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

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Edited by:

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

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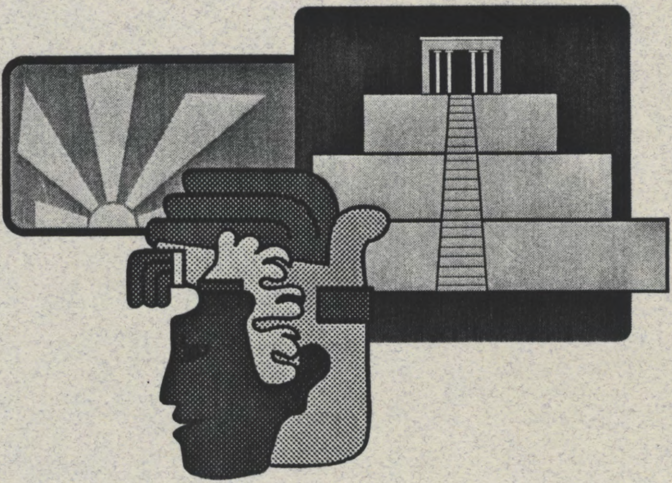

A Two-Stage Analysis of the Effectiveness of Promotion Programs for U.S. Apples

Timothy J. Richards
Pieter Van Ispelen
A. Kagan
Eric P. Thor

Introduction

Exports of high-value agricultural products (HVAP) represent a significant potential source of market growth for U.S. agriculture. Constituting only 12 percent of total exports in 1980, by 1992 they had grown to 47 percent, to 59 percent in 1995, and are forecast to represent 62 percent of all agricultural exports by the year 2000 (Dwyer, 1994; Love, 1995). Although the worldwide growth in demand is responsible for much of the growth in U.S. exports, U.S. market share has improved from 10 percent to 15.5 percent over the 1980 to 1992 period (Dwyer, 1994). While some argue that depreciation of the U.S. dollar and changes in relative prices explain the increase in market share, others claim that federally subsidized export promotion efforts are responsible.

However, considerable controversy surrounded the re-authorization of funding for the Market Promotion Program (MPP), which has since been renamed the Market Access Program (MAP). Beginning in 1955 with the Foreign Market Development (FMD), or Cooperator program, the MPP and its predecessor, the Targeted Export Assistance (TEA) program, have sought to maintain and increase U.S. market share of high-valued agricultural products by subsidizing the export promotion programs of nonprofit trade organizations, agricultural cooperatives, and cooperating private agribusinesses. Both academic and government research shows that these programs have been effective in increasing sales of U.S. products abroad. In fact, the Foreign Agricultural Service (FAS) estimates an average $16 increase in exports for every MPP dollar spent (Dwyer, 1994) so that the increase in tax revenue due to higher export sales more than covers the cost of the program. Nonetheless, critics maintain that such benefits are achieved at a cost that the public need not bear.

In particular, critics of the program claim that MPP funds go disproportionately to large firms, that exporters become dependent upon the government assistance, that too much of the program goes indirectly to foreign firms, and that the subsidized promotion merely substitutes for promotion that private firms would have undertaken anyway (GAO, 1993). Opponents refer to the program as "corporate welfare" -- subsidizing firms that are already highly profitable.

The policy question, then, is not necessarily over the size of the return to public investment, but whether or not foreign market promotion constitutes a type of "international public good", or one that the private market will fail to provide on its own.[1] Promotion is a public good in international markets only when the spillover effects, or the benefits to other nations from U.S. promotion, dominate the country-specific effects. In other words, when promotion affects aggregate consumption, but not the share of a specific country (or national brand), then promotion has aspects of a public good and individual countries will have no incentive to invest in promotion programs. Investigating the aggregate versus the country-specific effects of promotion in a single commodity case study, therefore, provides a test of whether generic promotion permits others to free-ride on U.S. government programs. U.S. apple exports are a good example.

In fiscal 1994, the Washington State Apple Commission was one of the

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1 A classic public good must be nonrival in consumption and nonexclusive in use. Nonrivalry means that, once provided, anyone can use the good without reducing the consumption of another. In this sense, promotion that benefits all apple sellers is nonrival. Nonexclusivity means that, once provided, no one can be prevented from deriving benefit from the good. Again, other apple exporters cannot be prevented from using the "halo effect" of generic product promotion to raise their own sales.

largest individual recipients of MPP funds with an allocation of $3.4 million. Although fresh apples constitute a relatively small share of the total volume of HVAP exports, growth in U.S. apple exports clearly mirrors the trend in HVAP products overall. Exporting only 12.4 million cartons, or 6.4 percent of U.S. production in 1980, U.S. growers sent 33.1 million cartons, or 12.8 percent of total production, abroad in 1995 (Washington Apple Commission, 1995). The primary markets for U.S. apples consist of Mexico (14.8 percent of the 1995 exports), Saudi Arabia (5 percent), Singapore (3.1 percent), Thailand (6.6 percent), Taiwan (14.7 percent), Hong Kong (14.7 percent), Indonesia (8.8 percent), and the United Kingdom (2.9 percent). Rapidly growing per capita incomes, growing populations, and appreciating currencies in many of these countries mean that they will likely continue to be strong consumers of U.S. apples. Whether U.S. export promotion efforts reinforce these trends to expand overall apple demand, or help give the U.S. a competitive advantage in expanding apple market share remains a key question.

Efforts to explain both aggregate and share effects of promotion exist only at the domestic industry level. In fact, many of the recent developments in the study of promotion have yet to find application in the export case. Goddard and Amuah (1989) consider a two-stage model of fats and oils demand that incorporates promotion at both stages. Furthermore, several studies apply Pollak and Wales' (1980, 1981) methods of incorporating exogenous variables into demand systems to model the effect of promotion (Chang and Green, 1989; Cox, 1992; Duffy, 1991a; and others). Few of these studies, however, maintain theoretical consistency with consumer optimization in specifying the effects of promotion. Consequently, this study presents a two-stage model of consumer decision-making that explicitly incorporates the effect of promotion on preferences at both stages. To estimate the resulting complete system of import demand equations, the paper employs Anderson's (1979) iterative two-stage estimation method. Brown and Heien (1972), Yen and Roe (1989), and Gao, et al. (1994) are examples of applications of this method applied in a nonpromotion, demand systems framework.

In applying these tools to the apple export case, the objective of this study is to determine the effectiveness of apple export promotion in increasing total import demand and U.S. market share in two major importing countries. The first section reviews the existing research on commodity promotion in general, and export promotion in particular. Section Two develops a conceptual model of import demand and promotion that differentiates between the aggregate and market share impacts of promotion. Given the restrictions of this model, the third section develops an econometric model to estimate both the first and second stage demand systems. A fourth section describes the application of this model to apple promotion in Singapore and the U.K., including a description of the data and the methods of estimation. Interpreting the parameter estimates and hypothesis tests form the basis of the fifth section, while a final section presents some conclusions and implications for policy and future research.

