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Promotion in the Marketing Mix: What Works, Where and Why

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EVALUATING PRIMARY PRODUCT PROMOTION: The Returns to Generic Advertising by a Producer Cooperative in a Small, Open Economy

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ABSTRACT

Studies have used a variety of criteria to evaluate the benefits from promotion and, relatedly, to prescribe optimal advertising strategy. Gross benefit measures, that do not account for the costs of the commodity, are clearly inappropriate. Allowing for international or interregional trade, or multiple outlets for a commodity (e.g., fresh and processing) may mean that net benefits are small or zero. Some questions require measures that account for other costs and benefits (such as consumer benefits and effects on taxpayers through commodity programs). This paper explores the effects of horizontally disaggregating commodity markets (into domestic and foreign and fresh and processing), and allowing for market distortions from commodity programs, on producer incentives and on measures of the private and social payoff to advertising financed by a per unit tax or check-off.

Introduction

Primary product promotion is becoming increasingly important. In California alone, farmer organizations have been spending over \$100 million per year on promotion (Carman, Green and Mandour 1992).¹ Much of this activity is funded using mandatory assessments or check-offs made possible by legislative decree, sanctioned by and using the coercive powers of the government. The legislative basis for industry-wide contributions to promotional programs includes federal and state enabling legislation for marketing orders and stand-alone legislation for particular commodities, such as the US Beef Promotion and Research Act of 1985 (and similar Acts for dairy products, pork, and potatoes) at the federal level, and commodity commissions at the state level.

Along with the growth in promotional activity, there has been a growing interest among economists and others in understanding the effects and measuring the benefits from advertising. A variety of measures have been used to evaluate the benefits from promotion and, relatedly, to prescribe optimal advertising strategy. Some studies evaluate advertising using criteria that do not correspond directly to measures that economists would advocate. For example, in some settings, a campaign might be assessed in terms of its artistic merit, or its effectiveness in terms of cognitive impacts on a target audience. In the recent agricultural economics literature, however, measures have been used that do

have economic meaning. Still, the measures are sometimes used inappropriately and occasionally the appropriate measure for a particular question has not been used.

Some studies still report measures of the effect of advertising on gross producer revenues, when clearly the effect on net revenue ought to be the criterion, and in some cases even the effect on net *producer* revenue might not be the appropriate criterion.² For instance, when advertising is financed by a check-off, or using grants from general tax revenues, it would be reasonable for the government to require that such advertising be in the public interest (i.e., with net benefits to society as a whole) as well as in the private interest of a majority of producers.³ Moreover, market distortions arising from government policies can mean that the private and social payoffs from advertising are quite different. Further, measures that may be appropriate for closed economy situations are often inappropriate in a setting with actual or potential international (or interstate) trade in the advertised commodity. Similar arguments apply to situations where multiple domestic markets exist for a given commodity – such as fresh and processing markets for milk, eggs, or oranges – and advertising applies only to a subset (usually the fresh market).⁴

A central point is that producer net benefits from advertising can arise only when the advertising leads to a rise in the producer price or average revenue (and, usually, an increase in production). This generally requires both (a) that the demand for the advertised commodity must increase, giving rise to an increase in gross sales revenue, and (b) that the *relevant* supply function slope upwards. The price will not rise, and thus there will be no gain in producer surplus, if the relevant supply is perfectly elastic – as would be the case for a small country exporter or importer of the advertised commodity, or where the demand for the processing use of the commodity is perfectly elastic, and the advertising applies to the fresh market. More generally, the issue is whether the price can rise enough for increased revenues to cover the costs of promotion, and the answer depends on the elasticity of (excess) supply of the commodity to the advertised market.

The issues of international trade, multiple end-uses, and market distortions come together in interesting ways in relation to advertising agricultural commodities. Many commodities would be unprofitable to advertise in the absence of commodity programs, because the commodities are tradeable either in fresh or processed form, and the effective supply to the advertised market is highly elastic in the absence of programs. This would be true, for instance, of most if not all of the state or provincial milk markets in the United States and Canada, where each state or province would be a price taker in the domestic and international markets for freely traded milk and dairy products. Profitable advertising is made possible by the creation of trade barriers that allow markets to be separated, both geopolitically and according to the end-use of the commodity. Fluid milk commands a premium over manufacturing milk, and it is within the powers of the milk marketing authorities to determine whether any advertising-induced increase in demand is accommodated by increase in price or an increase in volume.

In many instances, advertising competes with R&D for the use of check-off funds, a competition that advertising seems to be winning to a great extent, and commodity programs have changed the incentives for producer groups to spend money on advertising versus research. In the public policy setting, where authority is given for producer groups to tax sales in order to finance the provision of “public” goods such as advertising and research, it is reasonable to ask what is the social rate of return to advertising and to ask

whether the existence of commodity programs has distorted the allocation of resources between advertising and R&D.⁵

Evaluating the effectiveness of advertising financed by a check-off involves two elements. The first is to measure the effect of the advertising and check-off on shifting demand curves and on shifting supply curves, respectively. There is much to say about the econometric problems that are likely to be encountered in such work, and the likely implications for biases in the estimates; but we will not say such things here. We will say something about the fact that most studies do not consider the effects of check-offs in terms of the "supply response to advertising" and the implications of this response for measures of advertising effectiveness.

The second element in an assessment of advertising is to translate the measures of supply and demand shifts into measures of benefits. This second element is the focus of this paper. We illustrate the issues using simple supply and demand models in a range of settings ranging from a closed economy to various multimarket settings and including farm programs. It is a comparative-static analysis that abstracts from any dynamic, persistent effects of advertising.⁶ The effects of different measures of the cost of advertising on optimal advertising from the producers' viewpoint are shown and contrasted with measures from the literature. Finally, data on advertising intensities for commodities in California, combined with estimates of supply and demand elasticities, are used to explore propositions that follow from the theoretical analysis.

Benefits and Costs of Advertising in a Closed-Economy Model

Figure 1 shows supply and demand curves for a commodity in a closed-economy setting. In panel (a), when advertising shifts demand from D_0 to D_1 , while supply remains at S_0 , the price rises from P_0 to P_1 , quantity rises from Q_0 to Q_1 , and producers benefit by area P_0abP_1 . If the area beneath the demand curve represents the value of consumption of the commodity, and the area beneath the supply curve represents the cost of production, total economic surplus from the commodity has risen by the area between the demand curves and above the supply curve, area I_0abl_1 . Thus the consumer benefit is equal to area $I_0abl_1 - P_0abP_1$.⁷

What about the costs of advertising? In panel (b) of figure 1, a check-off of t per unit shifts the effective supply function from S_0 to S_1 , while demand remains at D_0 , the price rises from P_0 to P_1 , and quantity falls from Q_0 to Q_1 . Consumers lose surplus of area P_0abP_1 and producers lose area P_0bcd of producer surplus. This analysis is symmetric with the analysis of the welfare effects of advertising in panel (a), and, if we reverse the direction of the supply shift, is exactly the analysis for welfare impacts of a research-induced supply shift.

