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Effects of Generic Advertisement on Demand: The Case of the Washington State Apple Commission

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The Washington Apple Commission (WAC) generically promoted apples for the Washington state industry from 1937 until 2003. This paper provides an analysis of the effects on demand attributable to these activities. Demand movement associated with promotion tends to be positive, though the results are mixed. Overall, WAC promotion increased growers' total revenue by approximately $53.4 million for 2002. The estimated average return to advertising topped $8.7 per dollar of advertising. Continuing selected promotional activities could increase revenue for growers if these activities could be carried out by voluntary, coordinated efforts.

United States fresh apple sales generate approximately $1.7 billion annually (USDA NASS 2006), and the productive value of apples ranks sixteenth among our nation's crops (USDA NASS 1998). Washington State has been the leading supplier of fresh market apples since the 1920s. The production in Washington during the 2005 season topped 5.8 billion pounds, which constituted more than 58 percent of the total U.S. apple production (USDA NASS 2006). Apples represent a crop of significant value to the country and Washington State.

The Washington apple industry may owe its success in part to promotional activities. From 1937 until 2003, the Washington Apple Commission (WAC) operated as one of the most successful commodity-promotion programs in the United States. (Eddy 2003). The Washington Apple Commission spent millions of dollars each year to provide direct advertising, merchandising, in-store displays, export promotion, and other forms of advertising. Successful advertising alters consumer behavior through consumer education, building trust in the label and brand, or a persuasion of a superior product (Liu and Forker 1988). This study examines the ability of the Washington Apple Commission promotion to affect the demand for Washington State apples and measures the revenue changes attributable to these efforts. We identify the annual loss in revenue due to the elimination of the Washington Apple Commission activities and suggest how voluntary promotion dollars should be spent for generic advertising.

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Generic goods such as apples may need industry-level promotion, since these products vary little across producers and may not be efficiently advertised privately. The hope is that group promotion will positively affect the demand for all Washington apples and each producer will benefit with larger revenues. Many producers of generic goods combine their promotion efforts in an attempt to influence the demand for their product. Several studies explain the promotional impacts of generic advertising on demand for several commodities, including pears, pork, catfish, salmon, and fluid milk (Erikson 1999; Hoover, Hayenga and Johnson 1992; Kinnucan and Miao 1999; Kinnucan and Myrland 2003; Johnson, Stonehouse and Hassan 1992). Generally these studies find small positive effects on demand associated with generic commodity promotion.

The usefulness of advertising can be evaluated by examining the change in the responsiveness of the quantity demanded to a price change (Morrison 1984). Chang and Green (1989), Capps and Moen (1992), and Chakravarti and Janiszewski (2004) consider the long-term effects of advertising on demand elasticity. They find that generic advertising leads to an increased responsiveness to changes in price. Liu and Forker (1988), Gallet (1999), and Schmit, Reberte, and Kaiser (1997) suggest that price elasticity may increase or decrease depending on the product differentiation generated by the advertising. Richards (1999) illustrates the effects of advertising in terms of long-run and short-run own- and cross-price elasticities for Washington State apples and four other fruits. He reports that advertising is marginally more effective than retail promotion, but has positive spillover effects to other fruits. Kinnucan and Zheng (2004) show

that advertising has both a shift and a rotation effect on demand. Rotations may be positive, zero, or negative depending on the content of advertising. In our model, we allow advertising efforts to shift and rotate the demand function in order to capture the total effects of these programs.

Focusing exclusively on the promotion of apples, Ward (1993) estimates the gains from Washington Apple Commission television and radio advertising average $6.60 per dollar of promotion expenditure. Using a single-equation method to estimate demand, Van Voorthuizen, Schotzko, and Mittelhammer (2003) show that radio and television advertisements do not significantly affect Washington apple demand; however, the level of expenditure on print media does matter. By contrast, with a multi-equation approach they show that while promotional prices do not significantly affect demand, radio and television advertisements are jointly significant.

