quad b_{ij} = A_{ij}\, EP_{ij}^{\beta}\, EX_{ij}^{\Omega}$$

where EP_{ij} is U.S. promotion expenditures for cotton in country i, EX_{ij} is the bilateral exchange rate, i.e., the ith country's local currency per U.S. dollar, and A_{ij}, β, and Ω are constants.

Substituting equation (2) into equation (1) and setting $MS_{ij} = MS_{ij}^{*}$ yields:

$$(3) \quad MS_{ij}^{*} = (A_{ij}\, EP_{ij}^{\beta}\, EX_{ij}^{\Omega})^{\sigma_i}\, (P_{ij}/P_i)^{-\sigma_i}$$

where MS_{ij}^{*} is the desired market share. The actual market share specified in equation (1) is replaced with the desired market share to accommodate a partial adjustment model. Previous research indicates the effects of promotion linger beyond the period of initial expenditure. This means that some type of lag structure must be specified in the empirical model (see, e.g., Kinnucan). In addition, actual adjustments to relative prices and exchange rates may not be instantaneous. The partial adjustment model set forth by Nerlove is assumed to represent these dynamic responses so that (ignoring i,j subscripts):

$$(4) \quad MS_t/MS_{t-1} = (MS_t^{*}/MS_{t-1})^{\lambda}$$

where λ is the adjustment coefficient. Substituting equation (3) into equation (4), rearranging terms, and taking logarithms yields the estimating equation:

$$(5) \quad \ln(MS_{ij}(t)) = \lambda\ \sigma_i \ln A_{ij} + \lambda\ \sigma_i\ \beta \ln EP_{ij} - \lambda\ \sigma_i \ln (P_{ij}/P_i) + \lambda\ \sigma_i\ \Omega \ln EX_{ij} + (1 - \lambda) \ln (MS_{ij}(t-1)) + \epsilon(t)$$

The above adjustment framework is similar to the one used by Duffy, Wohlgenant, and Richardson and by Sirhan and Johnson for their studies of the export demand for cotton and by Chambers and Just for wheat.[1] The underlying assumption for using the partial adjustment model is that if the relative price of U.S. cotton or exchange rates change, consumers in the importing country will adjust their purchases of U.S. cotton gradually because they are uncertain about whether the changes are transitory or permanent. By the same token, because market development efforts financed by the FAS are often designed to affect long-term demand, a lag is expected between program expenditures and the resulting shift in U.S. market share. The coefficients of equation (5) are interpreted as short-run (market share or substitution) elasticities. The corresponding long-run elasticities are computed by dividing the short-run elasticities by λ.

The coefficients of the relative price and exchange rate variables are expected to have negative signs. (An increase in EX_{ij} implies an appreciation of the dollar against the respective foreign currency.) If long-run market share (substitution) elasticities exceed short-run elasticities, the coefficient of the lagged dependent variable is expected to be between zero and 1. The coefficient of the export promotion variable is expected to be positive.

DATA

Annual data of cotton imports from all sources, including local cotton production, were collected from various issues of World Cotton Statistics published by World Cotton International. The quantity data were transformed to a calendar-year basis to match the data on exchange rates and export promotion expenditures, both of which are reported on a calendar-year basis. Local cotton production for South Korea, the Philippines and Thailand were added to total imports in calculating the U.S. market share for these countries. Recognizing the importance of local production is in agreement with Armington's assumption of *ex-ante* demand analysis, (i.e., local production has to compete with the imported goods in the same market). The transformation of the quantity data from market-year (August/July) to calendar-year basis was performed by taking a two-year moving average of market-year data. The price data were also collected from the various issues of World Cotton Statistics. U.S. cotton price is the c.i.f. Liverpool price of S.M. 1 1/16" cotton. The world average price index A was used to calculate a trade-weighted price index,

which in turn was used to calculate the average world price of cotton in each market.