But there is an important difference in the case of a check-off: producers gain the revenue raised, P_1acd in panel (b). Thus the producer net benefit from the check-off is equal to area $P_0acd - P_0bcd = \text{area } P_1aeP_0 - bce$. Hence the well-known Harberger triangle of deadweight loss is given by area abc . If the check-off funds were simply handed back to producers, they would be better off at the expense of consumers and society as a whole. It might not be feasible, and is never entirely costless, to make lump-sum transfers to producers; and it might not be legal under the check-off scheme to attempt to do so directly.⁸ One way to distribute the check-off revenues to producers is to

spend the money on research or advertising, which might have the added virtue of being profitable (so that the benefit to producers exceeds the amount of the check-off funds) but needn't be so; from the producer's point of view, the expenditure would be worthwhile so long as the net losses from advertising (or research) are smaller than the net losses from the next best way of distributing the check-off revenues back to the individual producers and so long as they benefit on net from the institutional arrangement.

The "optimal" advertising intensity is often defined without regard for the fact that consumers share with producers in the costs, as well as the benefits, from advertising financed by a check-off. From the producers' point of view, it is the producers' costs that should be equated, at the margin, with the producers' benefits. Many studies would equate marginal producer net revenue from advertising (i.e., additional gross revenue minus additional production costs) with marginal advertising expenditure, as if money were provided entirely by producers (or the opportunity were available to producers to use the revenue for some other purpose or to redistribute it among themselves for consumption).⁹ An even greater distinction between *expenditure* on advertising, and *producer cost* of advertising, must be drawn when, as occurs in some instances, the check-off funds are matched by government grants.¹⁰

Of course, in this simple setting, when the check-off funds are distributed back to producers through the commodity market (by research or advertising), consumers may benefit along with producers. Indeed, in such a setting, if the check-off arrangement yields net benefits for producers, it will also yield net benefits to consumers. In fact, benefits are distributed between producers and consumers in exact proportion to their shares of costs when research or advertising applies directly to the market where the check-off is raised and the expenditure induces parallel shifts in linear functions.¹¹ When the analysis is extended into distorted multimarket settings, the producers' share of costs

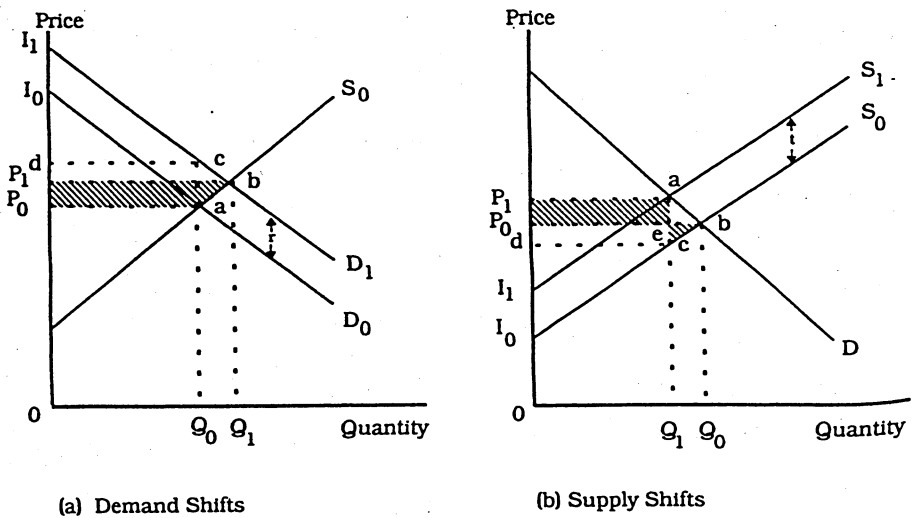


Figure 1: Advertising Effects in a Closed Economy Setting

may differ from their share of benefits since the check-off and the advertising may apply at different places in the markets; and, different results apply when the supply and demand curves are nonlinear or the shifts are nonparallel.

Figure 2 combines figure 1(a), showing the demand shift due to advertising (drawn as an increase in willingness-to-pay of r per unit), with figure 1(b), showing the supply shift due to the check-off to finance the advertising (drawn as an increase in marginal and average cost of t per unit). The supply shift is smaller than the demand shift ($r > t$) which is the necessary condition for the advertising expenditure financed by the check-off to be profitable for producers (and for society). The advertising expenditure is equal to $P_1ceg = tQ_1$ (notice that when quantity changes, the advertising-induced demand shift affects the amount of advertising expenditure – in this model advertising expenditure, $a = tQ_1$, is jointly endogenous with prices and quantities if all check-off funds are spent on advertising). Assuming that the demand shift is parallel, the net consumer benefits from using the check-off to fund the advertising are equal to area $abcP_1$ and the producer net benefits are equal to area $gefP_0$. If the demand shift were nonparallel, the measure of consumer welfare change would be equal to the difference in consumer surplus areas, $I_1cP_1 - I_0fP_0$, and could be a loss (it will be a loss, for instance, when supply is inelastic and the demand shift is proportional in the quantity direction).

Benefits and Costs of Advertising a Traded Good

Now consider the case of a small-country exporter shown in figure 3 (the case of an importer would be essentially the same). Supply and demand are defined as before with subscripts 0 and 1 denoting (a) supply before and after a check-off is collected from producers, respectively, (b) demand before and after an increase in demand induced by successful advertising, and (c) quantities consumed, C , and produced, Q before and after the check-off and advertising are applied. Export demand is perfectly elastic at the world price, P_w . The check-off is borne entirely by producers: they incur a loss of area I_1cdI_0 in

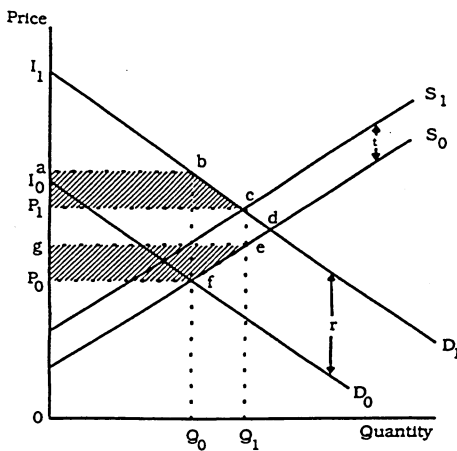


Figure 2: Costs and Benefits of Advertising

order to generate revenues of area I_1ceI_0 , and a deadweight loss of cde . Any benefits from the demand shift go to consumers (consumer surplus rises by area J_0abJ_1) but both the increase in domestic demand and the reduction in supply are met entirely by reducing exports from E_0 to E_1 .

