Export Demand for U.S. Almonds: Impacts of U.S. Export Promotion Programs

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The purpose of this study was to estimate the impact of the major factors affecting the export demand for U.S. almonds in Asia and the E.U. which together import about 93% of U.S. almond exports. The primary objective pertained to the impacts of federal promotion programs on the foreign demand for U.S. almonds. Based on previous literature, a single-equation framework was specified for estimation of the almond model. Based on promotion elasticities, impacts on almond export revenue from promotion were evaluated. The marginal return per dollar to decreasing promotion expenditures for almonds was $47.74 for Asia, reflecting prudent promotion expenditures for more efficient utilization of promotion funds as the Asian market for U.S. almonds approaches maturity. The E.U. appears to be a mature market for U.S. almond exports with no detectable responsiveness to promotion expenditures. Thus, simple reminder-type promotion activities for this market may be sufficient.

Introduction

Almonds are the leading export commodity in the tree-nut industry. According to Johnson (1997), the United States is the world's largest producer and exporter of almonds accounting for more than 70% of world almond production and more than 80% of total world almond exports. The other major producers are Spain, Italy, Turkey, Greece, Morocco, and Portugal, Table 1 (U.S. Department of Agriculture, FAS, *Almond Situation and Outlook* 1997).

Some 70% of U.S. almond exports enter the E.U. Within the E.U., Germany is the largest export market, receiving about 25% of all U.S. almond shipments. Asia is the second most important market with about 23% of total U.S. exports. Japan typically purchases about half of all U.S. almond exports bound for Asia. U.S. exports to the E.U. in 1996 jumped 36% from the previous year, and significant increases also occurred in Asia, especially in South Korea, Hong Kong, and Taiwan (Johnson 1997). Expanded U.S. exports were reportedly demand driven in spite of a larger world supply in that year (Johnson 1997). About 1.3 million mt of almonds were exported to Asia and the E.U. between 1986 and 1996, representing export sales of more than $4 billion (U.S. Department of Commerce). Table 2 presents U.S. almond exports to Asia and the E.U. by year.

Exported almonds are sold largely as ingredients to food processors and bakers for manufacturing purposes, such as almond paste (marzipan/nougat) and whole or sliced shelled almonds for the confectionery trade, breakfast cereals, and baked goods. The E.U., Japan, Hong Kong, Canada, and South Korea are significant customers for shelled almonds, while the Middle East countries like Israel and Saudi Arabia, many Mediterranean countries, and some markets in the E.U. and Hong Kong prefer in-shell almonds (Johnson 1997).

Spain, which is the major competitor for U.S. almond sales, imports about 80% of its almond needs from the United States. Spain's marzipan manufacturers reportedly prefer Spanish almonds to U.S. almonds, claiming that U.S. almonds have less flavor and oil content and are only suitable for low-priced nougat (U.S. Embassy, Madrid, Spain 1997). Spanish slice and flour processors, on the other hand, generally prefer U.S. almonds due to their uniformity and low breakage.

It has been reported that even with higher prices in the principal almond markets, U.S. exports have increased. This phenomenon is consistent with reports that emphasize the large role that quality plays in the foreign sales of U.S. almonds (U.S. Department of Agriculture, FAS *Almond Situation and Outlook* 1997).

Reportedly, the government promotion programs have been valuable to the growth in the U.S. agricultural export market in general (Ackerman 1994), and in particular, this also may be the case for the U.S. almond market. A need to systematically determine the effectiveness of promotion programs is essential to guide the allocation of future funding.

This is the first independent study to evaluate the impact of major factors affecting the export demand for U.S. almonds in both Asia and the E.U. which together import about 95% of all U.S. al-

Table 1. Commercial Production of Almonds (Shelled Basis) by Country, 1986-1995.