This paper specifically examines the effectiveness of all promotion expenditures by the Washington Apple Commission to influence the demand for Washington State apples. We compare the industry with and without Washington Apple Commission advertising. We quantify the revenue attributable to the Washington Apple Commission generic advertising and provide producers guidance for what activities they may want to jointly pursue voluntarily. The next section contains a description of the specific characteristics unique to the Washington Apple Commission, followed by an empirical model of the demand for Washington State apples. The estimation results follow. We use the regression results to calculate the change in demand and revenue due to the Washington Apple Commission's promotion. The conclusion of the paper provides suggestions for maximizing the effectiveness of current voluntary generic promotion.

An Overview of the Washington Apple Commission

The Washington Apple Commission (WAC) began operations in 1937 and court orders stopped its promotional efforts in 2003 (Prichard 2003). Prior to 2003, the Washington Apple Commission conducted several activities including direct advertising, merchandising, in-store displays, national publicity, consumer publicity, research, school and industry publicity, export promotion, and assistance to other organizations during much of that period (Washington Apple Commission 2005). Figure 1 shows the real expenditures for selected promotion activities and total sales of the Washington Apple Commission since 1970. The Washington Apple Commission spent several million dollars annually and increased its expenditures over time. Direct advertising generally represented the largest expenditure in recent years, and promotion expenditure was the second-largest category. Expenditures on these two types of activities sharply increased beginning in the late 1980s. Total sales also increased during this period, suggesting a relationship may exist between Washington Apple Commission promotion and sales.

Growers paid for the Washington Apple Commission-managed promotion through self-imposed mandatory fees. Real mandatory assessment rates varied historically from two cents in 1937 to 40 cents in 1998, per 42-pound box equivalent. The size of the assessment and the quantity of apples produced determined the amount available for Washington Apple Commission advertising expenditures each year (Bergstrom 2006).[1] The Washington Apple Commission produced the largest promotional campaign for generic items in United States history in 1999, with a $36 million budget, which was estimated to reach 40 percent of United States consumers (Litwak 1998).

During the 1990s two separate court cases probed the issue of using grower assessments to fund promotion. In a proactive move, the Washington Apple Commission tested the legality of their practice of funding promotion from mandatory fee assessments. The Washington Apple Commission identified two growers willing to raise the legal question (at Commission expense) over the use of the mandatory assessments. Later, a group of organic growers and three warehouses joined the suit (Warner 2003).

On March 31, 2003, a federal judge ruled that the Washington Apple Commission fee-assessment program violated the producers' First Amendment rights. The judge stated that producers could not be

[1] Washington Apple Commission assessments were calculated according to information from the Department of Agriculture's compliance-inspection database record, which detailed the number of state apples within USDA compliance standards and labeled by sticker. Individual packers received a corresponding invoice, and they would then collect fees from growers.