Suppose the commodity is subject to an export subsidy of s per unit. How does that change the analysis? With the subsidy, producers incur a loss of area $I_1c'd'I_0$ in order to generate tax revenues of area $I_1c'e'I_0$, and a deadweight loss of $c'd'e'$ which is equal to cde , the deadweight loss without the export subsidy. Since the check-off revenue is greater, the demand shift due to advertising might be greater, too. Consumer benefits are smaller (the same benefit per unit on fewer units so consumer surplus rises by area $J_0a'b'J_1$). Thus, compared with the case without the subsidy, producer costs are greater (by area $c'd'dc$) and consumer benefits are smaller (by area $a'b'ba$). These lower producer and consumer benefits with the subsidy are offset exactly by a gain to taxpayers arising from the reduction in export subsidy costs when the combined check-off and advertising induce a reduction in exports. Hence, in this model, the presence of an export subsidy does not change the net social welfare consequences of the check-off and advertising, but it changes the distribution of the benefits and costs among producers, consumers, and general taxpayers.¹² This is equivalent to the type of result found by Alston, Edwards and Freebairn (1988) in relation to the benefits from research in the presence of farm programs.¹³ They showed that the trade status of the country and the chosen instrument(s) of protection were important determinants of the effects of producer protection on the size and distribution of research benefits. Similar conclusions are to be expected in the relation to the size and distribution of benefits from advertising financed by check-offs in the presence of farm programs, a topic to which we will return later.

Now, consider the case of a large-country trader (an exporter that is able to influence the export price), as shown in figure 4. In this figure the domestic supply and demand curves, and quantities produced and consumed, are defined as before. The right-hand panel shows the export market with excess demand from the rest of the world (ED) and

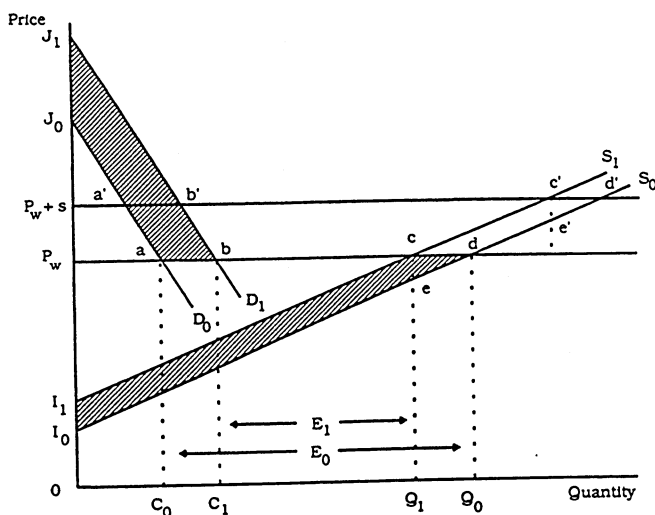


Figure 3: Benefits and Costs of Advertising a Traded Good

excess supply from the exporter (*ES*), the horizontal (algebraic) difference between domestic supply and demand. ES_0 is the excess supply associated with S_0 and D_0 , without the check-off and advertising; and ES_1 is the excess supply associated with S_1 and D_1 , with the advertising funded by the check-off. In this case the advertising increases demand (i.e., willingness-to-pay) by more than the check-off reduces supply (i.e., increases marginal cost) and one may tend to think that the advertising must therefore be profitable. However, producers will not benefit unless the advertising induces an increase in price greater than the increase in cost (i.e., t per unit) so that more output is produced. This requires that *aggregate* demand shifts up further than supply does.

In figure 4, price rises from P_0 to P_1 when excess supply shifts from ES_0 to ES_1 but that is not enough to compensate producers for the increase in their costs (i.e., $P_1 - P_0 < t$) and so output falls to Q_1 and producers sustain a loss equal to area P_0def . The consumer welfare effect is a gain equal to area $abcP_1$, and this arises because the rise in the price happens to be smaller than the increase in consumers' willingness to pay (i.e., $P_1 - P_0 < r$); but in general consumers could gain or lose. Here, some of the check-off costs are borne by foreigners and there could be a net welfare gain associated with the check-off itself (i.e., it captures part of the benefits that would arise if an optimal export tax were applied). The correspondence with an optimal tax requires that the revenue raised not be squandered in wholly ineffective advertising, of course. The loss sustained by foreigners is equal to area P_1ghP_0 in the export market panel.

Whether producers and domestic consumers gain or lose from the combined check-off and advertising expenditure depends on the elasticity of export demand and the sizes of the shifts of the domestic curves, r and t . For instance, when the export demand is less elastic at ED' instead of ED , price rises by more than t per unit and producers benefit along with consumers. In the more typical situation of perfectly elastic export demand at P_0 , price cannot rise and there are no producer benefits from advertising.

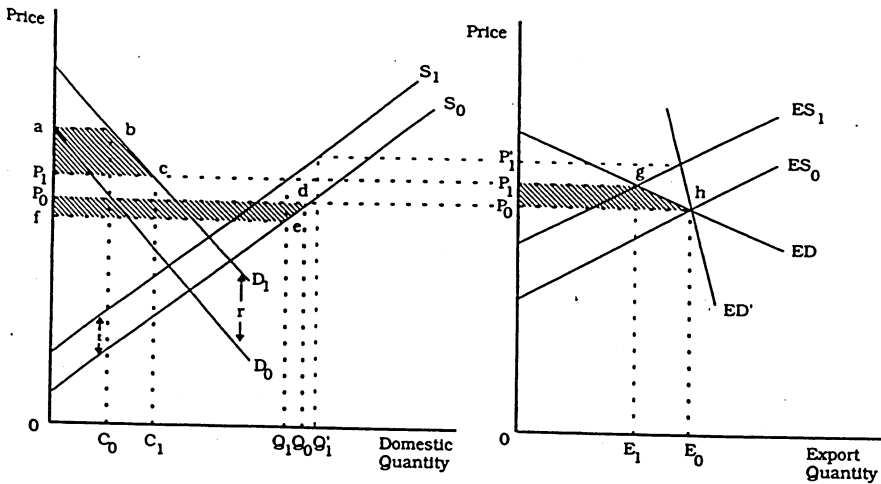


Figure 4: Benefits and Costs of Advertising by a Large Exporter

Benefits and Costs of Advertising a Multipurpose Commodity

Now consider a nontraded good that can be used for both a fresh market and processing (any multiple uses will do, but this is a common situation) as shown in figure 5. Supply and demand are defined with subscripts 0 and 1 denoting supply before and after a check-off is collected from producers; fresh market demand, DF , before and after an increase in demand induced by successful advertising; and quantities consumed by the fresh market, F , and processing market, M , and quantities produced, Q before and after the check-off and advertising are applied.

The left-hand panel represents the fresh market and the right-hand panel shows the processing market with demand (DM) and the excess supply from the fresh market (SM), the horizontal difference between supply and demand by the fresh market. SM_0 is the excess supply for processing associated with S_0 and DF_0 , without the check-off and advertising; and SM_1 is the processing supply associated with S_1 and DF_1 , with the advertising funded by the check-off.

The model in figure 5 is deliberately constructed to parallel the case of a large-country exporter in figure 4, and the results are similar in many ways. The advertising increases fresh market demand (i.e., willingness-to-pay) by more than the check-off reduces supply (i.e., increases marginal cost) and one may tend to think that, therefore, the advertising must be profitable. However, as in the case of the export good, producers will not benefit unless the advertising induces an increase in price greater than the increase in cost (i.e., t per unit) so that more output is produced – it is the aggregate demand shift that matters.