Export promotion expenditures for U.S. cotton were furnished by the National Cotton Council. The data represent an aggregate expenditure by the USDA, the U.S. Cooperator, and the third-party foreign firm or government. The expenditure data were divided by the Consumer Price Index (1967 = 100) to place the expenditures on a constant (inflation-adjusted) basis. The nominal annual exchange rate of each country's local currency per U.S. dollar was collected from various issues of the United Nations statistical yearbooks. (See dissertation by Solomon for an appendix containing the raw data and sources.)

The U.S. market share of cotton for the sample periods ranges from 26 percent in Hong Kong to 89 percent in South Korea. The data for the recent five-year period (1981-85) indicate a general decline in U.S. market share in the region.

Table 1 summarizes the market share of U.S. cotton in the various Pacific Rim countries for the sample periods 1965-85 and 1981-85. The U.S. market share for the sample periods ranges from 26 percent in Hong Kong to 89 percent in South Korea. The data for the recent five-year period (1981-85) indicate a general decline in U.S. market share in the region. The notable exception is Japan, where U.S. market share increased from 33 percent to 41 percent.

U.S. expenditures (in 1967 dollars) on export promotion of cotton in the region show an average annual expenditure for the sample periods ranging from $8,730 in Taiwan to $419,000 in Japan (Table 2). The data for the more recent time period (1981-85) indicate an increase in promotion expenditures in Japan, South Korea, Taiwan, and Hong Kong and a decrease in the Philippines and Thailand.

TABLE 1. Market Shares of U.S. Cotton in Selected Pacific Rim Countries, 1965-85 and 1981-85

Country	1965-85	1981-85
Japan	0.33	0.41
South Korea	0.89	0.73
Taiwan	0.53	0.36
Hong Kong	0.26	0.20
Philippines	0.78	0.58
Thailand	0.49	0.34

TABLE 2. U.S. Export Promotion Expenditures on Cotton in Selected Pacific Rim Countries, Annual Averages 1965-85 and 1981-85

Country	Period of Promotion	Annual Average Expenditure	
		1965-85	1981-85
		- - - - - 1967 Dollars - - - - -	
Japan	1965-85	419,000	667,000
S. Korea	1971-85	115,000	181,000
Taiwan	1971-85	8,730	19,050
Hong Kong	1973-85	17,900	33,500
Philippines	1965-85	59,000	20,000
Thailand	1971-85	54,000	49,500

ECONOMETRIC RESULTS

A summary of the econometric estimates for equation (5) is presented in Table 3. In general, the estimation results are satisfactory. Price and exchange rate coefficients are uniformly negative in sign, are in agreement with theory, and are significant at the 5 percent level in all cases but one. The elastic responses to price indicated in Table 3 highlight Grigsby and Dixit's point that the effectiveness of U.S. export promotion will hinge on changes in domestic agricultural policies that would make U.S. products more price competitive in world markets.[2]

The adjustment coefficients associated with the lagged dependent variable all lie on the unit interval as required for stability and are significant for three of the six countries. The R^2's range from .75 for Hong Kong to .89 for the Philippines. These R^2's are higher than those obtained with simpler versions of the Armington model (e.g., the Armington model for cotton estimated by Duffy, Wohlgenant, and Richardson have R^2's ranging from .21 to .59). The high R^2's, coupled with the overall high incidence of significance of the estimated coefficients and general lack of serial correlation in the residuals, suggest the extended model as specified here offers potential improvement in explanatory power over the basic Armington specification.