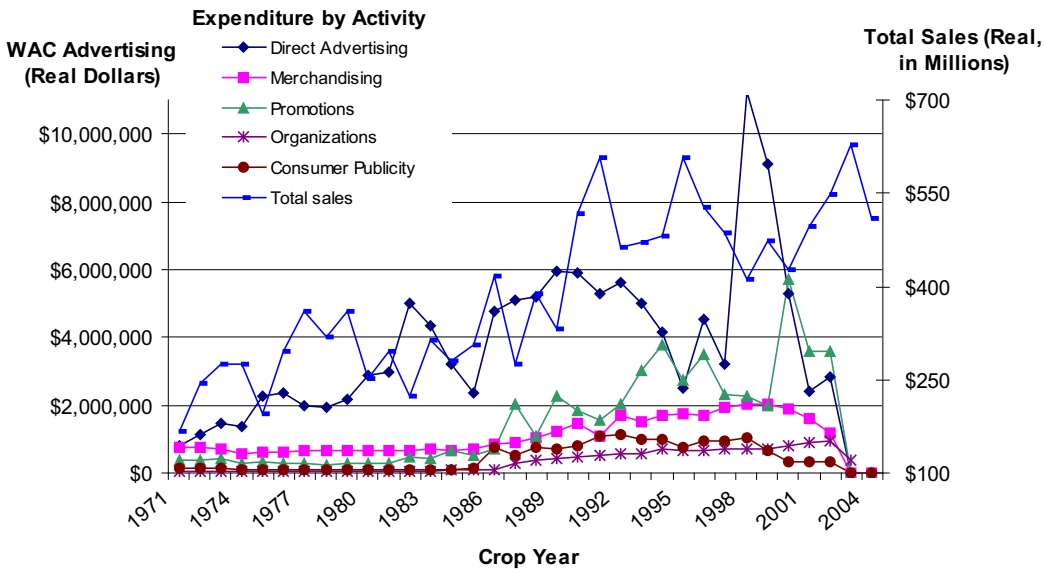

Figure 1. Total WAC Promotion Expenditures for Selected Activities and Total Sales.

Data Source: WAC (2005).

forced to fund activities that benefited competitors and found it illegal to require growers to pay to promote a message, even if that message was intended to increase consumption of their own crop (Prichard 2003). In compliance with these findings, the fee-assessment program to fund promotion ended. The current activities of the Washington Apple Commission consist of export promotion, administrative duties and coordination, and website maintenance at www.bestapples.com (Bergstrom 2006).

Model, Data, and Estimation

In order to characterize the effects of the Washington Apple Commission promotion prior to 2003, we specify a demand function to estimate the effects of these activities on producers' total revenue.[2] We include the price of the primary substitute for Washington fresh apples, aggregate consumer food expenditures, population, Washington Apple Commission advertising, and interaction terms. The general form of this equation can be written as

$$(1)\quad q = \beta_0 + \beta p_t + \boldsymbol{\delta}'\mathbf{ad}_t + \boldsymbol{\gamma}'(p_t \cdot \mathbf{ad}_t) + \mathbf{a}'\mathbf{x}_t \ ,$$

where q_t is the quantity of Washington fresh apples at time t, p_t is the price of Washington fresh apples, $\mathbf{ad}_t$ is a vector of advertising expenditures for a set of advertising categories, $\mathbf{x}_t$ are control variables, β_0 and β are parameters, and $\boldsymbol{\delta}$, $\boldsymbol{\gamma}$, $\boldsymbol{\alpha}$ are vectors of parameters.

The advertising variables may shift and rotate demand via interaction terms. The marginal effect of advertising can be used to find the price-point of rotation in demand with respect to a change in advertising expenditure. At this price, rotation and shift cancel each other out in terms such that $\partial q/\partial ad_i = \delta_i + \gamma_i p = 0$. Rearranging this shows the point of rotation for each advertising effect as $p^r = -\delta_i/\gamma_i$. An outward shift in demand is characterized by $\delta_i > 0$, and a clockwise rotation is characterized by $\gamma_i > 0$.

[2] We base our demand equation on Schmit, Reberte, and Kaiser (1997).

Data

The data used in this analysis come from Washington Apple Commission records of expenditures, the United States Department of Agriculture (USDA) publications, the Federal Reserve Economic Data website, and other sources. We use annual observations for the years 1971 to 2004. We deflate all price or expenditure variables with the consumer price index (CPI) for food using 1982–84 as the base. Table 1 contains a brief description and listing of variable sources. We present summary statistics for each variable in Table 2.

The dependent variable *WA fresh quantity* represents fresh apples sold by growers in the state of Washington (millions of pounds). We exclude juice, applesauce, and other forms of low-end production that do not consist of whole ripe apples and which are not a part of the Washington Apple Commission programs. The *WA fresh price*$_t$ variable represents the annual average price per pound for the same category of apples.

We include the national quantity-weighted average price of apples from states other than Washington, *U.S. price*. The *food expenditures per capita* variable serves as a targeted proxy for income.[3] This expenditure per capita includes only food at home (meaning sales, home production, and donations). We also include the *U.S. Population* (millions) for each year.