In figure 5, price rises from P_0 to P_1 when supply for processing shifts from SM_0 to SM_1 but that is not enough to compensate producers for the increase in their costs (i.e., $P_1 - P_0 < t$) and so output falls to Q_1 and producers sustain a loss equal to area P_0def . The fresh market consumer welfare effect is a gain equal to area $abcP_1$, and this arises

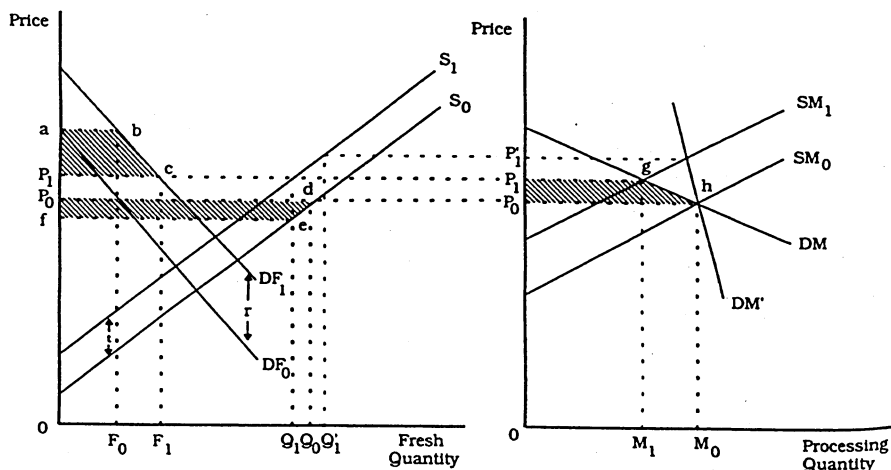


Figure 5: Benefits and Costs of Advertising on the Fresh Market

because the rise in the price is smaller than the increase in consumers' willingness to pay (i.e., $P_1 - P_0 < r$) but it need not be so, and fresh market consumers could lose. Consumers in the processing market necessarily lose. Their loss is equal to area P_1ghP_0 in the processing market panel. Unlike the case of a large country exporter, the combination of processing and fresh markets does not involve a *de facto* optimal tax so there are no benefits of that type.

Whether producers and domestic consumers gain or lose from the combined check-off and advertising expenditure depends on the elasticity of processing demand and the sizes of the shifts of the domestic curves, r and t . For instance, when the processing demand is less elastic, at DM' instead of DM , price rises by more than t per unit and producers benefit along with fresh market consumers, but processing market consumer losses are greater.

When processing demand is perfectly elastic, price does not rise and producers do not gain. Processing demands are typically much more elastic than fresh market demands for commodities, sometimes because the processed products are more storable and can substitute over time whereas perishable fresh products cannot, but more often because, for similar reasons, processed products are more easily traded interregionally and internationally. Thus the existence of a processing market often negates the potential for profitable advertising of the fresh product (since the effective supply to the fresh market is highly elastic when the processing demand is highly elastic). In such cases, in order to be able to profitably advertise the fresh product, it is necessary to be able to separate the markets and prevent arbitrage between the fresh and processing markets from undermining the fresh market gains.¹⁴ One way to do this may be brand advertising (which is not being addressed here); another is to introduce a regulatory barrier and that is the more common approach.

Other Multimarket Issues

We have considered multiple markets for the same commodity disaggregated horizontally. Two other types of multimarket issues that warrant attention will only be touched on here. First, advertising can have complicated effects among markets that are related vertically, such as when producers of a primary product (e.g., raw wool) fund promotion of final consumer goods (such as woollen apparel). Some of these effects have been analyzed by Wohlgenant (1993), with an application to beef and pork. One of the results is that the benefits from advertising (or research) applied at one stage of a multistage production process generally will be distributed differently from the costs of a levy collected at a different stage, unless the farm product and retail product are in fixed proportions.¹⁵ It remains to be seen what effects market-distorting policies combined with these vertical linkages may have on the size and distribution of benefits and costs of advertising.

Second, markets for different products are linked horizontally and advertising (and taxing) one commodity can have spillover effects on other commodities that are substitutes or complements in production or consumption. If prices are endogenous these spillover effects feed back into the market for the commodity being advertised (or taxed). Producers concerned with only one commodity ought to consider these effects if only to ensure that they obtain accurate measures of the full effects of advertising on their own

commodity. But sometimes producers are concerned with more than one commodity (e.g., the Australian Meat and Livestock Corporation is concerned with beef and sheepmeats, is funded in part by check-offs on both sectors, and attempts to increase the demand for both).¹⁶ In such situations it is relevant to want to measure the direct cross-commodity effects of advertising as well as the feedback of induced price changes. Piggott, Piggott and Wright (1993) have analysed this problem.

In what follows we continue to abstract from vertical market linkages and to ignore cross-commodity impacts, as we turn to a consideration of the roles of farm programs. However, we suggest that, for the more general problem, it may be appropriate to adopt the approach used by Martin and Alston (1994) to analyze the effects of market distortions on the size and distribution of research benefits in a full general equilibrium setting.¹⁷

Benefits and Costs of Advertising with Farm Programs

Some empirical studies of the payoff to advertising have taken account of farm commodity programs when calculating producer benefits (e.g., Kaiser et al. 1992; McCutcheon and Goddard 1992; Wohlgenant and Clary 1993; Chyc and Goddard 1994).¹⁸ In this section we explore the interactions between commodity policy and advertising in a more generic setting, allowing also for international (or interregional) trade. The commodity we consider is milk in a hypothetical country, *Uphoria* (it could be a state), that is a price taker in both fresh milk and manufactured dairy products at the border so that, in the absence of any policies, producers would receive and consumers would pay the border price, P_W for all milk regardless of its final use.¹⁹

The *Uphoric* milk market is represented in figure 6. In the absence of any commodity programs, Q_0 is produced, F_0 is sold for fluid milk, and $M_0 = Q_0 - F_0$ is sold for processing. In this setting, advertising fluid milk *must* be unprofitable for producers while supply-shifting agricultural research *might* be profitable. However, suppose a quota is introduced, along with an embargo against imports of fluid milk, limiting fluid milk sales to F_1 . Then the market-clearing fluid milk price rises to P_F , creating quota rents equal to $(P_F - P_W)F_1$, or area $P_F b c P_W$. Now producers might benefit when a check-off (at a cost to them of $I_j f g I_0$ and yielding revenue of $I_j h I_0$) is used to finance advertising that shifts demand from D_0 to D_1 . Whether they benefit depends on whether the increase in quota rents is greater than the cost of the check-off, which might depend on how the increase in demand is accommodated in the market.

One option would be to allow price to rise to P_F' , allowing an increase of quota rents equal to $(P_F' - P_F)F_1$, or area $P_F' a b P_F$; another would be to expand the quota to F_1' , allowing an increase of quota rents equal to $P_F(F_1' - F_1)$, or area $b c d e$. A third option would be to allow both price and quantity to rise, as indicated by the price P_F'' and quantity, F'' .²⁰ Which of these the producers would prefer would depend on the elasticity of demand; which happens in practice would depend on political constraints and the arrangements for fixing prices (and quantities) in the quota market.