The export promotion variable is significant at the 10 percent level or better in four of the six countries (Table 3). The estimated response elasticities, although not strictly comparable to promotion elasticities based on models having quantity (rather than market share) as the dependent variable, seem reasonable in that the magnitudes are small (i.e., generally closer to zero than to one). For example, export

TABLE 3. Estimated Market Share Equations for U.S. Cotton in the Pacific Rim, Extended Armington Model, Based on 1965-85 Annual Data

Country	Estimation Procedure	Constant	Lagged Market Share	Price Ratio	Exchange Rate	Export Promotion	R^2
Japan	GLS	0.77 (0.49)	0.53** (2.71)	-2.82** (-4.13)	-0.53** (-2.29)	0.25** (1.99)	.85
S.Korea	OLS	1.56** (4.23)	0.18** (2.00)	-2.96** (-6.22)	-0.29** (-4.46)	0.04** (3.35)	.83
Taiwan	GLS	0.60 (0.08)	0.19 (0.71)	-2.31** (-2.76)	-0.02 (-0.54)	-0.44 (-0.21)	.80
Hong Kong	OLS	1.59 (1.58)	0.08 (0.45)	-4.11** (-2.98)	-2.01** (-3.21)	0.19** (3.40)	.75
Philippine	OLS	0.30 (1.14)	0.81** (2.28)	-9.72** (-6.97)	-0.31** (-2.59)	0.05* (1.45)	.89
Thailand	OLS	5.24** (2.73)	0.12 (0.24)	-3.37** (-2.91)	-2.14** (-3.00)	0.04 (0.87)	.75

Note: Asterisks indicate significance at the 5 percent level (**) and 10 percent level (*).

OLS and GLS indicate the equation was estimated, respectively, by ordinary least squares or by generalized least squares to correct for first-order serial correlation.

Figures in parentheses are t-statistics.

promotion elasticities for soybeans estimated by Williams (based on a quantity-dependent linear model) range from 0.02 to 0.08. The long-run export promotion elasticity for Australian wool in the United States estimated by Dewbre, Richardson, and Beare from household panel data (using quantity as the dependent variable) is 0.086. The long-run (market share) export promotion elasticities for cotton estimated in this study, obtained by dividing the coefficients of the export promotion variable in Table 3 by one minus the estimated coefficients of the lagged dependent variable, are 0.53 (Japan), 0.045 (South Korea), 0.21 (Hong Kong), and 0.26 (the Philippines). Interpreted literally, these elasticities imply that if export promotion expenditures for cotton in the selected Pacific Rim countries were to increase 10 percent (in 1967 dollars), *ceteris paribus*, the U.S. market share of cotton would increase 0.45 percent to 5.3 percent depending on the country.

MODEL SIMULATION

The foregoing econometric results suggest export promotion affected the market share of U.S. cotton in all but two of the countries studied. For those countries with a positive effect, the model was simulated to determine the effect of the promotion program on market share and to estimate marginal returns. Specifically, the equations in Table 3 were converted to two dimensional representations of market response by collapsing all variables but advertising into the intercept and replacing the export promotion coefficients with the respective long-run parameter values (for details, see Solomon, p. 104f). Market share impacts were then evaluated by first setting the promotion variable equal to the mean level of spending over 1981-85 in the respective country and calculating the market share consistent with this level of spending. Then the promotion variable was set equal to the highest level of spending over the 1981-85 period and a second measure of market share was obtained consistent with this higher level of spending. The difference between the simulated market shares at the mean and high levels of spending was taken as an estimate of the

Export promotion of cotton in the Pacific Rim subsidized by the U.S. government appears to have been successful. Measurable increases in market share attributable to advertising were estimated for Japan, South Korea, Hong Kong, and the Philippines -- countries representing the bulk of the promotion effort in the region over the sample period.

TABLE 4. Increases in U.S. Market Share and Marginal Returns from U.S. Promotion of Cotton in Selected Pacific Rim Countries, 1981-85

Country	Average U.S. Cotton Exports	Estimated Increase in Market Share Attributable to Promotion	Estimated Marginal Returns to Promotion
	(million tons)	(percent)	(dollars)
Japan	699	8.2	32
South Korea	349	1.6	13
Hong Kong	193	5.0	171
Philippines	20	2.6	11

increase in market share attributable to promotion. Results show increases in market share ranging from 1.6 percent in South Korea to 8.2 percent in Japan (Table 4). Note Japan is the largest export market for U.S. cotton and receives the highest level of promotional effort (see Table 2).