Export Promotion Evaluation

Due to the long history of federal export promotion programs, there is a considerable amount of research that attempts to determine its effectiveness. The bulk of this research shows that export promotion is, in general, a sound public investment. For example, Lee, et al. (1991) review empirical studies of Florida Department of Citrus' (FDOC) participation in the Cooperator program. Lee (1977), Lee, et al. (1979), and Lee and Brown (1986) each show that cooperative promotion of frozen-concentrated orange juice in Europe generates very favorable returns -- $5.50 for every dollar of promotion invested, on average. While Tilley and Lee (1981) show that FDOC promotion of orange juice products in Canada tend to increase Brazilian sales, Lee and Tilley (1983) find the opposite result, with FDOC promotion increasing sales of Florida juice at the expense of Brazilian market share. In fresh grapefruit, Fuller et al. (1992) confirm earlier findings by Lee et al. (1991) that show significantly positive promotion effects in both European and Pacific Rim markets. Similarly, Rosson, et al. (1986) find returns to cooperator promotion of apples in excess of $60 per dollar of promotion. Evaluating the performance of the more recent TEA and MPP programs, Halliburton and Henneberry (1995) indicate returns of between $4 and $9 per dollar of almond promotion into Japan, Taiwan, and Hong Kong, but report insignificant effects for South Korea and Singapore. Using aggregate HVAP market share data, Dwyer (1994) finds a short-run promotion elasticity of 0.034 and a long-run elasticity of 0.15. Among nonhorticultural commodities, Solomon and Kinnucan (1993) report promotion elasticities of between 0.045 to 0.53 for various Pacific Rim importers, while Williams (1985) finds a range of elasticities from 0.02 to 0.08 for soybean promotion. Despite the almost uniformly positive empirical evidence on the effectiveness of promotion, few studies estimate how much of the export increase is due to an increase in total consumption, or how much is due to an increase in market share.

Separating the competing or complementary effects of export promotion is directly analogous to determining the relative effectiveness of generic versus branded promotion by a commodity association. Ward, Chang, and Thompson (1985) and J. A. Chang (1988) argue that the effect of generic promotion is to "precipitate and remind, while brand advertising is primarily intended to persuade and reinforce." While the former tends to increase overall market size, the latter attempts to differentiate the product from its rivals.

Thus, generic and brand promotion affect demand in two different ways. One school of thought maintains that the role of promotion is to provide information to consumers regarding competing products, thus having a pro-competitive effect on the industry and increasing the elasticity of each product (Nelson, 1974; Hurwitz and Caves, 1988, Stephen, 1994). This is the generic effect. Others regard promotion as changing consumer tastes either directly through the utility function (Basmann, 1956; Dixit and Norman, 1978; Nichols, 1985) or through a household production function (Stigler and Becker, 1977; Cox, 1992). Such persuasive advertising allows firms, or, in this case, exporters, to obtain a degree of market power through differentiating their products, creating brand loyalty, or by raising the costs of entry (Das, et al. 1993). Still another theory maintains that promotion increases demand by changing consumer perceptions of a product's quality (Kotowitz and Mathewson, 1979).

In the case of export promotion, the "buy U.S. apple" message on Singapore T.V. clearly is meant as a brand promotion, but the difficulty of establishing brand loyalty for produce means that the effect of the ad may indeed be generic, or informative in nature, increasing the demand for apples from all sources. Research on alcohol promotion provides an illuminating example of this problem.

In order to avoid a ban on promoting their product, liquor producers claim that promotion merely reallocates expenditure among products within the category and does not increase liquor consumption overall. While evidence from models of U.S. liquor demand (Lee and Tremblay, 1992; Nelson and Moran, 1995) support industry claims, others show that the same is not necessarily true in Canada (Fuss and Waverman, 1987), nor in Europe (Duffy, 1991a, 1991b, 1995; Selvanathan, 1989). Although these studies are cast as tests of the Galbraithian hypothesis, they only test one part of the theory -- the ability of promoters to influence the inter-firm or inter-country allocation of demand, and thereby ignore the aggregate effects (Duffy, 1991b, 1995; Baye, et al., 1992).

Testing the influence of promotion at the share and aggregate levels requires a two-stage model of demand similar to Goddard and Amuah (1989). In an import-demand context, two-stage budgeting assumes that consumers first allocate their income between imports of a good and all other goods, and then allocate their import expenditure among source countries at the second stage (Armington, 1969). Consider a simple two-stage import demand model. In the first stage, the aggregate per capita expenditure on imports depends upon a price index for the import, price indices for all other goods, income per capita and promotion:

$$X_I = X_I(P_I, P_J, Y, A); \qquad (1)$$

where X_I is the total import expenditure on good I, P_I is an index of the price of good I, P_J is a similarly constructed price index (or vector of indices) of the alternative goods to I, Y is the total income level, and A is the amount spent on promoting good I. The level of expenditure provides a link to the second stage problem of allocating between various sources of good I.

In general notation, the second stage model shows how consumers allocate total expenditure on good I between alternative import sources. The market share of the ith country is:

$$(2) \qquad w_i = w_i(p_i, p_j, A, P_I, X_I)$$

where w_i is the share of total import expenditure of the ith country, p_i is the price of the good from country i, p_j is the price from country j, and X_I, P_I, and A are defined above.[2] Unlike single stage, or conditional import demand models, the effects of prices on each country's share must reflect the endogeneity of the second stage expenditures on group I. Goddard and Conboy (1993) recognize the effect of promotion on both stages of demand in deriving expressions for the own price elasticity:

$$(3) \qquad \epsilon_i = \frac{\partial w_i}{\partial p_i}\frac{p_i}{w_i} + \left(\frac{\partial w_i}{\partial X_I}\frac{X_I}{w_i} + 1\right)\frac{\partial X_I}{\partial p_i}\frac{p_i}{X_I} - 1.0;$$

Equation (3) shows that price changes influence a country's imports both through a market share effect, and an aggregate expenditure effect. Promotion has a similar effect on both the share and size of the market:

[2] Writing the allocation equations in share form implies that the quantity of the ith good is given by $q_i = w_i(X_I/p_i)$.

$$(4) \qquad \epsilon_A = \frac{\partial w_i}{\partial A}\frac{A}{w_i} + \left(\frac{\partial w_i}{\partial X_I}\frac{X_I}{w_i} + 1\right)\frac{\partial X_I}{\partial A}\frac{A}{X_I}.$$

Conceptually, therefore, it is possible for promotion to have both aggregate and share effects. However, the question of the relative importance of each is an empirical one. Consequently, the next section develops an empirical model to test the Galbraithian hypothesis, and to show the specific way in which promotion affects market demand curves. This development also explains the empirical restrictions of two-stage budgeting. Specifically, for this method to produce valid estimates of the two-stage parameters, price indices for the broad product groups at the first stage must be "perfect price indices." The following section describes the conditions under which these indices are perfect, and presents a specific econometric model that meets these conditions.

Econometric Model

Although the Armington (1969) model of import demand remains a popular way of representing import demand as a two-stage budgeting process, empirical applications of this approach still estimate conditional, or second stage, demand systems (Sarris, 1983; Figueroa and Webb, 1986; Babula, 1987; Duffy, et al., 1990; Ito, et al., 1990; Davis and Kruse, 1990; Yang and Koo, 1993 and others). Estimating only the final stage of this process does not explain the total amount spent on imports from all countries. Furthermore, the Armington approach makes two assumptions that are untenable and likely to bias its econometric results. Namely, the Armington model assumes separability between product sources, and its construction implies homotheticity of the conditional import demand functions (Alston, et al., 1991). Many demand systems are able to encompass the source differentiation logic of Armington, while avoiding the inherent problems of the Armington model itself.