In the absence of the policy, all of the benefits from advertising would accrue to consumers (a gain equal to the area above the price line, P_W and between the two demand curves, D_0 and D_1). The policy changes the distribution of benefits and may change the

total benefit. Under the first option, all of the benefits from advertising accrue to quota owners as increased quota rents. There are no benefits to consumers, and the social payoff to advertising is reduced by an amount exactly equal to the increase in the distortion in consumption associated with the increase in demand from D_0 to D_1 that is accommodated fully by a rise in price. Under the second option, the distortion due to the policy is unchanged by advertising and hence the total benefits from advertising are unaffected by the presence of the policy. Producers now gain area $bcde$ and consumer benefits are commensurately reduced. The third option involves some increase in the distortion due to the policy (hence lower overall benefits to some extent), a reduction in consumer benefits and, perhaps, greater producer benefits (depending on the elasticity of demand).

Notice that producers can gain, even with the second option when the fresh milk price does not rise. This is because their *average* revenue has risen when a higher proportion of their production is sold on the higher-priced market. A number of mechanisms also may allow quota-milk prices to rise in response to an advertising-induced rise in fresh-market demand. For instance, in California, the quota market is a pool of several markets having different prices, not solely class 1 milk for fresh consumption. Hence, an increase in the proportion of quota milk that is sold for fresh consumption will increase the average return from the quota pool, corresponding to a rise in the quota milk price in figure 6. In several Canadian supply-managed industries prices are set according to cost-of-production formulas, and the cost of levies for promotion is included in the formula.²¹ Thus a check-off leads to a rise in the commodity price whether or not there is an increase in demand associated with it.

Finally, the model in figure 6 can easily be extended to another common form of milk

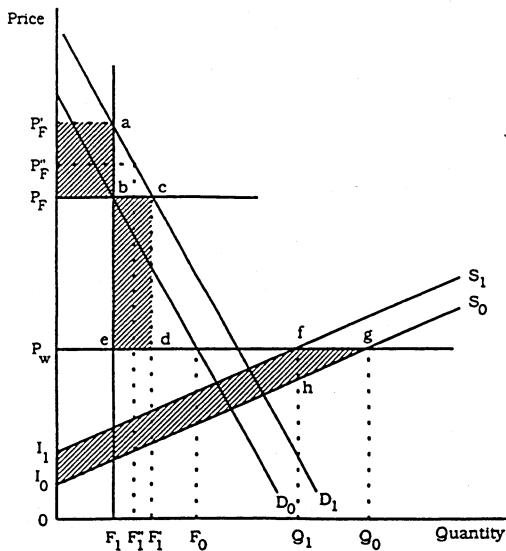


Figure 6: Benefits and Costs of Advertising with a Marketing Quota

marketing policy. Figure 7 replicates the situation in figure 6, but instead of a fresh milk quota, the market is controlled by a marketing board that pools returns from the high-priced fresh milk market and the lower-priced manufacturing milk market.²² In this case, producers face the pooled price line, P_p . Assuming that the fresh milk price is fixed (i.e., the second option for policy response), when advertising increases demand the pooled price line shifts to the right as well, and an increase in production is induced, from Q_0' to Q_1' . From the producers' viewpoint, advertising is profitable if the difference in average revenue at Q_0' between P_p' and P_p is greater than the per unit check-off, t (this is so whether we have price pooling or a quota as analyzed in figure 6). As the figure is drawn, the advertising is profitable and Q_1' is greater than Q_0' .

Optimal Advertising Intensities and Check-offs

Much of the literature on optimal primary product promotion rests on two foundational papers: Dorfman and Steiner (1954) and Nerlove and Waugh (1961). According to the Dorfman-Steiner theorem, given fixed output, a monopolist will maximize profits by setting the advertising budget such that the increase in gross revenue resulting from a one dollar increase in advertising expenditure is equal to the ordinary elasticity of demand for the product. That is,

$$\frac{\partial v}{\partial a} = \eta, \text{ or } \frac{a}{v} = \frac{\alpha}{\eta} \text{ where } \alpha = \frac{\partial v}{\partial a} \frac{a}{v}. \quad (1)$$

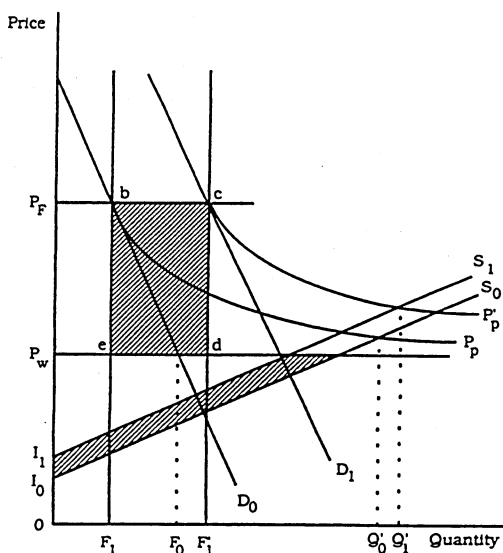


Figure 7: Benefits and Costs of Advertising with Price Pooling

In this equation a is the advertising expenditure, v is the value of sales (the product of price, p and the quantity sold, q), α is the elasticity of demand with respect to advertising, and η is the absolute value of the elasticity of demand with respect to the price. The Dorfman-Steiner result may be applicable to a number of primary products where output is fixed (e.g., by a quota) and a marketing organization advertises on behalf of producers. However, as shown by Conboy, Goddard and McCutcheon (1992), a different rule is required either (a) when the monopolist can optimize quantity along with advertising, or (b) when the funds for advertising must be raised by a per unit levy on output so that, unlike the Dorfman-Steiner case, in which advertising is funded in a lump-sum fashion independently from output, the marginal cost of the commodity depends on the rate of advertising.²³

The more relevant reference for our study of advertising by a producer cooperative without the ability to control output is that by Nerlove and Waugh (1961). Like Dorfman and Steiner (1954), Nerlove and Waugh (1961) modeled a case where advertising is funded in a lump-sum way, unrelated to output, with the implication that all of the advertising cost is borne by producers. That approach has been adopted in many subsequent studies of primary product promotion. Here we will extend the Nerlove-Waugh model to the situation where advertising is funded by a per unit check-off. The industry supply and demand functions are written:

$$q = D(p, a) = D(p, tq), \quad (2)$$

$$q = S(p-t) = S(p^*), \quad (3)$$

where t is the per unit check-off used to fund advertising. The difference here, from the Nerlove-Waugh model is that, on the supply side, the supply price depends on the check-off which, for given quantity, is synonymous with advertising expenditure) and, as a result, the advertising expenditure, a , price, p , and quantity, q , are jointly endogenous given an exogenous check-off, t .