Year	Country						
	Greece	Italy	Morocco	Portugal	Spain	Turkey	United States
	(1,000 mt)						
1986	15.0	17.0	7.0	3.0	50.0	12.0	113.0
1987	9.0	12.0	6.0	3.0	65.0	10.0	299.0
1988	19.0	14.0	7.0	1.0	40.0	13.0	268.0
1989	17.2	18.0	11.1	3.5	80.0	15.0	222.3
1990	15.5	19.0	11.5	2.5	50.0	15.0	299.4
1991	11.0	11.0	9.9	--	64.5	15.3	222.3
1992	16.0	18.0	8.2	--	72.0	14.8	248.6
1993	20.0	15.0	8.9	--	84.0	16.0	222.3
1994	16.0	14.0	5.7	--	70.2	15.7	333.4
1995	13.0	15.0	7.4	--	45.3	13.7	167.8

Source: U.S. Department of Agriculture, FAS, *Almond Situation and Outlook* (1997).

Table 2. U.S. Almond Exports (Shelled Basis) to Asia and the E.U., 1986-1996.

Year	Asia	E.U.
	(mt)	
1986	20,443	54,612
1987	13,632	60,360
1988	27,197	87,701
1989	33,668	69,611
1990	27,769	100,012
1991	21,393	77,048
1992	23,144	72,228
1993	24,605	63,965
1994	27,303	87,605
1995	52,335	138,527
1996	51,473	153,611

Source: U.S. Department of Commerce.

mond exports (Johnson 1997). The primary objective is to estimate the impact of federal promotion programs on the foreign demand for U.S. almonds. The paper is organized as follows. A brief explanation of the export promotion programs for almonds is presented ensured by a literature review which lays the basis for the study. The model specification and then, an explanation of the data are given. The analysis and results are presented followed by a summary of the study.

U.S. Almond Export Promotion

The U.S. Department of Agriculture currently administers two non-price export market promotion programs that pertain to tree nuts -- Foreign Market Development Program (FMDP) and Market Access Program (MAP). Both programs assist eligible trade organizations and companies to develop export markets for U.S. agricultural products (Ackerman 1994).

While FMDP was introduced in 1955 to cater to generic promotion of bulk commodities in developing and developed countries, the Targeted Export Assistance (TEA) program was established in 1985 to maintain and expand foreign markets for exports of specific commodities hurt by foreign subsidies, import quotas, or other unfair trade practices (Ackerman 1991). The TEA provides foreign market assistance through consumer promotion, trade services, and technical assistance. Financial assistance is provided in the form of generic commodity certificates issued by the Commodity Credit Corporation. The U.S. Department of Agriculture, Foreign Agricultural Service (FAS) expenditures on FMDP and TEA promotions for the period 1986-1989 averaged $30.5 million and $98 million, respectively. Horticultural products grossed the largest share, 53 % of TEA expenditures over the four-year period (Ackerman 1991). The almond share of the TEA expenditures was $15,621,987 (ABC 1997). Almost 35% of the U.S. Department of Agriculture expenditures on TEA in fiscal years 1986-1989 were towards promotion activities in Western Europe while 37% were aimed at Japan (Ackerman 1991).

The Market Promotion Program (MPP) authorized in 1990 replaced TEA. Market development was the main goal of the MPP, with its activities directed more towards consumers of higher-value products in highly developed and middle income countries (Ackerman 1994). Further, priority still was given to exports of commodities that are disadvantaged by unfair trade practices of other nations. The farm bill authorized $200 million for MPP for each of the years 1991 through 1995. However, the allocations slipped to $147.7 million, $100 million, and $85.5 million in 1993, 1994, and 1995, respectively, due to concerns about accountability, industry shares of promotion funds, and allocations to large U.S. and foreign firms (Ackerman 1993; Ackerman 1998; Ackerman 1994). Perhaps as a result of the decrease in annual MPP appropriations, export promotion fund allocations for almonds were reduced to $13,957,993 (ABC 1997).

Authorized by the Federal Agricultural Improvement and Reform Act of 1996, the Market Access Program (MAP) uses funds from the U.S. Department of Agriculture, Commodity Credit Corporation to help U.S. producers, exporters, private companies, and other trade organizations finance promotion activities for U.S. agricultural products (U.S. Department of Agriculture, FAS, *Fact Sheet* 1996). The MAP encourages the development, maintenance, and expansion of commercial export markets for agricultural commodities. Activities financed include consumer promotion, market research, technical assistance, and trade servicing. Under the program, an annual sum of $90 million is to be allocated for fiscal years 1996 through 2002. The program prohibits direct MAP assistance for brand promotion to foreign companies for foreign-produced products or to companies that are not recognized as small businesses under the Small Business Act (U.S. Department of Agriculture, FAS, *News* 1996). In 1996 the export promotion allocations for almonds were $1,259,669 (ABC 1997).