The Washington Apple Commission promoted Washington apples using several different methods including direct advertising, merchandising, display, promotions, organizations, and consumer publicity. We obtained measures of these variables from Washington Apple Commission historical data (2006) and Bergstrom (2006). To capture both shifts and rotations of demand in response to advertising, we included interaction variables, each defined as price times an individual advertising variable.

Direct advertising includes expenditures on radio, television, billboard ads, and creative services rendered. Prior to the ruling against the Commission, the Washington Apple Commission contracted with large marketing agencies for these direct advertising activities. In the current decade, direct advertising also included promotions and "focus group" research that analyzed purchasing decisions of customers (Bergstrom 2006).

Merchandising involves expenditures on trade promotions received by middlemen and apples retailers. Categories of merchandising programs include corporate programs, retail in-store demonstrations, training programs for representatives, and investments in new markets in the United States (for example, merchandising focused on Latinos in Los Angeles). Regional representatives contacted retail stores in their areas and offered trips or other special incentives to retailers for selling Washington apples (Bergstrom 2006).

Display characterizes expenditures on point-of-sale promotion such as brochures and signs at retail stores. Washington Apple Commission-managed booths at conventions also constitute a small part of the display expenditures (Bergstrom 2006).

Promotions include any money given to retailers for cooperation in advertising according to a particular offer by the Washington Apple Commission. The Gold's Gym three-a-day program is one example of promotion in this category, where participants are encouraged to eat an apple at every meal in order to lose weight (Bergstrom 2006).

The *organizations* variable represents contributions to industry-related groups. Industry organizations such as the Northwest Horticultural Council and the U.S. Apple Association coordinated with the Washington Apple Commission for specific activities including lobbying or gaining market access in foreign countries. In turn, the Washington Apple Commission donated funds annually to these organizations (Bergstrom 2006).

Consumer publicity constitutes expenditures on salaries, publicity, recipe development, conventions, apple giveaways, grower relations, photography, and crisis management. Consumer publicity also includes funds used to promote positive publications in magazines and other print media, as well as dues and subscriptions to groups that inform the Washington Apple Commission each time apples are in the news (Bergstrom 2006).[4]

[3] Including food expenditures but not income effectively assumes that changes in the price of apples do not affect overall food expenditures substantially.

[4] Washington Apple Commission expenditure categories not included in the demand model include *administration and revenue* (which is not directly promotional), *export promotion* (which does not directly affect domestic demand), *research* (which affects production in the long run rather than demand), *national publicity* (a category which has not been used in recent years), and *food service and school promotion*.

Table 1. Data Descriptions and Sources.

Variable	Description	Source
WA fresh quantity	Weight of apples in millions of pounds, produced and sold fresh (unprocessed) by Washington growers.	USDA NASS (2005) http://usda.mannlib.cornell.edu
WA fresh price	Return at packinghouse door for apples in the state of Washington (deflated), cents per pound.	USDA NASS (2005) http://usda.mannlib.cornell.edu.
U.S. price	Average price producers receive at the point of first sale for fresh apples in the U.S., except Washington[a] (deflated).	USDA NASS (2005) http://usda.mannlib.cornell.edu
Food expenditures per capita	Total expenditures for food at home for the U.S. divided by total population and deflated by the CPI for food described in this table below.	USDA Economic Research Service (2000) http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/Data/table1.htm
Population	U.S. population.	U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business.*
Direct advertising	Expenditure on billboards, ad-buys, television and radio commercials ($ 1,000 deflated).	WAC (2005). Data made available by Laverne Bergstrom of WAC in Washington
Merchandising	Gratuities for negotiations, expenses for sales representatives ($ 1,000 deflated).	"
Display	Retail point-of-sale promotion such as brochures, banners, signs; WAC booths at conventions ($1,000 deflated).	"
Promotions	Gratuities incentives ($ 1,000 deflated).	"
Organizations	Contributions to affiliated organizations of Washington apples such as Northwest Horticultural Council and the International (U.S.) Apple Institute ($ 1,000 deflated).	"
Consumer publicity	Consumer Publicity and public relations ($ 1,000 deflated).	"

[a] Values were calculated by subtracting the WA price weighted by quantity from the U.S. average price weighted by quantity and dividing by the pounds of all other states' apples to get the mean price for other states.