Intuitively, producers will prefer to increase the check-off and advertising so long as, at the margin, demand shifts up by more than supply, so that equilibrium quantity rises with an increase in producer surplus. Hence, the check-off will be optimized when an increase in the check-off yields an additional vertical shift in demand of the same amount per unit so that, at the margin, the combined advertising and check-off will have no net effect on quantity and

$$\frac{\partial q}{\partial t} = 0.$$

The effect of a change in the check-off on price and quantity is found by differentiating (2) and (3) with respect to t and solving for

$$\frac{\partial q}{\partial t} \quad \text{and} \quad \frac{\partial p}{\partial t}.$$

Differentiating (2) and (3) with respect to t yields

$$\frac{\partial q}{\partial t} = \frac{\partial D}{\partial p} \frac{\partial p}{\partial t} + \frac{\partial D}{\partial a} \frac{\partial a}{\partial t} = \frac{\partial D}{\partial p} \frac{\partial p}{\partial t} + \frac{\partial D}{\partial a} \left[q + t \frac{\partial q}{\partial t} \right]$$

$$= \frac{\frac{\partial D}{\partial p} \frac{\partial p}{\partial t} + \frac{\partial D}{\partial a} q}{1 - t \frac{\partial D}{\partial a}} \quad (4)$$

$$\frac{\partial q}{\partial t} = \frac{\partial S}{\partial p^*} \frac{\partial (p-t)}{\partial t} = \frac{\partial S}{\partial p^*} \frac{\partial p}{\partial t} - \frac{\partial S}{\partial p^*} \quad (5)$$

Setting (4) equal to (5) and solving yields

$$\frac{\partial p}{\partial t} = \frac{\frac{\partial D}{\partial a} q + \left(1-t \frac{\partial D}{\partial a}\right) \frac{\partial S}{\partial p^*}}{-\frac{\partial D}{\partial p} + \left(1-t \frac{\partial D}{\partial a}\right) \frac{\partial S}{\partial p^*}} \quad (6)$$

In elasticity terms,

$$\frac{\partial p}{\partial t} = \frac{\alpha \frac{p^*}{t} + (1-\alpha) \epsilon}{\eta \frac{p^*}{p} + (1-\alpha) \epsilon} \quad (7)$$

Setting $\epsilon=0$, yields an expression for the marginal increase in consumer willingness-to-pay as a function of a change in the tax rate, which must be equal to one at the optimum. Thus

$$\frac{\partial p}{\partial t} \Big|_{q=\bar{q}} = \frac{\alpha p}{\eta t} = 1. \quad (8)$$

Hence, when supply is fixed, the optimal tax rate from the producers' standpoint is where the tax rate, as a fraction of the consumer price, is equal to the the elasticity of demand with respect to advertising divided by the elasticity of demand with respect to price. This elasticity ratio is also equal to the advertising intensity, so we can see that we have duplicated the Dorfman and Steiner (1954) result when we fix supply (because, intuitively, when supply is fixed a per unit tax is equivalent to a lump-sum tax):

$$\frac{a}{v} = \frac{tq}{pq} = \frac{t}{p} = \frac{\alpha}{\eta} \quad (9)$$

More generally, the optimal tax is defined by setting $\partial q/\partial t = 0$. Substituting (6) into

(5) yields a solution for the marginal quantity response to changes in the check-off and advertising:

$$\frac{\partial q}{\partial t} = \frac{\frac{\partial D}{\partial a} q + \frac{\partial D}{\partial p}}{1 - t \frac{\partial D}{\partial a} - \frac{\partial D}{\partial p} \left(\frac{\partial S}{\partial p^*} \right)^{-1}} \quad (10)$$

In elasticity terms,

$$\frac{t}{q} \frac{\partial q}{\partial t} = \frac{d \ln q}{d \ln t} = \frac{\alpha - \eta \left(\frac{t}{p} \right)}{1 - \alpha - \left(\frac{\eta}{\varepsilon} \right) \left(\frac{p-t}{p} \right)} \quad (11)$$

Setting (11) equal to zero yields the condition for optimal advertising:

$$\frac{a}{v} = \frac{t}{p} = \frac{\alpha}{\eta} \quad (12)$$

Again, the condition for optimal advertising, financed by a check-off by a producer cooperative without supply control, is the same as the Dorfman-Steiner condition for optimal advertising by a monopolist with fixed output; it is different from the Nerlove-Waugh condition for optimal advertising financed by a lump-sum tax.

Nerlove and Waugh (1961) derived a condition for optimal advertising by a producer cooperative without supply control as follows:

$$\frac{p \frac{\partial D}{\partial a}}{\varepsilon + \eta} = \frac{\left(\frac{v}{a} \right) \alpha}{\varepsilon + \eta} = 1 + \rho \quad (13)$$

Here p is the rate of return on alternative forms of investment, so $1 + \rho$ is the opportunity cost of a dollar of advertising expenditure. But this assumes producers bear the full cost of advertising expenditure when, in fact, producers bear only a fraction of the cost, depending on elasticities, when the advertising is financed by a tax on production. 0

In terms of its final incidence the share of a tax borne by producers is approximately equal to $\eta/(\varepsilon + \eta)$ and the consumer share is approximately equal to $\varepsilon/(\varepsilon + \eta)$.²⁴ Hence, the marginal revenue from advertising on the left-hand side of (13) should be equated with the marginal cost of a dollar of advertising, multiplied by the producers' share, $\eta/(\varepsilon + \eta)$. Then the rule for optimal advertising financed by a check-off, using the Nerlove-Waugh result is

$$\frac{\left(\frac{v}{a} \right) \alpha}{\varepsilon + \eta} = (1 + \rho) \frac{\eta}{\varepsilon + \eta} \quad (14)$$

Now, if we assume $p=0$, so that a dollar of advertising costs a dollar, as assumed above, equation (14) simplifies to equation (12). Thus, our results are consistent with the Nerlove-Waugh results when we allow that producers pay only a fraction of the costs of advertising.

The main implication is that, when advertising is financed by a check-off rather than a lump-sum tax, producers will effectively bear only a fraction of the total cost of advertising, and therefore they will be inclined to advertise more than they would if they paid the full cost. Interestingly, the condition for optimal advertising by a producer cooperative is exactly the Dorfman-Steiner condition for optimal advertising by a monopolist. This also means that the evaluation of producer benefits from advertising must account for differences between the final incidence of the check-off and the initial incidence.²⁵

De Boer (1977) reviewed arguments about the applicability of the Dorfman-Steiner theorem to agricultural commodities, including critical articles by Hoos (1959) and Parish (1963). While seeming to accept the critical arguments, De Boer (1977, p. 123f) noted that "A number of recent studies have tended to confirm the very close correspondence between the optimal ratio of advertising expenditures to total sales (as forecast by the Dorfman-Steiner theorem) and the ratio actually observed by firms in imperfectly competitive industries." The results here suggest it would be of interest also to test whether the Dorfman-Steiner condition is a good predictor of behavior in competitive industries with advertising financed by check-offs.