MAP funds have helped the California almond industry to expand almond exports over the past 10 years (U.S. Department of Agriculture, FAS, *Almond Situation and Outlook* 1997). Most of the funding for promotion and market development comes from two sources: growers and government agencies. In the almond industry, as in most commodity groups, growers contribute a small (self-assessed) fee of two and a half cents per pound of shelled almond. One and a half cents of this fee combined with U.S. Department of Agriculture matching-funds support promotion activities, foreign and domestic (Marsh 1998). Note that this study encompasses only federal expenditures for export promotion.

While Asia has historically accounted for the larger portion of almond promotion expenditures, only about 23% of total export volume is imported by Asia. Within the period, 1986-1996, almond promotion expenditures in Asia totaled $24,207,253, representing 78% of the total funds, while the expenditures in the E.U. was $6,632,396 (ABC 1997). Since 1994, the U.S. almond industry has promoted almonds in China through the U.S. Department of Agriculture's MAP which has helped boost exports to Asia. The activities include technical conferences for Chinese food processors and bakers, emphasizing the many uses of almonds in the confectionery trade; trade shows in key Chinese cities where economic prosperity has been booming in recent years; and the use of "reverse" trade missions to California (ABC 1996).

Literature Review

Promotion may be defined as those activities of a firm which are intended to enhance the output of the firm for consumers without altering the physical characteristics or location of the output in time or space. In a profit-motivated firm, all activities are intended to enhance the output of the firm (Shaffer 1964). Inclusive in what is commonly known as promotions is commodity promotion. Generally, when discussing commodity promotions beyond country borders, one must deal with trade policies, trade promotions, and export promotions (Ward 1996).

According to Hibbert (1990, p.1-120) export promotions could be referred to as policies and operations in the public and private sectors designed to explicitly enhance the exports of a country, region, or sector. The private sectors of most capitalist systems are the major players in export promotion in terms of investments in demand enhancement efforts. However, one can turn to any market and find some level of government involvement in export promotion. As Ward (1996) stated, governments invest in promotions when the benefits accrue to the public, and not just to specific sectors. Export growth generally benefits the total economy and therefore its citizens too. In other words, expected gains not only benefit the sectors doing the promotion but also the total economy in the long run. For some sectors, government demand enhancement efforts may be an alternative to direct subsidies. Increasing demand for all producers via government promotions may be a much fairer and simpler way to assist industries than the direct payments historically used in most countries, including the United States.

Efforts to promote agricultural products concentrate on providing consumers with increased information about the product, providing consumers with increased information about and access to new forms of the product, or otherwise trying to convince consumers to buy more of the product (Hallberg 1992). The objective of such promotion is to shift the demand curve outward with the net effect of increasing farm revenues.

Food manufacturers, and commodity/farm groups have long engaged in promoting products through various means. The separation of the competing and complementary effects of export promotion can be likened to determining the effectiveness of generic and branded promotion. Ward and Chang (1990) argue that the effect of generic promotion is to "precipitate and remind, while brand advertising is primarily intended to persuade and reinforce." While the former tends to increase overall market size, the latter attempts to differentiate a product from its rivals. According to Richards, Van Ispelen, and Kagan (1997) when a promotion program, whether targeted as branded or generic, has a significant "generic effect," the message will be spread equally among products from any source. If the product is inherently difficult to brand, the benefit from promotion will flow to those who are most able to achieve some measure of differentiation.

Consumer promotions cover a variety of activities, including media advertising, point-of-sale materials and demonstrations, cooking schools for consumers, and recipes for food magazine editors (Ackerman 1994). U.S. agricultural promoters also provide educational materials to foreign industry partners, stage special events, and conduct food preparation training sessions for hotel and restaurant chefs, exporters, and food retailers in the potential import markets.