Of these models, the Rotterdam of Theil (1976) has seen extensive use in import demand modeling (Theil and Clements, 1978; Lee, et al., 1990; Sparks, 1991, Seale, et al., 1992; Zhang, et al., 1994). Alternatively, Deaton and Muellbauer (1980b) outline several advantages of their AIDS model, chief among these being its theoretical consistency and flexibility. Many import demand models employ the AIDS, either in the nonlinear, or linear approximation version (LAIDS) (de Gorter and Meilke, 1987; Haden, 1990; Heien and Pick, 1991; Arnade, et al., 1994; Yang and Koo, 1994; and Davis, 1995). Primarily because of the theoretical advantages of a systems approach, each of these models have seen extensive application to promotion as well.

Despite the fact that the Linear Expenditure System (LES) forces its products to be net substitutes and imposes a proportionality between own price and expenditure elasticities, Chang (1988), and Chang and Green (1989) use this approach to estimate the effects of promotion. Similar problems exist when using the Rotterdam model to incorporate promotion as it constrains the price and promotional elasticities to be proportional to each other -- a result with no *a priori* reason to be true. Nonetheless, Cox (1992) argues that its linearity and robustness make it especially attractive for the analysis of promotion. (Duffy, 1987; 1991b, 1995; Selvananthan, 1987; Aviphant, et al., 1988; Lee and Brown, 1992).

On the other hand, the AIDS model has seen extensive recent application modeling the effect of promotion (Green, 1985; Chang, 1988; Green, et al., 1991; Goddard and Cozzarin, 1992; Chang and Kinnucan, 1992; Baye, et al., 1992; Duffy, 1991a, 1995; Rickertsen, et al., 1995; and others). However, many of these authors report less than satisfactory results from the AIDS model with promotion as an argument.[3] One reason for this lack of performance may be due to the focus on the second stage problem. In the case of export promotion, estimating a

[3] Such findings are not unanimous, however, as Green, et. Al. (1995) use Pollak and Wales' (1991) Likelihood Cominance Criterion test to show that the AIDS model provides the best fit for their particular data set.

conditional AIDS model of U.S. market share may provide valuable information on the strategic effectiveness of promotion, but such an approach ignores the possible market expansion effect. An AIDS model is, however, valuable as part of a two-stage demand model that accounts for this effect.

While they use a translog form rather than the AIDS, Goddard and Tielu (1988) and Goddard and Amuah (1989) estimate two-stage demand models. Several authors discuss both the theoretical and empirical attractiveness of this approach (Brown and Heien, 1972; Blackorby, et al., 1978; Yen and Roe, 1989; Michalek and Keyzer, 1992; Gao, et al., 1994). First, if consumers do indeed allocate expenditures according to a "utility tree" process, then their decisions should be modeled directly and in a way that is consistent with the underlying restrictions implied by constrained utility maximization. Second, estimating both conditional and group demands avoids the misspecification bias created when group expenditure is estimated with fixed price indices. Third, partitioning the empirical problem into several related subproblems allows the analysis of a far more complete demand system. Fourth, and the most important for the present application, the method allows nested testing of the difference between aggregate and share effects of demand shifting variables, namely, promotion. Exactly how promotion enters such a demand system and the specification of the functional form at each stage are both matters of considerable debate.

To be consistent with two-stage budgeting, consumer preferences must adhere to a rather restrictive structure. Blackorby, et al., (1978), following Gorman (1959) define the conditions for the existence of group price aggregates. Specifically, the utility function must be either homothetically separable, which means that the first stage utility function is weakly separable and the subutility functions homothetic, or its indirect analogue must be strongly separable into Generalized Gorman polar forms (Deaton and Muellbauer, 1980a). Examples of the former approach include Jorgenson, et al., (1988), Michalek and Keyser, (1992); and Gao, et al., (1995), while Brown and Heien, (1972); Blackorby, et al., (1978), and Yen and Roe, (1989) represent applications of the latter. However, homothetic separability is undesirable econometrically as it implies the second stage income elasticities will all be unitary. Therefore, adopting the second alternative, preferences are written in terms of the Gorman polar form of the indirect utility function as:

$$(5) \qquad v_G(m_G, p_G) = F_G[m_G / b_G(p_G)] + a_G(p_G)$$

where F is a monotone increasing function, m is the expenditure on group G, and a, b are functions of the group price index. The direct total utility function is additive between the product groups so that;

$$(6) \qquad u = \sum_G \phi_G(q_G),$$

for subutility functions ϕ defined over the commodity groups. Although this additive form means that products within a certain group are only related to products in other groups through the expenditure term, if they are truly separable, then this assumption is of no consequence. Generating estimable demand functions at both stages requires the specification of specific functional forms that are consistent with both (5) and (6) above.

Again to maintain consistency with two-stage allocation, the first stage is block additive in the subgroup commodity indices. This suggests that preferences take a Gorman polar form as in the expenditure function:

$$(7) \qquad e(u,P) = a(P) + b(P)u,$$

where U is total utility, P is the vector of price indices, and a and b are concave, linearly homogeneous functions of the prices. Applying Shephard's Lemma to (7) provides expressions for the commodity group demands:

$$(8) \qquad Q_I(P, Y) = a_I(P) + b_I(P)\left(\frac{Y - a(P)}{b(P)}\right),$$

where Q_I is the demand for the I^{th} commodity group, and a_I and b_I are derivatives of a and b with respect to the I^{th} product price. Following Deaton and Muellbauer (1980), let $a(P) = \sum P_K \Psi_K$, and $b(P) = \Pi P_I^{B_I}$, so that (8) yields a Linear Expenditure System (LES) of the form:

$$(9) \qquad X_I = P_I Q_I(P, Y) = \Psi_I P_I + B_I\left(Y - \sum_J \Psi_J P_J\right).$$

where X_I, is the expenditure on product class I, Y is per capita income, and Ψ_I measures the "subsistence" amount of expenditure on good I.

The first stage LES can capture the aggregate effects of commodity promotion through Pollak and Wales' (1980, 1981) "translation" or "scaling" methods. Although these approaches are essentially *ad hoc*, Cox (1992) derives a theoretical basis for translating and scaling within a household production framework. Translation in the LES implies that the augmenting variable essentially reduces supernumerary income. While this interpretation is convenient econometrically, it does not describe the theoretical effects of promotion outlined above.

Rather, if promotion either provides information or changes consumer preferences, the effect is more akin to Pollak and Wales' scaling process. Chang and Green (1989) apply a scaling approach to an LES model of promotion with five broad food categories. Scaling multiplies prices by a "scaling function": $m_i = M_i(A)$, that defines the relationship between a certain exogenous variable, promotion in this case, and the effective price of the good, where M is the scaling function and A is the level of advertising. Defining the scaling function as:

$$\textbf{(10)} \qquad M_I = 1 + \theta_I(A_I/P_I)\ln P_I,$$

and multiplying prices in a(P) above by m_i gives the expenditure function:

$$\textbf{(11)} \qquad e^*(u,P,A) = \sum_I P_I(1 + \theta_I(A_I/P_I)\ln P_I)\Psi_I + u\prod_I P_I^{B_I}.$$

Applying Shephard's lemma to (11), multiplying by P_k, and substituting for u provides the aggregate level demands in expenditure form as functions of prices, advertising, and income:[4]

$$\textbf{(12)} \qquad X_I = P_I Q_I = P_I\Psi_I + \theta_I\Psi_I A_I + B_I\left(Y - \sum_J \Psi_J P_J\right).$$

For this equation to be part of a system of demand equations that is consistent with constrained utility maximization, all $B_I \geq 0$, $\Sigma B_I = 1$, and $Q_I \geq \Psi_I \; \forall \; I$ (Deaton and Muellbauer, 1980). A similar approach introduces promotion into the second stage demand system.

