Advertising Traded Goods[*]

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This article focuses on returns to generic advertising for agricultural products that move freely across political boundaries, hereafter referred to as "traded goods." Traded goods represent the norm rather than the exception for the some 55 commodities covered by promotion checkoffs (Forker and Ward, pp. 102-103; Neff and Plato). Yet the scholarly literature is virtually devoid of studies that elucidate the economic impacts of advertising traded goods in any systematic fashion. Early work by Nerlove and Waugh remains the theoretical foundation for much of the literature on advertising benefit-cost analysis (e.g., see Ferrero *et al.*). Nerlove and Waugh's analysis, however, applies strictly to non-traded goods. Trade is taken into account in recent work by Piggott, Piggott and Wright and by Kinnucan and Christian, but their models assume that the promoting industry is a net exporter. In an important paper, Alston, Carman and Chalfant consider the returns to generic advertising in a small, open-economy setting, but their analysis is confined to a graphical treatment of the problem and does not consider the net importer case.

The purpose of this research is to determine the effectiveness of generic advertising in instances where the advertised good faces competition from foreign supplies and trade barriers are low or absent so that open-economy conditions prevail. The analysis builds on Nerlove and Waugh's theory of generic advertising by extending their model to the traded-good case in which a portion of the advertising cost is shared with consumers via "tax shifting" (Chang and Kinnucan). The model is general in the sense that trade status is endogenous. That is, both the net importer and the net exporter case can be analyzed with a simple redefinition of the trade variable. For the net importer case,

a parameter is included to take into account cost sharing with foreign producers when a promotion levy is imposed on imports to prevent free riding.

Following presentation of the model and comparative-static results, we apply the model to egg advertising in California to demonstrate utility. A key finding is that ignoring trade can prejudice benefit-cost ratios in favor of the advertising program. And this is true even if trade exposure is modest.

Model

Consider a competitive industry that produces a tradeable good and that advertises strictly in the domestic market. Assume further that price is determined by market forces, not the government. The industry ordinarily exports a portion of its production, but depending upon domestic supply and demand conditions, the trade status can change from net exporter to net importer. The domestic market for the industry's product is integrated with the world market so that the law of one price holds across all markets, domestic and foreign. The industry represents a sufficiently small portion of the total economy that the supply and demand for goods that are related to the industry's good through consumer preferences or production technology can be safely ignored, at least as a first approximation.

With these assumptions, and holding constant all exogenous factors that affect supply and demand except advertising, the structural model for this industry that defines initial equilibrium is:

(1) $\qquad q_D = D(p, A)$

(2) $\qquad q_S = S(p)$

(3) $q_T = T(p)$

(4) $q_T = q_S - q_D$

(5) $R = p\, q_S - \int_0^{qS} S^{-1}(t)\, dt - \Omega\, \phi\, A$

where q_D is the domestic quantity demanded, q_S is the domestic quantity supplied, q_T is the quantity traded, p is market price, A is domestic advertising expenditures, and R is net economic surplus (quasi-rent) accruing to domestic producers.

The endogenous variables in the system are assumed to be measured at the farm level, i.e., the quantity variables, q_T, q_S and q_D, are expressed in farm-equivalent units, p is the farm-gate price, and R is rent at the farm level. Thus, D is a derived demand relationship and S is a primary supply relationship.

The trade relation, T, differs in its interpretation depending on trade status. If the region exposed to the advertising ("domestic" market) is a surplus region with respect to the advertised good (net exporter), $q_T > 0$ and T is an export demand relation. If the exposed region is a deficit region (net importer), $q_T < 0$ and T is an import supply relation.

S^{-1} is the primary supply curve written in inverse form, i.e., price as a function of quantity in equation (2). The Ω term is an incidence parameter to account for "tax shifting," i.e., the hypothesis that a portion of the advertising cost is shifted to consumers when advertising funds are raised through a per-unit levy in a competitive market (Chang and Kinnucan). Ω is bounded between zero and one, and equals one when supply is fixed or demand is perfectly elastic.

Following Nerlove and Waugh, A is treated as exogenous. It appears as a shift variable in the derived demand relation, even though advertising ordinarily occurs at retail.