California Commodity Case-studies

Table 1 contains data on California commodity group budgets for 1988-89 taken from Carman, Green and Mandour (1992). The table includes annual budgets for advertising and promotion, the farm value of each commodity, and advertising as a percentage of farm value (a measure of the advertising intensity). The commodity programs are ranked according to their advertising intensities which range from 5.79 percent (raisins) to 0.04 percent (dairy council).

Some patterns are apparent in the table. First, the top-ranked 16 commodities, are all perennial crops. No other commodities (apart from eggs) have advertising intensities (or advertising tax rates) greater than one percent. Few of the 17 commodity groups with advertising intensities less than one percent are perennial crops – only artichokes, apricots, the wine commission, and the Walnut Marketing Board (which represents only a fraction of total walnut advertising).

The predominance of high advertising intensities for perennial crops might reflect the fact that California production dominates the market for those commodities, and the relevant demand is relatively inelastic. This is true for most of the commodities, including almonds – even though over half the crop is exported, California dominates the world almond market so that the demand elasticity is about -1. In addition, however, the fact that they are perennials characterized by long lags in supply response, might be relevant since there may be implications for the distribution of benefits and costs between consumers and producers.²⁶

A second aspect to notice in the table is that there are some cases where advertising

Table 1. California commodity group Advertising Intensities

Commodity	Advertising & Promotion \$'000	Farm Crop Value \$'000	Advertising Intensity %
Raisins	19,050	328,860	5.79
Kiwifruit Commission	1,220	26,565	4.59
Prunes—dried	7,578	166,440	4.55
Walnut Commission	8,600	210,700	4.08
Avocado Commission	6,993	200,490	3.49
Pistachio Commission	2,155	64,350	3.35
Almonds (F)	14,922	460,800	3.24
Pears—fresh	789	25,406	3.11
Grape Commission—table	5,914	264,150	2.24
Peaches—joint	2,406	111,240	2.16
Olives (F)	1,353	65,175	2.08
Figs	839	16,666	2.03
Nectarines (F)	1,495	79,290	1.89
Plums (F)	1,680	94,796	1.77
Dates (F)	325	19,203	1.69
Peaches—fresh	1,074	63,504	1.69
Egg Commission	4,543	401,825	1.13
Strawberries—fresh	2,887	309,062	0.93
Milk—mfg	489	53,421	0.92
Milk—market	19,662	2,342,540	0.84
Artichokes	275	38,193	0.72
Apricots	243	35,948	0.68
Wine Commission	4,166	634,110	0.66
Honey	37	8,186	0.45
Beans—dry	482	125,414	0.38
Walnut Marketing Board (F)	700	210,700	0.33
Lettuce Commission	2,155	722,099	0.30
Rice	642	229,969	0.28
Turkeys	285	248,820	0.11
Tomatoes—fresh	244	247,795	0.10
Carrots	148	216,969	0.07
Beef Council	805	1,251,334	0.06
Wheat Commission	155	203,852	0.06
Dairy Council	1,031	2,430,691	0.04

Source: Carman, Green and Mandour (1992, p. 10).

Note: (F) denotes Federal programs; all others are California programs.

cannot be profitable – since the relevant demand elasticity facing California producers is infinite and there can be no price response to state-level demand enhancement – and yet the advertising intensities are not zero. These cases include eggs (1.13 percent), turkeys (0.11 percent), beef (0.06 percent) and wheat (0.06 percent). The explanation for these expenditures may be that the objective is something other than producer benefits from demand enhancement.

Thirdly, the greatest expenditure by a commodity group is on fresh milk advertising, almost \$20 million per year. This is a case where the demand for the farm product would be highly elastic (virtually perfectly elastic) in the absence of regulation, so that advertising could not be profitable for producers, but the milk marketing arrangements

(including state-level quotas and federal price supports) mean that advertising might be profitable. We do not have direct evidence on the parameters for milk in California, but previous studies have found elasticities of demand for fresh milk with respect to price typically around $\eta = 0.2$, and elasticities of demand with respect to advertising ranging from $\alpha = 0.002$ to $\alpha = 0.06$ (see Goddard and McCutcheon 1993 for a review of estimates). Using equation (12), an advertising intensity of 0.84 percent, given $\eta=0.2$, would require $\alpha=0.0016$, smaller than the range in the literature. While we might not recommend using the formula in that fashion, and acknowledge the importance of the specifics of functional form and so on raised in the literature, we cannot reject the idea that fresh milk expenditure of \$20 million per year in California is profitable for producers, due to the marketing arrangements.

Conclusion

Primary product promotion as a cooperative venture by producers is facilitated by marketing order and federal commodity check-off legislation. Effectively, the legislation gives producers taxing powers, and this raises public policy questions about what constraints ought to be put on the exercise of those powers.

The total payoff to advertising and its distribution, and the optimum advertising effort from the viewpoint of both producers and society, depend on how the advertising is financed. They also depend on the structure of the market for the commodity, and on the nature of any government interventions, such as trade barriers and farm programs. Many studies model the effects of advertising agricultural commodities using a closed economy model, and they assume (implicitly) that the advertising is financed by a lump-sum tax.

For most commodity markets, it would be more realistic to assume a small open economy (i.e., one with exogenous prices) – a setting in which advertising cannot be profitable for producers unless the government intervenes in some other way in the market. In the archetypal case of fresh milk promotion, advertising is made privately profitable for producers by the creation of barriers to entry that prevent the gains from advertising from being undermined by arbitrage, either from other fresh milk producers or by the diversion of milk from the manufacturing milk market.

The fact that advertising is financed by check-offs rather than lump-sum taxes means that producers pay only a fraction of costs, a result that means that previous studies may have understated the rate of return to producers from advertising and the optimal advertising intensity from the producer standpoint. The condition for optimal advertising by a producer cooperative under check-off financing is shown to be the same as the Dorfman-Steiner condition for optimal advertising by a monopolist. This result raises questions about whether the creation of the funding institutions has contributed to "excessive" advertising. The combination of check-off financing and market distorting policies means that producer incentives may have been biased away from agricultural R&D in favor of promotion.