Specifically, write the second stage preferences in terms of a PIGLOG expenditure function:

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[4] Notice that this form represents a simplification of Chang and Green's (1989) LES demands in that advertising enters as an intercept term instead of a slope-shifter. Consequently, advertising in this form does not affect the own-price elasticity as in Chang and Green.

$$(13) \qquad \ln e(u,p) = f(p) + g(p)u,$$

for some functions f and g and level of utility u. Deaton and Muellbauer (1980) specify f(p) as a translog price index, and g(p) as Cobb-Douglas:

$$(14) \quad f(p) = \alpha_o + \sum_i \alpha_i \ln p_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j, \quad g(p) = \beta_o \Pi p_i^{\beta_i},$$

Substituting these expressions into the expenditure function (13) and applying Shephard's Lemma provides a second level AIDS. In a trade context, Yang and Koo (1995) term this type of system a Source Differentiated AIDS (SDAIDS) wherein consumers allocate within group expenditure among imports from each source country according to the share equations:

$$(15) \qquad w_i = \alpha_i + \sum_j \gamma_{ij} \ln(p_i) + \beta_i \ln(X_A/P_A),$$

where w_i, is the import share of country i ($p_i q_i/X_A$), p_i is the price from country i, X_A is the amount of expenditure on the A commodity subgroup, and $\ln P_A$ is a Stone price index for this group such that $\ln P_A = \sum_i w_i \ln p_i$. Note that this specification results in the linear AIDS (LAIDS).[5]

There are several methods of incorporating promotion into the LAIDS specification. Chang (1988), Duffy (1991a, 1995), Green, et al. (1991), Baye, et al. (1992), Rickertsen, et al. (1995) follow Deaton and Muellbauer by allowing the α_i in (15) to vary linearly with the log of advertising expenditure. Alternatively, Green, et al. (1991) and Goddard and Cozzarin (1992) derive a version of the

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[5] Although many studies either use the lagged values of the shares (Eales and Unnehevr, 1988), or the average value of the shares (Haden, 1990) in order to avoid simultaneity problems, this paper obviates that problem by using a simultaneous estimation procedure.

LAIDS that includes advertising as a price-scaling factor. To see this, scale the price terms in $f(p)$ above by the function $m_i(A_i) = A_i^{\delta_i}$, such that the expenditure function becomes:

$$\text{(16)} \quad \ln e(u,p) = \alpha_o + \sum_i \alpha_i \ln\left(p_i/A_i^{\delta_i}\right) + \frac{1}{2}\sum_i\sum_j \gamma_{ij}\ln\left(p_i/A_i^{\delta_i}\right)\ln\left(p_j/A_j^{\delta_j}\right) + u\beta_o \prod_i p_i^{\beta_i}.$$

Applying Shephard's lemma in the usual manner to the expenditure function provides the Hicksian (compensated) demand curves in share form:

$$\text{(17)} \quad w_i = \alpha_i + \sum_j \gamma_{ij}\ln p_j - \sum_j \gamma_{ij}\delta_j \ln A_j + \beta_i \ln(X_A/P_A),$$

where Stone's price index again approximates ln P_A. Blanciforti and Green (1983) discuss the problems inherent in estimating the LAIDS specification. For the second stage model to be consistent with utility maximization, homogeneity requires $\sum_j \gamma_{ij} = 0$, symmetry requires $\gamma_{ij} = \gamma_{ji}$, and adding-up requires $\sum_i \alpha_i = 1$, $\sum_i \beta_i = 0$, and $\sum_i \gamma_{ij} = 0$. While the homogeneity and symmetry restrictions can be imposed and tested, the adding up restrictions are implicit in the estimation procedure. Adding up also requires that the sum of the promotion effects be zero ($\sum_i \delta_i\gamma_{ij} = 0$) and homogeneity requires the sum of the own and cross-promotion effects be zero within each share equation: $\sum_j \delta_i\gamma_{ij} = 0$.

Chang and Kinnucan (1992) derive a third restriction on the promotion parameters that results from introducing an exogenous variable into a system of uncompensated demands. Differentiating q_i with respect to promotion gives:

$$\text{(18)} \quad \frac{\partial \bar{q}}{\partial \bar{A}} = -1/\lambda K V,$$

where $\bar{q}$ is the vector of uncompensated demands, $\bar{A}$ is the vector of promotion values, λ is the marginal utility of income, K is the Slutsky substitution matrix, and V is the matrix with element $\partial^2 U/\partial q_i \partial A_j$. In other words, promotion in the second stage model can only reallocate sales between countries, whereas promotion can increase total expenditure at the first stage.

Recognizing the interdependence of demand between each stage, Goddard and Conboy (1993) provide expressions for the total price elasticity, promotion elasticity, and expenditure elasticity. In terms of the parameters of the model above, the own-price elasticity becomes:[6]

$$(19)\quad {}_{i} = \left(\frac{\gamma_{ii}}{w_i} - \beta_i\right) + \left(\frac{\beta_i}{w_i} + 1\right)\left(\frac{\Psi_I w_i P_I}{X_I}\left(1 - B_I\right)\right) - 1.0,$$

while the cross price elasticity is:

$$(20)\quad \epsilon_{ij} = \left(\frac{\gamma_{ij} - \beta_i w_j}{w_i}\right) + \left(\frac{\beta_i}{w_i} + 1\right)\left(\frac{\Psi_I w_i P_I}{X_I}\left(1 - B_I\right)\right).$$

Again in general notation, the promotion elasticity with the LES/AIDS specification must take into account both the share and aggregate effects:

$$(21)\quad \epsilon_{i,A_i} = \left(\frac{\delta_i}{w_i}\right)\left(1 - \beta_i \ln p_i\right) + \left(\frac{\beta_i}{w_i} + 1\right)\left(\frac{\theta_i A_i}{X_I}\right).$$

6 If the share equations retain the nonlinear translog price index, then the price elasticites are functions of the level of promotion. However, if Stone's price index is used for ln P_A, as is the case here, then the price elasticities are not functions of the level of promotion, and the nonlinear AIDS elasticities should not be used.

In calculating these elasticities, prices, budget shares, promotion amounts, and expenditure levels in (20) and (21) are each evaluated at their respective means. The following section describes each of these variables and explains the two-stage estimation method in detail.

Data and Methods

Although the U.S. exports apples to dozens of countries each year, the focus of this analysis is on two of the largest recipients of MPP funds, Singapore and the United Kingdom. By focusing on these countries, the study not only evaluates the effectiveness of a significant amount of expenditure, but also provides a comparison of the structure of demand between a European and a Pacific Rim market.[7]

Data on Singapore and U.K. apple import quantities and values are from the *United Nations Commodity Trade Statistics* for the years 1962-93. Although studies document some problems with these data, including nonreporting, biased reporting, and inconsistent reporting (Gehlhar, et al., 1992), the U.N. data are somewhat unique in that they provide an exhaustive record of produce imports from each source. Import quantities are in metric tons, while values are on a cost-insurance-freight (CIF) basis in U.S. dollars from the importer's perspective.