A considerable number of studies have examined export demand and the impacts of U.S. export promotion programs on various agricultural commodities in the importing countries. For example, studies have encompassed measuring the effectiveness of U.S. export promotion programs for meat and poultry products (Comeau, Mittelhammer, and Wahl 1997;

Le, Kaiser, and Tomek 1997), fruit and fruit products (Fuller, Bello, and Capps 1992; Armah and Epperson 1997; Rosson, Hammig, and Jones 1986) tree nuts (Halliburton and Henneberry 1995; Kinnucan and Christian 1997; Weiss, Green, and Havenner 1996; Onunkwo and Epperson 2000), and tobacco (Rosson, Hammig, and Jones 1986).

Specific to almonds, Halliburton and Henneberry (1995) estimated the effectiveness of U.S. nonprice promotion in the Pacific Rim. They found that export promotion had no impact in Singapore and South Korea, but had a positive and statistically significant impact in Japan, Taiwan, and Hong Kong. The gross rates of return per dollar invested in U.S. almond export promotion were $4.95 in Japan, $5.94 in Hong Kong, and $8.89 in Taiwan. Applying Nerlove and Waugh's theory of cooperative advertising, Kinnucan and Christian (1997) also estimated the effectiveness of almond promotion in the Pacific Rim. Their analysis showed, that owing to the instability of the estimated elasticities, no firm conclusions could be made about the effectiveness of almond export promotion.

Model Specification

Binkley (1981) showed that it is proper to specify import demand as a single equation when the supply faced by the importing nation is exogenous. This occurs when the importer faces a highly elastic supply curve, and hence is a price taker. He added that in many cases in which demand (supply) are estimated, use of single-equation methods are justified on the basis that because of the highly elastic nature of supply (demand), simultaneous effects are of no practical consequence.

Thursby and Thursby (1984) pointed out that economic theory offers little guidance on appropriate measures of variables which are included in the import demand function or on the appropriate functional form. An appropriate model is defined as one which generates unbiased (or at least consistent) and efficient elasticity estimates. Hence, according to the authors, the precise specification of import demand is largely an empirical issue.

U.S. almonds have a variety of competing uses. Depending on the regional markets, Asia and the E.U., almonds face competition from foreign suppliers and in some cases local production. The institutional and retail market segments drive the export demand for the different forms, shelled and in shell, of almonds. These factors, taken together, suggest that competitive forces are sufficient to assure price-taking behavior (Kinnucan and Christian 1997). As a result, a single-equation model is specified similar to those of Rosson, Hammig, and Jones (1986); Halliburton and Henneberry (1995); Aviphant, Lee, and Seale (1990); and Onunkwo and Epperson (2000).

The crucial economic variables affecting total export demand are hypothesized to be own price, cross prices, income, and promotion expenditures. The export demand equation for U.S. almonds is specified as follows:

$$(1) \qquad Q_{rt} = f\,(Pa_t^*, Pw_t^*, Pp_t^*, Y_{rt}^*, Proa_{rt}^*, Prow_{rt}^*, Prop_{rt}^*), \text{ and}$$

$$(2) \qquad Pa_t^* = \frac{Pa_t}{I_{at}},\ Pw_t^* = \frac{Pw_t}{I_{at}},\ Pp_t^* = \frac{Pp_t}{I_{at}},$$

$$Y_{rt}^* = \frac{Y_{rt}}{I_{rt}},\ Proa_{rt}^* = \frac{Proa_{rt}}{I_{at}},$$

$$Prow_{rt}^* = \frac{Prow_{rt}}{I_{at}},\ Prop_{rt}^* = \frac{Prop_{rt}}{I_{at}}.$$