Table 2. Descriptive Statistics for the Data (34 observations).

Variable	Mean	Std. dev.	Min	Max
WA fresh quantity	11.3	3.2	5.3	15.8
WA fresh price	14.7	3.8	9.2	22.4
Direct advertising	3,632.2	24.1	0.0	112.4
Merchandising	1,025.9	588.6	0.0	2,039.1
Display	220.3	102.8	0.0	493.4
Promotions	1,446.5	1,431.8	0.0	5,692.7
Organizations	334.8	310.5	44.1	961.3
Consumer publicity	423.6	396.7	0.0	1,131.0
U.S. apple price	16.1	2.8	12.5	24.1
Food expenditures	968.1	85.5	877.0	1,137.7
Population	248.0	26.9	207.5	295.0

Estimation

Estimation of this model of demand requires a careful specification of the dynamic characteristics of the data. Economic theory provides little guidance about the specific dynamic structure of the model. Therefore, we performed preliminary specification analysis to characterize the dynamics of the demand equation. In particular, we examined various autoregressive distributed lag models for the demand equation.

We find minor heteroskedasticity in the residuals. Exploratory feasible generalized least squares (FGLS) estimates for various heteroskedasticity specifications showed little effect on parameter estimates, so rather than applying FGLS we performed OLS but reported White's heteroskedastic-consistent standard errors.

We considered the possibility that the *WA fresh price* may be endogenous in the demand equation, as price and quantity are often jointly determined. We initially included several supply-related variables as instruments for price (including lags of Washington apple prices, an interest rate measure and lags of the interest variable, and apple-bearing acreage) and ran a two-stage least-squares estimation. However, we found that based on a Hausman test we do not reject the null hypothesis at any conventional levels ($p = 0.35$), so we include the original fresh price in the demand equation. Additionally, we verified that the Washington Apple Commission activities did not affect price, in order to be confident that the change in quantity captured the entire revenue effects of the programs. The joint significance of the advertising variables in the preliminary price equation is not significant (p-value = 0.67), so Washington Apple Commission programs do not appear to affect price significantly. In summary, because we fail to reject price exogeneity and find no significant effect of Washington Apple Commission promotions on price, we use OLS with the original fresh apple price series to estimate the demand function, and use the original fresh apple price series to calculate the revenue changes with and without the Washington Apple Commission activities.

Results

Table 3 displays the final model specification and results.[5] Based on a battery of Bruesh-Godfrey tests and Ljung–Box portmanteau (Q) tests, the final specification includes one lag of the dependent variable (*WA fresh quantity*). This specification generates white-noise errors out to lag 15 (p-values > 0.44 for Ljung–Box Q statistic). An Engle-Granger test for cointegration based on the residuals of the

[5] We used STATA version 10 for estimation.

Table 3. Washington Fresh Apple Demand Coefficient Estimates Using OLS.

Variable	Estimate	Standard error	P-value
WA fresh quantity lagged 1	0.30***	0.09	0.003
WA fresh price	−39.76	23.64	0.112
Direct advertising	177.81*	89.89	0.065
Merchandising	−2485.66***	776.36	0.006
Display	3045.27	2022.73	0.152
Promotions	537.56**	223.45	0.029
Organizations	2667.34***	559.90	0.000
Consumer publicity	1002.42*	520.70	0.072
Price X Direct advertising	−0.01	0.01	0.120
Price X Merchandising	0.14**	0.05	0.014
Price X Display	−0.27**	0.11	0.029
Price X Promotions	−0.03	0.02	0.121
Price X Organizations	−0.14***	0.03	0.001
Price X Consumer publicity	0.00	0.04	0.949
U.S. price	52.59***	16.27	0.005
Food expenditures	1.23	1.21	0.324
Population	15.72***	4.84	0.005
Constant	−3477.97*	1844.13	0.078