Dividing total import values by quantities produces a unit-value index that proxies an actual price variable. Many claim that such indices contain serious measurement errors (eg. Kravis and Lipsey, 1974) which may cause estimation bias. However, Shiells (1991) reports no significant difference between elasticity estimates from a highly accurate BLS importer survey database and estimates from

[7] Other large importers in which U.S. export associations spend MPP funds include Thailand, Mexico, Malaysia, and the Netherlands. These are not included in the application as a consistent data set was not available for each. Hong Kong and Canada are two of the largest markets for U.S. apples, but public market promotion funds are not used in these markets and so they are not included in the study.

BLS unit-value indices. Therefore, the problems with these data should not be ignored, but evidence suggests that they may be minor for all countries in general, and developed economies in particular.

For each importing country, the list of exporters includes all those countries with a significant (> 10 percent) share of the import market over the last ten years. This criterion includes all those in the market during the most active period of U.S. export promotion (1986-93). After determining the list of significant exporters, remaining imports are attributed to the "rest of the world." Whereas consumers allocate their import expenditure between source countries at this stage, at the first level consumers allocate their income between broad commodity groups.

These groups consist of other fruit imports (grapes, oranges, and bananas), and all other goods. The U.N. data provide price and quantity data on each of the other fruit imports, while the CPI for each importer proxies the price index for all other goods. The CPI data are from the *IMF Financial Statistics* data base. The IMF also provides the data for the total national income, population, and exchange rate of the local currency for U.S. dollars.[8] Export promotion expenditure amounts are from the Foreign Agriculture Service (FAS), USDA for the years 1986-1993. Although the cooperator program has been in existence since 1955, the level of funding under this program is insignificant compared to the TEA/MPP amounts. This assumption appears to be a strong one given the results of Rosson, et al. (1986), but Washington Apple Commission officials suggest that the assumption of no funding prior to 1986 is valid for practical purposes. Including all of these variables, the data set provides 31 observations with which to estimate the econometric model.

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[8] Exchange rates are unnecessary at the second stage as they would simply scale the price from each country by the same constant value each year. However, exchange rates in the first stage influence the allocation between apple imports and all other domestic goods.

Yen and Roe (1979) and Gao, et al. (1995) discuss Anderson's (1979) iterative method of estimating two-stage demand systems. Specifically, estimates of the parameters of both stages are found by using the fitted values for one stage as data in the next, and then iterating until no improvement in the likelihood function of the second stage occurs. To begin, the procedure calculates fitted values of the commodity expenditure using the first stage, or broad commodity group, estimates. Substituting these expected levels of expenditure into the second stage share equations allows the estimation of the share parameters. The procedure then calculates a new value of the Stone price index for the commodity of interest using the fitted share values from the second stage estimates. Reestimating the first stage model with the new price index provides a new value for expected expenditures. After several such iterations, the resulting price index approximates a perfect price index. Convergence of the system occurs when the likelihood function of each stage changes by less than 0.001, and ensures that the estimates are consistent. Because the first stage consists of only the apple equation, the LES estimates are obtained using nonlinear least squares, while estimates of the full LAIDS model use the iterative seemingly unrelated least squares (ITSUR) algorithm in SHAZAM. For both countries, the process converges after eight iterations of the entire system.[9]

Results and Discussion

This section presents the results from estimating the structure of import demand and evaluating the effectiveness of U.S. export promotion with the LES/LAIDS system. For each country, the discussion considers the second stage results prior to the first stage results and the total elasticity measures. Presenting the results in this order allows the study to demonstrate the relationship between structural (or price and income) elasticities and the effects of U.S. promotion. With a two-stage approach, the structural estimates provide information on not only the size and growth potential of the apple market, but also determinants of the U.S.

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[9]Using fitted values from each stage as regressors in the other stage produces consistent parameter estimates, but because the fitted values are estimated with error at each stage, the covariance matrices are biased. However, Hoffman (1987) provides evidence that such bias is small.

share of the market. Results from estimating the United Kingdom model follow those using the Singapore data.

Singapore Results

The first set of tests using the Singapore model concern the consistency of the second stage model with the theoretical demand restrictions, namely homogeneity and symmetry. Similar tests also assess the effectiveness of promotion at both the first and second stages. A third test determines the significance of the "spillover" effect of U.S. promotion onto the market share of rival exporters. The test statistic in each case is the corrected likelihood ratio (CLR) as in Rickertsen et al. (1995), where the model is restricted under the null hypothesis and unrestricted model under the alternative. Table 1 shows the values of the LR statistic for each test.

These results show that the data reject homogeneity at the 5 percent level quite strongly, and marginally at 1 percent. This result suggests that perhaps the AIDS model may not be the proper representation for input demands, or that some other misspecification exists (Green et al., 1991). With a critical value of 25.00, however, the data fails to reject symmetry. Despite rejecting homogeneity, subsequent hypothesis tests retain both the symmetry and homogeneity restrictions in order to maintain theoretical consistency. These tests consider the market expansion and the market allocation effects of promotion.

Table 1. Tests of Theoretical Demand Restrictions and Promotion Effects: Singapore

Model	LLF Value	CLR Statistic[1]
Homogeneity and Symmetry	435.095	Null
Homogeneity only	451.175	21.708
Symmetry only	448.674	18.397
No first stage promotion[2]	-338.706	4.058
No second stage promotion[3]	418.400	22.619
No spillover effects	419.678	20.887

[1] The CLR statistic is chi-square distributed with q degrees of freedom, where q is the number of restrictions. The critical value for q = 6 at a 5 percent level is 12.59, for q = 15 is 25.00, for q = 5 is 11.07. The CLR statistic corrects for the bias of the LR statistic in small samples and is given by: $CLR = \frac{2(T-k)}{T}(L_U - L_R)$ where T is the number of observations, k is the number of regressors, L_U is the unrestricted log likelihood value, and L_R is the restricted log likelihood value.

[2] For the first stage test, the unrestricted LLF value is -335.511.

[3] In this case, the restricting the promotion effects to zero represents the null hypothesis, whereas the base model above is the alternative.

Testing for the aggregate effects of promotion compares the unrestricted value of the first stage log likelihood function to its value with the promotion parameter restricted to zero. Producing a CLR statistic of 4.058, this test marginally rejects the null hypothesis of no aggregate effect. In other words, U.S. export promotion increases the total amount of expenditure by Singapore consumers on all apple imports. Tests of the market allocation effect maintain that, under the null hypothesis, U.S. export promotion has no effect on the share of any exporting country. With a critical value of 12.59, the data soundly reject this hypothesis. Based on this result, it appears that promotion does have a significant reallocation effect. Next, the test for a spillover effect restricts all advertising parameters on the shares of countries other than the U.S. equal to zero. At a critical level of 3.84 (at a 5 percent level), the model again rejects the null hypothesis. Taken together, the first and second stage results provide considerable support for the Galbraithian hypothesis that promotion changes both the demand for a particular good within a product category and the demand for the category itself. Furthermore, export promotion by the U.S. changes the allocation of apple import expenditures, but the nature of this reallocation requires a closer examination of the second stage results.