The dependent variable (Q_{rt}) represents the total volume of U.S. almond exports, (Q_a), to the importing region, in metric tons (mt). All monetary values in the model are in U.S. real dollars with 1990 as the base year. The explanatory export price (f.a.s.) variables are Pa, price of U.S. almonds; Pw, price of U.S. walnuts; and Pp, price of U.S. pecans. Prices are in dollars per kilogram (kg). Gross Domestic Product (Y) in trillions of dollars is included in the model as a region-specific explanatory variable for Asia and the E.U. The Japanese GDP was used as a proxy for Asia because of the importance of Japan as a customer and because of the importance of the yen as an Asian currency. Other region-specific variables are the index of consumer prices (base year 1990) in the importing region (I_r) and the United States (I_a); promotion expenditures on U.S. almonds (Proa); promotion expenditures on U.S. walnuts (Prow); and promotion expenditures on U.S. pecans (Prop). Promotion expenditures are in thousands of dollars. The subscripts *r*, *a*, and *t* denote the importing region, the United States, and the year, respectively.

The effect of the price of almonds on quantity demanded is expected to be negative according to economic theory. To account for complementary/ substitutional relationships, prices of U.S. almonds, walnuts, and pecans were included in the model to measure their effects on the dependent variable. A positive relationship is expected between income (Y) of the importing region and the demand for U.S. almonds. All else equal, a higher (lower) level of income implies higher (lower) disposable income allowing for increased expenditure on U.S. almond exports. To evaluate the influence of promotion programs on the export demand for almonds, U.S. export promotion expenditures on almonds, walnuts, and pecans were included in the model. Export promotion expenditures on almonds are expected to have a direct effect on U.S. almond exports (Hallberg 1992, p.139-158). U.S. export promotion expenditures on any set of two nuts may impact positively on U.S. exports of the third nut if the consumption relationships among these nuts are complementary or if differentiation among them is weak in the region of destination. For situations to the contrary, a negative relationship is plausible.

Dummy variables are used to allow the intercept and slope coefficients to vary by region of the world, i.e., Asia and the E.U. The dummy variable, D, is for Asia, while the E.U. is captured in the intercept. The seven slope dummy variables are as follows: Pa*D, Pw*D, Pp*D, Y*D, Proa*D, Prow *D, and Prop*D.

Using GLS, White's heteroskedasticity-consistent matrix (White 1980) and Newey-West's autocorrelation-consistent matrix with order one (Newey and West 1987) were employed to correct the estimates for any unknown form of heteroskedasticity and autocorrelation of order one, respectively. Based on statistical tests of significance, the following functional form for the U.S. almond export demand model is deemed appropriate:

$$(3)\ \ln Q_{rt}^{*} = \alpha_0^{*} + \alpha_1 Pat^{*} + \alpha_2 Pw_t^{*} + \alpha_3 Pp_t^{*} + \alpha_4 Y_{rt}^{*} + \alpha_5 Proa_{rt}^{*} + \alpha_6 Prow_{rt}^{*} + \alpha_7 Prop_{rt}^{*} + \upsilon.$$

Data

Annual observations from 1986-1996 for U.S. export volume of almonds to Asia and the E.U. were obtained from the U.S. Department of Commerce. Thus, the total number of observations in the equation is 22. All physical quantities are reported on a shelled basis. Implicit unit values (f.a.s.) were calculated by dividing the annual export value by the corresponding export volume to Asia and the E.U. Annual data on GDP at 1990 price levels and exchange rates were taken from the OECD *National Accounts* (1997). Indices of consumer prices were gathered from the same source. Export promotion expenditures on U.S. almonds and walnuts were obtained from the Almond Board of California and the California Walnut Commission, respectively. Pecan promotion budget allocations were obtained from the Southern U.S. Trade Association (SUSTA), and the Western United States Agricultural Trade Association (WUSATA).

In this study, only federal promotion monies from the U.S. Department of Agriculture, Foreign Agricultural Service (FAS) were used in estimating the models as part of the contributions from program participants were unavailable. As such, the estimated dollar returns due to export promotion expenditures are to be attributed to the federal share of export promotion funds.

Several studies have estimated promotion impacts on export demand without consideration of monetary contributions made by private parties (Comeau, Mittelhammer, and Wahl 1997; Le, Kaiser, and Tomek 1997; Halliburton and Henneberry 1995; Onunkwo and Epperson 2000). The non-inclusion of such funds could lead to an upward bias on the demand enhancing effects attributed to the promotion programs. However, program participants usually provide matching funds which implies that the magnitude of the total promotion expenditures for almonds is proportional to the FAS share used in the regression. As such, the estimated coefficients for promotion are unbiased (Halliburton and Henneberry 1995).