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Thus, we abstract from the marketing channel, a simplification that is innocuous as long as the demand elasticity is measured at the farm level and the industry's aggregate marketing technology is fixed proportions (Kinnucan, 1997), a maintained hypothesis in this study.

When the trade status is net importer, a promotion tax is frequently levied on imports to prevent free-riding. In these instances, the cost of advertising is shared with foreign producers. The ϕ parameter in (5) is the portion of the advertising funds collected from domestic producers. If no levy is imposed on imports, $\phi = 1.0$; otherwise ϕ is a positive fraction.

Analysis

The first task is to determine the effect of an increase in advertising on net producer surplus. For this purpose, express (1) - (5) in total differential form:

(1') $\text{dln } q_D = - \eta \text{ dln } p + \beta \text{ dln } A$

(2') $\text{dln } q_S = \epsilon \text{ dln } p$

(3') $\text{dln } q_T = e \text{ dln } p$

(4') $\text{dln } q_T = (q_S / q_T) \text{ dln } q_S - (q_D / q_T) \text{ dln } q_D$

(5') $dR = p\, q_S \text{ dln } p - \Omega\, \phi\, dA$

where dln x (= dx/x) is the relative change in variable x, η is the absolute value of the domestic demand elasticity, ϵ is the domestic supply elasticity, e is the price elasticity corresponding to the T function, and β (= $(\partial q_D / \partial A) (A/q_D)$) is a parameter that indicates the percent change in demand associated with a 1% change in advertising expenditures, *holding prices constant*, hereafter referred to as the "advertising elasticity." Given the negative sign in equation (1), all elasticities except e are defined to be positive. That is,

the domestic supply curve is upward sloping, the domestic demand curve is downward sloping, and adverting causes the domestic demand curve to shift to the right.

The sign of e depends on trade status. For a net exporter, $q_T > 0$ and $e = e_D$ is interpreted as an export demand elasticity. For a net importer, $q_T < 0$ and $e = e_S$ is interpreted as an import supply elasticity. In this analysis, e_D is assumed to be negative and e_S is assumed to be positive. Specifically, the excess demand function is non-increasing and the excess supply function is non-decreasing.

dR in (5') represents the change in net producer surplus (hereafter called "profit") associated with a small change in advertising expenditure. It can be seen that price enhancement is a necessary condition for an increase in advertising to be profitable. The conditions conducive to price enhancement are determined by substituting (1') - (3') into (4') and solving for dln p:

(6) $\text{dln } p = \{\beta /[(1 + k) \epsilon + \eta - k e]\} \text{ dln } A$

where $k = (q_T /q_D)$ is the "trade share." Note from (6) that regardless of trade status, under the stated assumptions an increase in advertising always increases price (unless e is plus or minus infinity). For example, if the trade status is net importer, $k < 0$ and $e > 0$, which means that $- k e$ in (6) is positive, so the total expression is positive. (Since $(1 + k)$ = $q_S/q_D > 0$, the first term in (6)'s denominator is always positive.) Similarly, if the trade status is net exporter, $k > 0$ and $e < 0$, which again produces a positive sign for $- k e$ and thus for (6).[3]

That (6) represents a generalization of Nerlove and Waugh's analysis can be seen by considering their comparable expression (p. 818, equation (5)), which, in our notation, is:

(7) $\qquad$ $\mathrm{dln}\, p = [\beta / (\epsilon + \eta)]\, \mathrm{dln}\, A.$

Comparing (6) and (7), it is evident that (6) reduces to (7) when $k = 0$. Thus, Nerlove and Waugh's analysis applies to non-traded goods only.

Both (6) and (7) are consistent in showing that advertising's price-enhancement ability increases as domestic supply or domestic demand becomes less elastic or as consumers become more responsive to the advertising. Direct inspection of (6) indicates price enhancement is facilitated by a less elastic import supply or export demand curve, as might be expected from Nerlove and Waugh's analysis for the autarky case.

Trade Share and Price Enhancement

Intuitively, one would expect an increase in trade share to diminish advertising's price-enhancement ability when advertising is confined to the domestic market. For example, in the net exporter case, an increase in export share would mean less of the total crop being exposed to the advertising, and thus a weaker price effect. This may be checked by setting $\zeta = \beta / [(1 +k)\, \epsilon + \eta - k\, e]$ in (6) and taking the derivative with respect to k to yield:

$$\partial \zeta / \partial k = \beta\, (e - \epsilon) / [k\, (\epsilon - e) + \epsilon + \eta]^2$$

For the net exporter case ($k > 0$ and $e < 0$), $\partial \zeta / \partial k$ is negative, which means an increase in export share always diminishes advertising's price-enhancement ability when advertised occurs in the domestic market. Thus, intuition is confirmed in the net exporter case.