Table 2. Singapore Apple Import Demand: Second Stage Parameter Estimates

	Const.	P_{AUS}[1]	$P_{N.Z.}$	P_{CHILE}	P_{FRANCE}
Aus.[2]	2.494 (3.831)**	.754 (0.740)	-0.121 (-0.271)	0.364 (0.516)	-0.718 (-0.359)
N.Z.	-1.288 (-4.234)**	-0.121 (-0.271)	0.370 (0.803)	-0.479 (-0.573)	-0.179 (-1.539)
Chile	-0.921 (-0.174)	0.364 (0.516)	-0.479 (-0.573)	0.710 (2.274)	-0.265 (-0.101)
France	-0.360 (-2.387)*	-0.718 (-0.359)	-0.179 (-1.539)	-0.265 (-0.101)	0.140 (1.816)*
U.S.	-2.267 (-3.766)**	0.493 (0.534)	-0.711 (-1.499)	-0.944 (-0.969)	0.126 (0.607)
China	1.970 (4.689)**	-0.512 (-0.842)	0.155 (0.341)	0.729 (0.743)	-0.434 (-0.251)
R.O.W.	0.459 (2.714)**	-0.008 (-0.039)	0.042 (1.656)*	-0.002 (-0.085)	0.003 (0.418)

[1] All explanatory variables are in logs in the AIDS model. Symmetry, homogeneity, and adding up are imposed on the parameter estimates.

In fact, the second stage parameter estimates in Table 2 show that U.S. promotion has the effect of increasing Chilean market share significantly, and may also increase French, Chinese, and the R.O.W. market share as well. This table also shows that the AIDS model provides a satisfactory fit to the data, given the limited number of observations, with coefficients of determination ranging up to 0.79 in the case of Chile. Although the market share results may seem surprising, their cause becomes more clear upon closer inspection of the first stage results and the price and promotional elasticities that take into account the first stage, or aggregate import-apple expenditure effects.

Table 2 (Continued)

$P_{U.S.A.}$	P_{CHINA}	$P_{R.O.W.}$	Exp.	Promo.[3]	R^2
0.493 (0.534)	-0.512 (-0.842)	-0.826 (-0.385)	-0.216 (-3.365)**	-0.236 (-0.415)	0.828
-0.711 (-1.499)	0.155 (0.341)	0.424 (1.656)*	0.143 (4.830)**	-0.980 (-0.358)	0.495
-0.944 (-0.969)	0.729 (0.743)	-0.354 (-0.550)	0.263 (0.523)	0.245 (5.120)**	0.793
0.126 (0.607)	-0.434 (-0.251)	0.307 (0.418)	0.383 (2.591)*	0.158 (1.215)	0.515
-0.781 (-0.755)	0.175 (2.377)	-0.777 (-2.577)	0.261 (4.462)**	-0.286 (-0.526)	0.605
0.175 (2.377)	-0.181 (-2.255)	0.390 (1.332)	-0.194 (-4.453)**	0.878 (0.208)	0.721
-0.078 (-2.577)**	0.039 (1.332)	-0.004 (-0.549)	-0.035 (-2.146)*	0.001 (0.892)	0.153

2 Promotion coefficients are scaled by a factor of 1×10^7 for presentation purposes.
3 t-statistics are in parentheses. A single asterisk indicates significance at a 5 percent level, while a double asterisk indicates significance at 1 percent.

Table 3 shows the results from estimating the first stage LES model for Singapore apple import expenditures.

Table 3. Apple Imports by Singapore: LES Estimates: 1962-1992

Variable	Coefficient	T-ratio[1]
Population	99186	0.5817
Exchange Rate	-57376	-2.4196*
Promotion	0.2784	2.6762**
Income	3.1195	3.4381**
P_{APPLES}	-4871.9	-1.0365
$P_{BANANAS}$	11856	1.0074
$P_{ORANGES}$	58194	2.8756**
P_{GRAPES}	-24162	-2.4565*
$P_{OTHER\ GOODS}$	-474.74	-1.4575
LLF	-335.5107	

1 Critical t-ratios at a 5 percent and 1 percent level are 1.69 and 2.46, respectively. A single asterisk indicates significance at a 5 percent level, and a double asterisk indicates significance at 1 percent.

Clearly, as the CLR test above suggests, export promotion is successful in increasing aggregate apple demand. In fact, the parameter estimate in Table 3 suggests that each dollar of promotion increases total expenditure on apple imports by $27.84. Combining the first stage and second stage results through the total elasticity expressions (19) through (21) shows the net effect of promotion on sales of each country. Table 4 presents the elasticity estimates:

First, the expenditure elasticity estimates suggest that apples from most sources are luxury goods. This bodes well for U.S. exports in the future as Pacific Rim incomes continue their rapid rise. Second, the total own-promotion elasticity of 0.058 indicates that a 1 percent increase in U.S. promotion expenditure increases U.S. exports by 0.058 percent. Although promotion does have a positive effect on exports, this effect is small given the significant spillovers to sales of other countries. In particular, the same 1 percent rise in promotion expenditure increases Chilean apple sales by 0.6 percent and French exports by 0.186 percent. Although seven regions provide a small sample from which to make conclusions, a relationship between a country's own-price elasticity and the effect of promotion is evident.

While the demand for U.S. apples is relatively price elastic (-1.44), French, New Zealand, and Chilean apples are all inelastic in demand.[10] On the other hand, U.S. apple promotion has little influence on price elastic Chinese exports. This result suggests that when promotion has a stronger generic than country or brand effect, then the greatest impact will flow to those countries experiencing the most inelastic demand. It follows from this observation that, when brand differentiation is difficult, the most successful in doing so benefit disproportionately from an overall expansion in demand. The cross-price elasticity values lend some support to this result. Whereas Australian and South African apples are substitutes for those from the U.S., French apples are not. In order to benefit from U.S. promotion, theory suggests that a trade rival's product has to be considered a good substitute for the promoted product. While this small amount of cross-sectional evidence cannot lead to firm conclusions, if a similar pattern appears in the U.K. elasticities, then these results will be strengthened.

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[10]The own-price elasticity estimates for the U.S. are similar to those reported by Seale, et al. (1992), but they find the demand for Chinese apple imports to be strongly price inelastic (-0.66). The "absolute price" version of their Rotterdam model also shows the demand for U.S. apples to be income inelastic, contrary to the results of this study.

Table 4. Singapore Apple Import Demand: Elasticity Estimates

	P_{AUS}	$P_{N.Z}$	P_{CHILE}	P_{FRANCE}	$P_{U.S.A.}$
Aus[2]	-0.706 (-2.331)*	0.092 (0.657)	0.025 (0.968)	0.017 (0.286)	0.298 (1.096)
N.Z.	-0.333 (-1.079)	-0.611 (-2.036)*	0.018 (0.328)	-0.092 (-1.197)	-0.462 (-1.460)
Chile	-0.371 (-0.502)	-0.523 (-0.698)	-0.950 (-3.378)**	0.080 (0.324)	-0.071 (-0.079)
France	-0.739 (-1.035)	-0.876 (-2.054)*	0.036 (0.374)	-0.545 (-1.967)*	0.374 (0.140)
U.S.A.	-0.109 (-0.275)	-0.268 (-1.283)	0.089 (2.017)*	0.109 (1.260)	-1.440 (-3.329)**
China	0.236 (0.580)	-0.076 (-0.265)	0.067 (1.117)	0.017 (0.159)	1.042 (2.196)*
R.O.W	0.151 (0.538)	0.622 (1.925)*	-0.029 (-0.357)	0.063 (0.667)	-0.876 (-2.348)*

1 Promotion coefficients are scaled by a factor of 1×10^7 for presentation purposes.

2 t-statistics are in parentheses. A single asterisk indicates significance at a 5% level, while a double asterisk indicates significance at 1%.

Table 4 (Continued).