F = 638, p<0.0000; R-squared = 0.99.
Significant levels are denoted: * = 10%, ** = 5%, *** = 1%.

demand equation produces a test statistic of –6.25. A one-percent critical value for this demand specification is given in Davidson and MacKinnon (1993, p. 722) as –3.90, indicating a strong rejection of the null of no cointegration. The Engle-Granger approach, though convenient for our model, is often criticized for having weak power compared to other VAR-based tests. Our strong rejection of the null hypothesis of no cointegration given the low power of this test (meaning that we are more likely to fail to reject the null) provides substantial confidence that our regression represents a cointegrating vector among the variables (a necessary condition for consistent parameter estimation in dynamic models).[6]

Because the demand equation includes a lagged dependent variable, the parameter estimates themselves correspond to short-run impact coefficients. All discussion below relates to short-run (annual) effects. The long-run effect of any variable or set of variables can be estimated by dividing the short-run estimated effect by $1 - \lambda$, where λ is the coefficient on the lagged dependent variable. For example, if the estimated marginal effect of a variable in the regression is β, then the long-run equilibrium effect is $\beta\,(1 - \lambda)$.

[6] Based on Dickey-Fuller tests for unit roots, all variables except *population* are integrated of order one or zero. With *population*, however, integration of order 2 is not rejected at conventional significance levels. Including this variable apparently has sufficient impact that it leads to a null set of cointegrating vectors in the demand equation. After examining the data, we are confident that the non-stationarity of the first difference of *population* is a figment of the interpolation method used to estimate the data between census points. All things considered, we have included *population* in the regression equation for theoretical completeness, with some confidence that its inclusion is a net improvement empirically over its omission.

First, we consider the effects of own-price and lagged quantity on *WA fresh quantity.* As the own-price increases the quantity demanded decreases according to the law of demand. The lagged quantity of apples relates positively to the current quantity. Now we examine the non-price and non-advertising control variables on *WA fresh quantity*, shown at the bottom of Table 3 (*U.S. price* for non-Washington Apples, *population,* and *food expenditures*). Because non-Washington apples act as substitutes for Washington apples, we expect an increase in *U.S. price* to increase the quantity of Washington apples demanded. The coefficient is positive and significant at the one-percent level. The *population* variable also positively and significantly increases the quantity demanded. The parameter for the *food expenditure* variable is positive as expected, but not significant at conventional levels.

All but one of the advertising categories shifts demand outward (as indicated by a positive coefficient). The parameter estimates associated with all advertising-related variables (including shift and interaction terms) are strongly jointly significant (p = 0.0000), and five of these shifts are individually statistically significant at conventional levels (*direct advertising*, *merchandising, promotions,* and *organizations*, and *consumer publicity*). The effect of *merchandising* is significantly negative near the sampling range of our independent variables.

In contrast, point estimates for all other advertising categories show an outward shift in demand and a clockwise rotation, though these rotation effects tend to be relatively small and weak. The rotation points are far higher than any price points in the sample. For all advertising categories but merchandising, the marginal effects are positive within the sample space but diminishing slightly in their effectiveness as price increases and as market quantity decreases.[7]

Table 4 contains the marginal effects of price and advertising effects calculated using the sample means of the explanatory variables provided in Table 2. The marginal effect of *WA fresh price* is −39.76, which indicates that a one-cent increase in price leads to a decrease in quantity demanded of about 40 million pounds with all other variables at the sample means. All variable but *merchandising* have positive marginal impacts on quantities demanded at sample means. Of the advertising categories with expected signs, four are statistically significant at conventional levels. The marginal effects with expected positive signs range from 1.77 to 30.49 million pounds for the marginal dollar spent.