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For the net importer case ($k < 0$ and $e > 0$), the effect of trade share on advertising's price-enhancement ability hinges on the relative magnitudes of the supply elasticities. For example, if import and domestic supply are equally elastic ($e = \epsilon$), $\partial \zeta / \partial k = 0$ and import share is irrelevant. Conversely, if import supply is more elastic than domestic supply ($e > \epsilon$), the usual case given small-nation effects and the inelasticity of domestic supply response for most agricultural products, then $\partial \zeta / \partial k > 0$. The positive derivative in this case implies that a decrease in imports (smaller negative value for k) increases advertising's price enhancement ability.

This result accords with intuition as well, but for a different reason than given for the net exporter case. In particular, in the net importer case, supply response, not advertising exposure, is the operant factor. This can be seen by noting that as import share declines, so, too, does the portion of total supply that comes from the more elastic source when $\epsilon < e$. With less quantity coming from the more elastic source, supply response is attenuated, which enhances advertising's price effect.

Fundamental Returns Equation for Traded Goods

The effect of a change in advertising expenditure on industry profit is obtained by substituting (6) into (5'), which yields:

(8) $\qquad \mathrm{d}R/\mathrm{d}A = \alpha \, / \, [(1 + k) \, \epsilon + \eta - k \, e] - \Omega \, \phi$

where $\alpha = \beta \, p \, q_{\mathrm{S}} \, / \, A$ is loosely interpreted as the "...the marginal gross revenue from increased advertising expenditures, *holding prices constant* (sic)" (Nerlove and Waugh, p. 819). (If $q_{\mathrm{S}} = q_{\mathrm{D}}$ (autarky), α reduces to $p \, \partial q_{\mathrm{D}} \, / \partial A$, in which case the interpretation is exact.) Equation (8) indicates the net effect of a small change in advertising expenditure

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on net producer surplus, taking into account supply response in the domestic market, equilibriating adjustments in the domestic and foreign markets in response to the demand increase in the domestic market, and advertising cost shifting and sharing. It is a *net* measure of marginal returns in that it takes into account the incremental cost of the advertising (see equation (5')).

From (8) it is apparent that the marginal returns are positive, zero, or negative depending on the relative magnitudes of the terms on either side of the second negative sign, as the first term is non-negative by assumption. Because the first term in essence reflects advertising's price enhancement ability, the previously discussed factors that determine price enhancement also determine profitability.

Small, Open-Economy Problem

Consider now the issue raised by Alston, Carman and Chalfant with respect to advertising in a small, open-economy. A small, open-economy situation occurs when trade barriers are absent and the crop represented by the promotion entity is too small in relation to the total volume traded to affect price. This situation arises most particularly (but not exclusively) in the case of state-based promotion efforts. For example, California producers fund a wide variety of promotion programs through marketing orders and state commissions (Carman, Cook and Sexton, p. 140), some of which are state-specific. The point made by Alston, Carman and Chalfant is that such programs may be futile in that price enhancement is problematic.

The reason why price enhancement is problematic in a small, open-economy situation is that the excess supply or demand curve is horizontal. That is, the *e* parameter

in (8) is negative infinity in the net exporter case and positive infinity in the net importer

case. In either case, (8) reduces to

$$dR/dA = -\Omega \phi,$$

which means that the industry suffers a marginal loss equal to the incidence parameter

(adjusted for cost-sharing with foreign producers, where applicable). And this is true

regardless of the demand shift associated with the advertising, i.e., the magnitude of β, a

fact that highlights the dangers of single-equation modeling of advertising returns.