P_{CHINA}	$P_{R.O.W.}$	Exp.	Promo.[1]
0.036 (0.199)	0.061 (0.923)	0.328 (1.646)*	-0.011 (-0.193)
-0.355 (-1.215)	0.302 (1.700)*	1.945 (9.319)**	0.079 (2.455)**
0.743 (0.881)	-0.612 (-0.984)	1.729 (3.367)**	0.601 (5.565)**
0.048 (0.066)	-0.256 (-0.425)	2.384 (4.396)**	0.186 (1.794)*
0.410 (1.295)	-0.222 (-1.675)*	2.113 (8.166)**	0.058 (2.125)*
-1.348 (-2.767)**	0.302 (1.656)*	-0.305 (-1.096)	-0.095 (-1.235)
0.578 (1.542)	-0.984 (-2.468)*	0.554 (2.667)**	0.048 (2.424)*

United Kingdom Results

Similar to the Singapore case, the U.K. data reject the restrictions implied by consumer optimization. Results of the homogeneity and symmetry tests appear in Table 5. As with the Singapore model, the U.K. data reject homogeneity. However, this model rejects the symmetry restrictions as well. Maintaining theoretical consistency, albeit at a cost of estimation precision, the analysis of the results proceeds with results from symmetry and homogeneity-restricted models.

Table 5. Tests of Theoretical Demand Restrictions and Promotion Effects: United Kingdom

Model:	LLF Value	CLR statistic[1]
Homogeneity and Symmetry	437.062	Null
Homogeneity only	486.826	67.420
Symmetry only	464.960	37.796
No first stage promotion[2]	-376.929	2.899
No second stage promotion[3]	421.504	21.078
No spillover effects	426.594	14.182

1 The CLR statistic is chi-square distributed with q degrees of freedom, where q is the number of restrictions. The critical value for q = 6 at a 5 percent level is 12.59, for q = 15 is 25.00, for q = 5 is 11.07. The CLR statistic corrects for the bias of the LR statistic in small samples and is given by: CLR =

$$\frac{2(T-k)}{T}(L_U - L_R)$$

where T is the number of observations, k is the number of regressors, L_U is the unrestricted log-likelihood value, and L_R is the restricted log-likelihood value.

2 For the first-stage test, the unrestricted LLF Value is -374.788.

3 In this case, restricting the promotion effects to zero represents the null hypothesis, whereas the base model above is the alternative

Table 5 also shows the results of testing the U.K. data for aggregate, market allocation, and spillover effects of export promotion. In the aggregate model, the null hypothesis maintains that there is no promotion effect on total apple import expenditures. Comparing the restricted and unrestricted LLF values produces a CLR statistic of 2.977, so this test fails to reject the null hypothesis at a 5 percent level of significance, but does reject at 10 percent. Furthermore, using the standard LR statistic also leads to a rejection of the null at a 5 percent level, so these results provide on limited support for an aggregate promotion effect. At the second stage, restricting all promotion coefficients to zero produces a CLR statistic of 21.078, strongly rejecting the null hypothesis of no impact on market allocation. Finally, restricting the effect of U.S. promotion on all other countries' shares to zero leads to a CLR value of 14.182, again leading to a conclusion that the spillover effects are indeed statistically significant. Closer inspection of the structural parameters from the second stage model provides a better understanding of the extent of the spillover and own-market share effects of U.S. promotion.

Contrary to the Singapore results, promotion has a significantly positive effect on U.S. market share in the U.K. In fact, the results in Table 6 imply that an additional $100,000 of expenditure in the U.K. increases U.S. market share by over 5 percent. However, significantly positive spillover effects also cause Australian, Chilean, and South African market share to rise as well. Despite rejecting homogeneity and symmetry, the AIDS model again produces high r-squared values, ranging from 0.91 for Australia to 0.33 for South Africa. Again, evaluation of the total effect of promotion requires a closer inspection of the first stage results.

Table 6. U.K. Apple Import Demand: Second stage Parameter Estimates

	Const.	P_{AUS}[1]	$P_{N.Z.}$	P_{CHILE}	$P_{S.AFRICA}$
Aus.[3]	7.752 (9.118)**	0.258 (0.353)	-0.996 (-0.290)	-0.242 (-0.845)	-0.102 (-1.771)*
N.Z.	0.557 (1.324)	-0.996 (-0.290)	-0.270 (-0.910)	-0.195 (-0.112)	-0.333 (-0.894)
Chile	1.613 (3.646)**	-0.242 (-0.845)	-0.195 (-0.112)	0.382 (1.692)	0.223 (0.718)
S. Africa	0.505 (0.637)	-0.102 (-1.771)*	-0.333 (-0.894)	0.223 (0.718)	0.196 (2.312)*
U.S.	1.660 (2.494)**	0.282 (0.654)	0.698 (2.512)**	-0.148 (-0.626)	0.194 (0.395)
France	-11.209 (-6.955)**	0.281 (0.428)	-0.366 (-1.314)	-0.201 (-0.590)	-0.551 (-0.964)
R.O.W.	0.123 (0.194)	0.054 (1.423)	0.039 (1.547)	0.005 (0.022)	-0.047 (-1.030)

[1] All explanatory variables are in logs in the AIDS model.

[2] t-statistics are in parentheses. A single asterisk indicates signficance at a 5 percent level, while a double asterisk indicates significance at 1 percent.

[3] Promotion coefficients are scaled by a factor of $1x10^7$ for presentation purposes.

Table 6 (Continued).

$P_{U.S.A.}$	P_{FRANCE}	$P_{R.O.W.}$	Exp.	Promo.[2]	R2
0.282 (0.654)	0.281 (0.428)	0..540 (1.423)*	-0.601 (-8.934)**	0.462 (1.997)*	0.905
0.698 (2.512)**	-0.366 (-1.314)	0.391 (1.547)	-0.393 (-1.182)	-0.194 (-1.761)*	0.597
-0.148 (-0.626)	-0.201 (-0.590)	0.537 (0.218)	-0.122 (-3.484)**	0.359 (2.883)**	0.332
0.194 (0.395)	-0.551 (-0.964)	-0.468 (-1.030)	-0.237 (-0.378)	0.347 (1.641)*	0.686
-0.580 (-0.115)	-0.801 (-1.824)**	-0.166 (-0.488)	-0.128 (-2.447)**	0.528 (3.446)**	0.828
-0.801 (-1.824)*	0.220 (1.462)	-0.562 (-1.106)	0.918 (7.225)**	-0.147 (-3.003)**	0.495
-0.017 (-0.488)	-0.056 (-1.106)	0.026 (0.632)	-0.004 (-0.078)	-0.003 (-0.179)	0.445

From the first stage estimates in Table 7, it is clear that export promotion is not only effective in increasing U.S. market share, but also the size of the market as a whole. Each dollar of U.S. export promotion increases U.K. apple expenditure by $24.72. Calculating the total elasticities provides an indication of the total effect of U.S. export promotion and the degree of spillover to other countries.

Table 7. Apple Imports by the United Kingdom LES Estimates: 1962-1992

Variable	Coefficient	T-ratio[1]
Population	-7204.8	-1.7481*
Exchange Rate	-455810	-1.9316*
Promotion	0.2472	2.6213**
Income	1277.0	2.0311**
P_{APPLES}	-231.71	-1.9285*
$P_{BANANAS}$	-477.93	-1.2163
$P_{ORANGES}$	503.61	0.9615
P_{GRAPES}	-24162.0	0.4247
$P_{OTHER\ GOODS}$	-6.4303	-1.4523
LLF		

[1] Critical t-ratios at a 5 percent and 1 percent level are 1.69, and 2.46, respectively. A single asterisk indicates significance at a 5 percent level, and a double asterisk indicates significance at 1 percent.