Endnotes

- ¹The national figures are well in excess of \$400 million per year. Brader, Kesecker and Ricker (1992) provide details on the rapid growth in generic commodity promotion programs in the United States, including details of the commodities covered, legislative support, revenue sources, and expenditures.
- ²That advertising leads to an increase in gross revenues is a necessary condition for profitable advertising, but not sufficient. For some studies the appropriate question is whether advertising has affected demand at all – and legitimate questions can be raised about whether studies have measured the demand response to advertising accurately (e.g., as argued by Piggott, Chalfant, Alston and Griffith 1993).
- ³A similar point has been made by Chang and Kinnucan (1991).
- ⁴Many of these issues are raised in an excellent (but neglected) review article by De Boer (1977). De Boer (1977) also discussed some issues not dealt with here including variability of funds available for promotion, and consequences of that, under alternative financing arrangements.
- ⁵De Boer (1977) discusses some normative aspects of the social welfare analysis of promotion, drawing upon work by Tisdell (1974, 1975) among others, and reviews the arguments for government intervention in rural product promotion. See, also, the Industries Assistance Commission (1976) report.
- ⁶To the extent that demand shifts for more than one period due to advertising in the current period, the single-period, comparative-static analysis will understate the profitability of advertising and will be erroneous when advertising's effects on demand are determined to some extent recursively, rather than simultaneously, with tax effects on supply.
- ⁷If the two demand curves are linear and parallel (as drawn), the consumer benefit is also equal to area $POabcd$. These measures of consumer benefits ignore any impacts in markets for other commodities and, in view of the budget constraint, impacts in other markets are inevitable and it seems inappropriate to ignore them. This, among other things, leaves us reluctant to talk about consumer welfare impacts of advertising in a partial equilibrium setting, and that makes it hard to talk about social rates of return. A number of recent studies have estimated advertising effects in the context of complete systems of demand equations (usually for separable groups of goods), including Goddard and Amuah (1979), Green, Carman and McManus (1991), Cox (1992) (and some other studies in Kinnucan, Thompson and Chang), Piggott (1991) and Piggott, Chalfant, Alston and Griffiths (1993). Piggott, Piggott and Wright (1993) discuss some of the cross-commodity effects and implications for measuring benefits.
- ⁸Brader, Kesecker and Ricker (1992) document the details of a number of federally authorized commodity research and promotion programs, a number of which permit refunds, and in several cases the refunds represent a significant fraction of revenues raised. This could be a reflection of the use of check-offs that purport to be for providing industry public goods, as a device for transferring revenue from consumers (or the government) to producers. Whether it is so in effect depends on the market situation and the arrangements for making refunds.
- ⁹Johnson (1992) made the point that we ought to pay attention to supply shifts as well as demand shifts when evaluating promotion. In the same volume are some examples of studies that did not. For example, Jones and Choi (1992) indicate that the potato check-off program generated around \$5.7 million of which around \$3-4 million was spent on generic promotion. Their econometric results yielded an estimate of an additional \$15.1 million in sales due to generic advertising. Then they multiplied this estimate by .35, since producers' returns average 35 percent of retail sales, and concluded that the investment of \$3-4 million was profitable since producers earned an additional \$5.3 million. This comparison may be doubly flawed. First, the \$5.3 million represents producer gross revenue, from which the cost of production of the additional potatoes must be deducted in order to determine effects on net revenue, unless output were fixed and the change in revenue is entirely due to change in price. The net revenue gains may be very small if the supply of potatoes is highly elastic, as is likely. Second, the \$3-4 million dollars spent on advertising is only partly paid by producers and it is the producer cost that is relevant for the comparison. Also, Dewbre and Beare (1992) cited the study by the Australian Wool Corporation and Bureau of Agricultural Economics (1987) that did not account for the incidence of costs in calculating the profitability of wool promotion expenditure – a harder problem given the fact that the wool tax revenue is used to finance R&D as well, and a matching grant has been provided by the Australian government.
- ¹⁰Alston and Mullen (1992) illustrated this issue in relation to the distinction between producer and social

rates of returns to wool research financed by a combination of check-off funds and matching government grants.

- ¹¹The relevant issues are discussed by Alston (1991) and Wohlgenant (1993).
- ¹²If taxpayer dollars spent on export subsidies are worth more than a dollar, as argued by Alston, Carter and Smith (1993), for example, then the net social welfare effects will be different, too.
- ¹³See, also, Alston and Martin (1992).
- ¹⁴This result may seem fairly obvious, yet many instances can be found where fresh market advertising is conducted by producer bodies without separating the fresh and processing markets, when processing demand is highly (or perfectly) elastic. One example from Australia is the advertising of fresh oranges by the Victorian Citrus Fruit Marketing Board in the 1980s even though Australia was an importer of frozen concentrated orange juice and there was no possibility of advertising achieving a rise in fresh price; all it could achieve might be a reduction in juice imports.
- ¹⁵Chang and Kinnucan (1991) model the fixed-proportions case.
- ¹⁶See Ball and Dewbre (1989) and Piggott (1991) for details.
- ¹⁷Both Kaiser et al. (1992) and Wohlgenant and Clary (1993) allowed for both multiple end-uses of milk, and government interventions in the markets, in a multistage model of milk advertising effectiveness. They treated advertising expenditure as exogenous, however, which seems to mean that they did not account for any difference between the initial and final incidence of advertising check-offs.
- ¹⁸Freebairn's (1992) analysis of demand-enhancing research in the context of the Australian dairy industry is also pertinent; his results could be interpreted as applying to advertising- rather than research-induced demand shifts.
- ¹⁹This is owed to David Lodge, *Changing Places* London: Penguin, 198#. See, also, *Small World* by the same author.
- ²⁰Sumner and Wohlgenant (1985) suggested such a relationship in U.S. tobacco policy response in response to a tax-induced change in demand for cigarettes.
- ²¹Goddard, Griffith and Quilkey (1992) and Conway, Goddard and McCutcheon (1992) discuss the implications of levies given cost-of-production formulas for products with quotas.
- ²²De Boer (1977) discussed promotion in the context of price discrimination schemes of this type which were popular in Australia at the time and which are still used for some commodities. Also, see Freebairn (1992).
- ²³Conboy, Goddard and McCutcheon (1992) contrast the case where advertising is a fixed cost (i.e., funded in a lump-sum fashion) and a variable cost (i.e., funded by a check-off) and show how the Dorfman-Steiner optimal advertising expenditure rule for a monopolist is affected. They also contrast the Dorfman-Steiner rule with the rule for a monopolist who can optimize quantity as well as price and advertising (for an earlier analysis of this question, see Alston 1980) when advertising is financed by a check-off or as a lump sum. Also, see Goddard, Griffith and Quilkey (1992), especially pp. 31-40.
- ²⁴This is a well-known result. For instance, see Chang and Kinnucan (1991).
- ²⁵This point was clearly understood by the Industries Assistance Commission (1976, p. 28) when they wrote "Producers will bear most of the costs and obtain most of the benefits from promotion when demand is elastic and/or supply is inelastic while reverse conditions imply consumers will bear most of the costs and obtain most of the benefits." They also provided a table on the same page indicating likely shares of producers in both costs and benefits, which indicates clearly that the two were viewed as being different.
- ²⁶For perennial crops, the short-run output response elasticity is zero so that a check-off is borne entirely by producers and the benefits from increased demand accrue entirely to producers. Our rules for optimal advertising intensities do not involve the supply elasticity, so inelastic supply alone cannot explain large advertising intensities. But they were based on the assumption that all producers would be taxed to finance the advertising from which they benefit. We did not distinguish, therefore, between the supply response of current producers and the effects of new entrants. One possibility is that in perennial crops, new entrants cannot free ride on the advertising expenditure of incumbents whereas with annual crops there might be differential incidence between incumbents and new entrants. An inelastic supply coincides with a less elastic demand facing current producers. Free-riding by new entrants would require that advertising be collected on past production so that the direct link between benefits and

costs would be broken. In an explicitly dynamic treatment of supply response to price (or of demand response to advertising), there would be a role for the supply response elasticity to determine the duration of the stream of benefits to a permanent increase in advertising, for instance.

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