Potential Biases from Ignoring Trade

[*Omitted to conserve space.*]

Optimal Advertising Expenditure for Traded Goods

Industry profits from advertising are maximized when marginal net returns are zero, i.e.,

$dR/dA = 0$ in equation (8). However, as noted by Nerlove and Waugh, an optimum

expenditure level computed in this manner is likely to overstate the true optimum in that it

ignores opportunity cost. The opportunity cost of advertising funds can be incorporated

into the analysis by defining a parameter ρ that represents the marginal return on the next-

best use of advertising funds (e.g., production research, see Wohlgenant, 1993). In this

case, industry profit is maximized when

$$dR/dA = \rho.$$

Substituting (8) into this expression and solving for A (recalling that $\alpha = \beta\, p\, q_S\, / A)$ yields

(9) $\qquad A^* = pq_S\beta\, / \,[((1 + k)\, \epsilon + \eta - k\, e)\, (\Omega\, \phi + \rho)]$

where A^* represents the advertising expenditure that maximizes net producer surplus,

taking into account opportunity cost. The optimal expenditure level varies directly with

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the factors that increase advertising's price-enhancement ability (e.g., less elastic demand or supply) and that lower the effective cost of the advertising to the domestic industry (lower opportunity cost, levy share, or incidence). Incidence is determined by supply and demand elasticities as follows:

(10) $\Omega = \acute{\eta} / (\acute{\epsilon} + \acute{\eta})$

where $\acute{\eta}$ is the absolute value of the effective demand elasticity and $\acute{\epsilon}$ is the effective supply elasticity.

The effective demand and supply elasticities depend on trade status. For the net importer case,

(10a) $\acute{\eta} = \eta$

(10b) $\acute{\epsilon} = (1 + k) \epsilon - k\, e_S,$

and for the net exporter case

(10c) $\acute{\eta} = (1 + k)^{-1} \eta - (1 + k)^{-1} k\, e_D$

(10d) $\acute{\epsilon} = \epsilon.$

In essence, trade enlarges the supply or demand elasticity facing the industry, and this affects incidence. In a closed economy ($k = 0$), the situation examined by Chang and Kinnucan, $\acute{\eta} = \eta$ and $\acute{\epsilon} = \epsilon$ and producer incidence is always 100% ($\Omega = 1.00$) when supply is fixed ($\epsilon = 0$). However, this is not necessarily true in an open economy ($k \neq 0$). In particular, as can be seen by comparing equations (10b) and (10d), producer incidence is 100% with fixed *domestic* supply only if trade status is net exporter.

In the net importer case, a portion of supply comes from foreign producers, and as long as this supply is not fixed, the effective supply elasticity (equation (10b)) is positive,

which means that a portion of the advertising tax is always shifted to consumers (unless *domestic* demand is perfectly elastic (see equation (10a)), which is not likely for agricultural products). One implication is that, *ceteris paribus*, a net importer situation may provide a more favorable environment in which to promote than a net exporter situation, at least from a cost-shifting perspective. This insight was not available from Chang and Kinnucan's analysis, as their study did not consider trade.

Equation (9) may be compared to Nerlove and Waugh's optimality condition (p. 822) for a non-traded good, which in our notation is:

(11) $\qquad A^* \big|_{\text{N-W}} = pq_S \, \beta \, / \, [(\epsilon + \eta)\,(1 + \rho)].$

Equation (9) reduces to (11) when there is no trade and producers bear the full incidence of the promotion levy, i.e., $k = 0$ and $\Omega = \phi = 1$. Thus, equations (9) and (10) represent a generalization of Nerlove and Waugh's theory of cooperative (generic) advertising.

Application

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Concluding Remarks

A basic theme of this paper is that advertising benefit-cost analysis can be improved if models take into account trade relationships. The only situation where this would not be true is when non-competitive market structures, government intervention, or other factors prevent the free flow of the advertised commodity across political boundaries. In all other situations, ignoring trade is liable to prejudice the analysis in favor of the advertising program. This may explain the preponderance of very favorable benefit-cost ratios in the

literature, as most agricultural products are traded, but few advertising studies include trade relationships.

The major contribution of this research is theory development. In particular, our analysis extends Nerlove and Waugh's theory of cooperative (generic) advertising to the case of traded goods where the advertising cost is shared with consumers through tax shifting and, where applicable, with foreign producers through advertising import levies. It builds on the work of Alston, Carman and Chalfant by putting their graphical analysis into mathematical form and by extending their analysis to the net importer case. The net importer case has some unique aspects, not the least of which is the expanded role for supply response as a determinant of generic advertising effectiveness.

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