Econometric Analysis and Results

A description and simple statistics for the variables included in the model are presented in Table 3. The parameter estimates of the export demand equation for U.S. almonds are shown in Table 4. The measure of goodness-of-fit for the estimated equation was excellent at 0.92 indicating that 92% of the variation in U.S. exports of almonds was explained by the model.

Most of the region-specific elasticity estimates displayed in Table 5 appear reasonable. For example, the own-price elasticities for almond exports were negative, the cross-price elasticities with respect to walnuts were positive, indicating substitutes, and the walnut and pecan promotion elasticities were found to be negative, further indicating the competitive relationships among substitutes. However, other elasticity signs were not anticipated, requiring explanation.

The cross-price elasticities with respect to pecan exports to Asia and the E.U. were zero indicating no pecan price effects on almond exports which is an indication of the sheer dominance of almonds in terms of volume over pecan exports. However, some degree of substitution is reflected in the negative pecan promotion elasticities with respect to almond exports.

The income elasticity for Asia was negative, indicating that almonds are an inferior good, while positive and highly elastic for the E.U., indicating a luxury good. The positive income elasticity is consistent with the promotion efforts of the U.S. almond industry highlighting the quality and nutritional attributes of U.S. almonds (U.S. Department of Agriculture, FAS, *Almond Situation and Outlook* 1997). The anomaly of a negative income elasticity for Asia is because of macroeconomic forces causing a mostly flat GDP, while almond exports trended up over the study period.

The almond promotion elasticity for Asia was negative indicating that decreasing almond promotion expenditures were associated with increasing U.S. almond exports to Asia. Almond promotion expenditures were trending down, while almond exports were trending up over the study period. A promotion elasticity of zero for the E.U. indicates that almond exports were not responsive to export promotion expenditures in the E.U.

The negative signs for the walnut promotion elasticities for Asia and the E.U. are consistent with the finding that almond and walnut exports are substitutes, Table 5. Halliburton and Henneberry (1995) also suggested that walnuts and almonds are substitutes.

Based on the promotion elasticities shown in Table 5, promotion impacts on almond exports were evaluated for Asia and the E.U., Table 6. Generally, the results were as expected except for the apparent ineffectiveness of export promotion expenditures for almonds in the E.U. Of the three U.S. tree nut exports under study, almonds dominate by far, while average promotion expenditures for almonds have been far less in the E.U. than in Asia. This occurrence is consistent with that of a mature market which does not tend to respond to relatively small doses of promotion expenditures. Asia appears to be moving in the direction of a mature market as U.S. almond exports have trended upward, while almond promotion expenditures have trended in the opposite direction. Thus, more U.S. almond exports have been achieved with fewer promotion dollars. The marginal return to decreasing promotion expenditures for almonds was substantial at almost $48.00 per promotion dollar. In other words, promotion expenditures were effectively reduced allowing a marginal return of $48.00 per promotion dollar saved.

Export promotion expenditures for U.S. walnuts and pecans appear to dramatically and adversely affect U.S. almond exports. This finding must be tempered with the fact that U.S. almond exports in terms of sheer magnitude by volume vastly dominate the other two tree nuts under study. Though U.S. walnuts and especially pecan exports appear to be making tremendous inroads at the expense of U.S. almond exports, the dominant U.S. tree nut export, almonds, has continued to trend upward in both Asia and the E.U.

Summary

The United States is the world's largest producer and exporter of almonds, accounting for more than 70% of world almond production and more than 80% of total world almond exports. The export value increased from almost $300 million in 1986 to a record of over $1billion in 1996, up 30% from the previous year.

The U.S. Department of Agriculture currently administers two non-price export market promotion programs that pertain to tree nuts -- Foreign Market Development Program (FMDP) and Market Access Program (MAP). Both programs assist eligible trade organizations and companies to develop export markets for U.S. agricultural products. Within an 11-year period from 1986 to 1996, as reported by the Almond Board of California, total Targeted Export Assistance (TEA) and Market Promotion Program (MPP) allocations for the export promotion of almonds were about $31 million.