Marginal returns were calculated by converting the simulated increases in market share into values using a two-step procedure. In the first step, the quantity exported implied by the market shares was obtained by multiplying the market shares simulated at each promotion level by the corresponding total cotton imports of the respective country. In the second step, the quantity figures so obtained were multiplied by the average price of U.S. cotton in the country in question to get total U.S. export revenues consistent with each level of promotion (i.e., promotion at the mean level of expenditure and at the highest level of expenditure, respectively, for the 1981-85 period). Marginal revenue for each country was then calculated by computing the difference in U.S. export revenues realized at the mean versus high level of promotion and dividing this difference by the corresponding difference in promotion expenditures.[3]

Extending the Armington model to include export promotion -- the major methodological innovation of this study -- gave promising results. The extended Armington model warrants further application in empirical work aimed at shedding light on the economic effects of export promotion of farm commodities.

Marginal revenues estimated by the foregoing procedure are uniformly greater than one dollar, indicating that insufficient funds were being spent to maximize profits (Table 4). Moreover, the marginal returns are not equal across countries, suggesting a different allocation of funds would have resulted in higher total returns for the amount spent. For example, the marginal return for Hong Kong is $171 compared to $11 for the Philippines and $13 for South Korea. Thus, diverting funds from the Philippines or South Korea to Hong Kong would have, according to these estimates, increased the economic efficiency of the promotion program.

CONCLUSIONS

Export promotion of cotton in the Pacific Rim subsidized by the U.S. government appears to have been successful. Measurable increases

[3]This procedure implicitly assumes the excess supply schedule for U.S. cotton in the respective country is perfectly elastic. To the extent that price supports for cotton have made the U.S. a residual supplier, this assumption may not be unrealistic, at least as a first approximation.

in market share attributable to advertising were estimated for Japan, South Korea, Hong Kong, and the Philippines -- countries representing the bulk of the promotion effort in the region over the sample period. Moreover, estimated marginal returns are positive in all countries exhibiting a positive response, indicating investment in cotton promotion in the region was profitable. The investment, however, is not optimal in the sense that greater returns could be achieved by spending more in each market or by reallocating the existing budget so that markets showing the highest marginal returns (i.e., Hong Kong and Japan) receive enhanced funding.

Extending the Armington model to include export promotion -- the major methodological innovation of this study -- gave promising results. The extended model shows greater explanatory power than previous applications of the Armington framework. In particular, relative price and exchange-rate coefficients were estimated with a high degree of statistical precision, and the estimated promotion effects seem reasonable given existing knowledge about the magnitude of responses to generic commodity promotion (e.g., see Hurst and Forker). An especially attractive feature of the Armington specification in terms of export promotion evaluation is the emphasis placed on product differentiation and market share analysis. These attributes of the model are consistent with the U.S. Cooperator Program objective, which is to increase U.S. exports of agricultural commodities in part by differentiating the U.S. product from the offerings of competing suppliers. The extended Armington model warrants further application in empirical work aimed at shedding light on the economic effects of export promotion of farm commodities.

FOOTNOTES

[1] Disagreement exists in the literature about the role of exchange rates in import demand and the need, therefore, to include the exchange rate as a separate regressor in the demand equation (for example, see Chambers and Just and Figueroa). The balance of the arguments seems to favor including the exchange rate, especially when modeling a period covering the 1970s, a period which saw major realignments in currencies among nations. In any case, as argued by Chambers and Just, the issue of whether or not exchange rates matter is an empirical issue appropriately addressed by conducting econometric analysis.

[2] Care must be exercised in interpreting the coefficients of the relative price variable in that these coefficients are *substitution* elasticities, not ordinary demand elasticities. The ordinary (import) demand elasticity implied by the Armington model can be computed provided information is available on the expenditure share of cotton from country j in country i and the overall demand elasticity of cotton in country i (see Duffy, Wohlgenant, and Richardson, p. 469). Ordinary import demand

elasticities in general will be smaller (in absolute value) than the corresponding substitution elasticities.

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