For 2002, the last year of Washington Apple Commission promotion, the predicted quantity demanded given no Washington Apple Commission promotion for 2002 reaches 4.01 billion pounds (the actual quantity equaled 3.90 billion), and the predicted quantities demanded with Washington Apple Commission promotion set to zero for all categories is 3.52 billion pounds. This suggests that Washing-

[7] Other than for *merchandising*, the marginal effects go negative at prices ranging from p_f = 11,000 to p_f = 406,513. For *merchandising*, the marginal effect becomes positive at p_f = 18,313. Thus these rotation effects are very minor anywhere in our sample space.

Table 4. Marginal Effects of Price and Advertising on the Quantity of Fresh Apples Calculated at Sample Means.

Variable	Estimate	Standard error	P-value
WA fresh price	−40	24	0.111
Direct advertising	177	90	0.065
Merchandising	−2484	776	0.006
Display	3041	2021	0.152
Promotions	537	223	0.029
Organizations	2665	559	0.000
Consumer publicity	1002	520	0.072

ton Apple Commission promotion increased quantity demanded by approximately 11 or 14 percent, depending on whether the no-ad predicted value is compared to the actual market quantity or the model prediction (with ads), respectively. For 2001, the estimated percentage change in revenue was approximately five percent, approximately half of the estimated effect in 2002.

Total industry revenue is estimated to have been boosted by Washington Apple Commission promotions when compared to actual revenue, by $53.4 million for 2002 and $24.6 million in 2001. Furthermore, the average return to advertising reached over $8.70 per dollar and $3.75 per dollar in 2002 and 2001, respectively. This suggests that the industry benefited substantially from Washington Apple Commission advertising. Our results suggest a greater impact from generic advertising than do the estimates of Ward (1993) and other general fruit promotion predictions (Schmit, Reberte, and Kaiser 1997).[8]

Summary and Conclusions

This study measures the impact of generic advertising on demand in the special case of the Washington Apple Commission. We find that the Washington Apple Commission advertising positively affected the demand for Washington apples. The joint significance of all the advertising efforts suggests cumulative effectiveness of Washington Apple Commission promotion. Specifically, direct advertising, promotions, organization promotion, and consumer publicity positively affect the demand for Washington State apples. Washington Apple Commission promotion increased quantities demanded by nearly 15 percent compared to the simulated world with no Washington Apple Commission activities. The average return for a Washington Apple Commission dollar spent topped $8. These results suggest the Washington Apple Commission greatly affected the demand for Washington apples and the revenue received by producers.

Our results suggest that the elimination of the Washington Apple Commission negatively impacted the Washington apple industry. However, apple growers could resume an effective joint advertising effort to continue to affect the demand for Washington apples and increase their revenues with voluntarily raised promotion funds. By examining the results for each advertising category we see that promotion through in-store displays, investment in other organizations, and consumer publicity generates the largest impact. We also observe that these activities received the least amount of funding. This suggests that using these forms of promotion could be effective with a relatively small budget. However, without the infrastructure of the Washington Apple Commission, coordinating these activities may be difficult. Producers could hire a non-profit or for-profit organization to implement the voluntarily funded programs. To avoid these costs, or if coordination presents a significant problem, growers could reap promotional benefits simply by providing funds to the associated organizations. This would require little coordination and no program development and implementation costs.

Clearly, the days of multi-million dollar promotion budgets are over for the Washington State apple industry, but a focused small-scale campaign could positively impact revenues. However, not all producers would choose to participate in a voluntary program. The classic free-rider problem provides an incentive for producers to enjoy the benefits of promotion provided by others. Additionally, the Washington apple industry has become more diversified over time. Producers of new apple varieties or organic products may prefer to fund more narrowly focused promotion.

[8] This average return to advertising expenditure does not itself provide evidence about whether or not Washington Apple Commission was spending too much or too little; only that what the Commission did spend was on average apparently productive in boosting industry revenues.

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