Table 3. Description and Simple Statistics for Variables Included in the Almond Model, 1986-1996.

Variable	Description	Mean		Standard Deviation		Minimum		Maximum	
		Asia	E.U.	Asia	E.U.	Asia	E.U.	Asia	E.U.
Qa	Volume of U.S. almonds exports (mt)	29,360.18	87,752.73	11,671.41	30,398.73	13,632.00	54,612.00	52,335.00	153,611.00
Pa*	Price of U.S. almonds ($/kg)	3.20	3.20	0.31	0.30	2.85	2.85	3.87	3.87
Pw*	Price of U.S. walnuts ($/kg)	3.85	3.86	0.33	0.32	3.31	3.31	4.59	4.59
Pp*	Price of U.S. pecans ($/kg)	5.20	5.22	1.06	1.01	4.08	4.08	6.98	6.98
Y*	Gross Domestic Product (trillion $)	3.00	6.71	0.23	0.41	2.54	5.94	3.32	7.33
Proa*	Promotion expenditures on U.S. almonds (thousand $)	2,180.63	618.08	698.54	437.71	1,049.72	0.00	3,123.29	1,259.03
Prow*	Promotion expenditures on U.S. walnuts (thousand $)	1,929.61	2,955.51	636.31	1,313.90	1,090.03	727.89	2,886.60	4,752.74
Prop*	Promotion expenditures on U.S. Pecans (thousand $)	110.63	62.01	37.80	68.56	58.12	0.00	173.45	189.62

Note: Dollar values are in 1990 dollars.

Sources: U.S. Department of Commerce; OECD (1997); ABC (1997); CWC (1997); Nagrath (1997); Howell (1997).

Table 4. Estimated Export Demand Equation for U.S. Almonds, 1986-1996.

Variable	Coefficient Estimate	T- statistic
Constant	0.7736****	9.23
(Pa*)	-0.2645***	-2.90
(Pw*)	0.1534**	2.30
(Pp*)	-0.0058	-0.47
(Y*)	0.6291****	7.30
(Proa*)	0.6768E-4	0.59
(Prow*)	-0.9359E-4**	-2.19
(Prop*)	-0.2307E-2****	-9.26
(Pa**D)	-0.5827***	-3.15
(Pw**D)	-0.1994	-1.14
(Pp**D)	0.5830E-1	1.11
(Y**D)	-1.1695****	-4.82
(Proa**D)	-0.5569E-3***	-2.96
(Prow**D)	-0.1889E-3***	-2.58
(Prop**D)	-0.2439E-2	-0.69
D	8.8490****	5.65
	Number of observations 22	
	F-value 18.25	
	Adj. R-square 0.92	
	Degrees of Freedom 6	

Note: *, **, ***, **** on the coefficient estimates denote 15, 10, 5, and 1 percent levels of significance, respectively, two-tailed test.

Table 5. Elasticity Estimates for Asia and the E.U. for U.S. Almond Exports.

Variable	Asia	E.U.
Price		
Almonds	-2.71	-0.85
Walnuts	0.59	0.59
Pecans	--[a]	--[a]
Income	-1.62	4.22
Promotion Expenditures		
Almonds	-1.21	--[a]
Walnuts	-0.55	-0.28
Pecans	-0.26	-0.14

Note: Elasticity estimates obtained by: $b_{ir} * \bar{x}$
where
b_{ir} is the coefficient for independent variable *i* in region *r*, and
$\bar{x}$ is the mean of independent variable *i* in region *r* (Gujarati 1995, p.178). The coefficient for each independent variable, b_{ir}, for Asia was the sum of the respective E.U. coefficient estimate and its corresponding slope dummy coefficient for Asia as depicted in Table 4. Insignificant coefficients were valued at zero.
[a] Elasticity estimate not significantly different from zero.

Table 6. Estimated Annual Impacts of Promotion Expenditures on U.S. Almonds Export Demand by Region, 1986-1996.