Table 8 shows the matrix of total price, expenditure, and promotion elasticities. Perhaps as expected, given that both the share and aggregate promotion coefficients are positive, the U.S. elasticity of promotion into the U.K. is far larger than for Singapore. However, there are still significant spillover effects to the other countries. Specifically, the positive effect on French apple exports is two-thirds the size of that to the U.S., while the impact on Chilean and South African sales are one-half and one-third of the U.S. effect, respectively. Clearly, these results reveal ample scope for free-riding behavior on the part of our trade "rivals". As in the Singapore case, the price elasticities of demand suggest a linkage between the elasticity and the amount of spillover.

Although this pattern is not as clear as the previous case, it does appear to hold in general. Besides the U.S., which exhibits nearly unit elasticity, promotion has its greatest effect on French and Chilean market share -- two countries with a very low price elasticity of demand (-0.25 and -0.429, respectively). Whereas Seale, et al. find a price elasticity for New Zealand of -0.33 with the absolute price version of their model, the LES/AIDS model estimates an own price elasticity of -1.373. Given their results and the pattern shown in this study, promotion should have a positive impact on total New Zealand sales. However, the effect of promotion is significantly negative, suggesting that countries with relatively elastic demand lose both share and volume to the beneficiaries of promotion. It is also interesting to note the strong substitute relationship between U.S. and N.Z. apple sales. When consumers regard apples from a particular source as substitutes for U.S. apples, U.S. promotion is likely to reduce the share of this competitor. Furthermore, both the Singapore and U.K. results also suggest that countries that benefit from U.S. promotion have similarly high expenditure elasticities.

In the case of Singapore, each of the countries that benefit from U.S. promotion have expenditure elasticities greater than one, except for the R.O.W. However, this relationship is not entirely uniform as the largest beneficiary, Chile, does not have the highest expenditure elasticity. With respect to the U.K. results, South Africa, France, and the R.O.W. have both positive expenditure and promotion elasticities. This relationship appears to break down in the case of the U.S. While U.S. promotion has its greatest effect on U.S. sales, the expenditure elasticity is negative. Although estimating the nonlinear AIDS model allows for the recovery of the exact effects of promotion on the elasticities, as Chang and Green (1992) suggest, the apple import demand model does not converge with such an approach.

Table 8. U.K. Apple Import Demand: Total Elasticities

Share	P_{AUS}	$P_{N.Z}$	P_{CHILE}	$P_{S.AFRICA}$
Aus.[2]	-0.584 (-0.929)	-0.660 (-0.116)	-0.162 (-0.436)	-0.255 (-1.048)
N.Z.	-0.170 (-0.569)	-1.373 (-2.90)	0.360 (0.163)	0.364 (0.210)
Chile	-0.209 (-0.856)	0.378 (0.135)	-0.429 (-1.491)*	0.278 (2.073)
S. Africa	-0.903 (-0.179)	-0.368 (-0.588)	0.605 (1.450)*	0.440 (0.119)
U.S.A.	0.969 (0.254)	1.167 (2.626)**	-0.145 (-0.477)	0.263 (1.111)
France	1.783 (3.050)**	-0.326 (1.750)**	0.297 (0.633)**	-0.253 (-0.981)**
R.O.W	.462 (1.410)	.693 (1.740)	.932 (0.299)	-0.203 (-0.965)

[1] t-statistics are in parentheses. A single asterisk indicates significance at a 5 percent level, while a double asterisk indicates significance at 1 percent.

[2] Promotion coefficients are scaled by a factor of 1×10^7 for presentation purposes.

Table 8 (Continued).

$P_{U.S.A.}$	P_{FRANCE}	$P_{R.O.W.}$	Exp.	Promo.[1]
0.779 (0.890)	0.880 (4.797)**	0.613 (2.006)*	-4.130 (-7.162)**	-0.008 (-0.248)
1.456 (2.688)**	0.841 (6.958)	0.542 (1.354)	0.372 (0.700)	-0.025 (-1.815)*
-0.156 (-0.331)	0.846 (7.283)	0.186 (0.598)	-0.549 (-1.235)	0.045 (2.808)**
0.894 (0.861)	0.385 (2.542)	0.019 (0.093)	0.897 (3.309)**	0.034 (4.563)**
-1.050 (-1.070)	0.754 (4.660)	0.354 (0.566)	-1.510 (-1..472)*	0.093 (3.177)**
-0.677 (-0.677)**	-0.250 (-0.627)	0.716 (4.237)**	3.416 (10.215)**	0.079 (5.083)**
-0.191 (-0.293)	0.750 (4.440)	-0.604 (-1.167)	0.951 (1.152)	0.015 (0.923)

Conclusions

There continues to be considerable debate over the economic desirability of publicly funded export promotion programs. Criticism usually focuses on the "corporate welfare" issue -- large firms obtaining subsidies for promotion that they would likely do anyway. However, there is also concern over the public good qualities of export promotion, or how much other countries benefit from the promotion of a good that is inherently difficult to differentiate and branded as a good that is "Made in the U.S.A."

This study develops a two-stage model of import demand for apples in Singapore and the U.K. Estimates of apple import expenditure at the first stage use a Linear Expenditure System (LES) approach where the alternative goods consist of banana, orange, and grape imports, as well as all other domestic goods. At the second stage, estimates of equations representing the market share of each exporting country are obtained with a Linear Approximation Almost Ideal Demand System (LAIDS) approach. Promotion enters each stage as an exogenous factor that scales product prices. An iterative approach provides estimates of each stage such that the price indices at the first stage are perfect price indices for the product at the second stage.

As is often the case when applying the LAIDS model, the data reject the homogeneity assumption implied by consumer optimization. Despite this outcome, the parameter estimates are well within accepted bounds and the equations provide a good fit to the data.

Results from both the Singapore and U.K. models indicate that export promotion has a significant and positive effect on the total expenditure on apples from all sources. In fact, each dollar of promotion funding returns over $20 in total world exports in each case. However, in Singapore, export promotion causes the U.S. to lose market share to other countries that free-ride on our promotion efforts. Taking both the aggregate and share effects into account, the total promotion elasticity for U.S. apples is modestly positive. On the other hand, the U.K. results show that U.S. promotion both increases the size of the total market and the U.S. share of the market. Not surprisingly, the total elasticity of U.S. promotion is relatively high. The results also suggest a relationship between the price elasticity of demand and the degree of promotion spillover.

As theory suggests, promotion is more effective the less elastic demand is. The empirical results of this study also show that export promotion by one country has its greatest effect on the exports of other countries the more inelastic other countries' demand curves are. This result suggests that if a country is able to differentiate its product successfully, then it is likely to benefit from promotion that has a large generic component due to the nature of the product as inherently hard to brand.

Although there is little U.S. exporters can do to differentiate fresh apples beyond their current efforts, as this study suggests they do in order to avoid the free-rider effect, the policy implications of this study are more broad. In particular, these results imply that to avoid the subsidization of rivals' sales, export promotion should be targeted to those products that are intrinsically easier to differentiate. This includes manufactured goods, processed foods, and products with more value-added content.

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