Region/Product	Real Mean Almond Export Value	Real Mean Promotion Expenditures	Marginal Return to Promotion Expenditures
	----------($'000)----------		(dollars)
Asia			
Almonds	86,029.76	2,180.63	47.74[a]
Walnuts	86,029.76	1,929.61	-24.52
Pecans	86,029.76	110.63	-202.19
E.U.			
Almonds	275,220.90	618.08	0.00
Walnuts	275,220.90	2,955.52	-26.07
Pecans	275,220.90	62.02	-621.27

Note: Marginal return to promotion expenditures obtained by: $\frac{\bar{N}_r * \xi_{spn}}{\bar{E}_{nr}}$

where
$\bar{N}_r$ = real mean almond export value in region r,
$\bar{E}_{nr}$ = real mean promotion expenditures of nut, n, in region, r, and
ξ_{spn} = appropriate promotion elasticity (Richards, Van Ispelen, and Kagan 1997).
[a] Marginal return to decreasing promotion expenditures.

This study estimated the impacts of the major factors affecting the export demand for U.S. almonds in Asia and the E.U. which together import about 95% of all U.S. almond exports. The primary objective pertained to the impact of federal promotion programs on the foreign demand for U.S. almonds. Only federal promotion monies from the U.S. Department of Agriculture, Foreign Agricultural Service (FAS) were used in estimating the model as the contributions from program participants were unavailable. As such, the estimated dollar returns due to export promotion expenditures are to be attributed to the federal share of export promotion funds.

Based on previous literature, a single-equation model was used as the estimation technique in this study to garner degrees of freedom through stacking the regional observations and using dummy variables. The model for almonds was estimated using GLS with heteroskedasticity-consistent and autocorrelation-consistent matrices with order one.

The measure of goodness-of-fit for the estimated equation was excellent at 0.92 indicating that 92% of the variation in U.S. exports of almonds was explained by the model. Most of the region-specific elasticity estimates appeared reasonable. For example, the own-price elasticities for almond exports were negative, the cross-price elasticities with respect to walnuts were positive indicating substitutes. The income elasticity for Asia was negative, indicating on the surface that almonds are an inferior good, while positive and highly elastic for the E.U., indicating a luxury good. In reality, the apparent inferior good anomaly in Asia is associated with rising U.S. almond exports with stagnant GDP growth. The walnut and pecan promotion elasticities were found to be negative indicating non price competition among substitutes.

Promotion impacts on almond exports were evaluated for Asia and the E.U. Generally, the results were as expected except for the apparent ineffectiveness of export promotion expenditures for almonds in the E.U. The marginal return to decreasing promotion expenditures for almonds in Asia was substantial at almost $48.00 per promotion dollar. In an earlier almond study, Halliburton and Henneberry (1995) concluded that "ineffectiveness" of promotion expenditures in more developed Pacific Rim markets may have been caused by the level of maturity in those markets for U.S. almonds.

Based on the findings of the study, the substantial marginal return to decreasing promotion expenditures for almonds in Asia reflects prudent promotion expenditures for more efficient utilization of promotion funds as the Asian market for U.S. almonds approaches maturity. Since the E.U. market for U.S. almonds appears to be mature with no detectable response to promotion, simple reminder-type promotion activities for this market may be sufficient.

References

Ackerman, K.Z. 1991. "U.S. Agricultural Export Programs." *Food Review*. Washington, DC: U.S. Department of Agriculture, Economic Research Service. 14(3):53-56.

Ackerman, K.Z. 1993. "Export Promotion Programs Help U.S. Products Compete in World Markets." *Food Review*. Washington, DC: U.S. Department of Agriculture, Economic Research Service. 24(2):31-35.

Ackerman, K.Z. 1994. "Market Development Programs Help Expand U.S. High-Value Agricultural Exports." *Food Review*. Washington, DC: U.S. Department of Agriculture, Economic Research Service. 17(3):23-37.

Ackerman, K.Z. 1998. "MPP Annual Allocations." Unpublished data. Washington, DC.

Almond Board of California (ABC). 1996. "Exports Continue Strong Role in Almond Success Story." *Almond Almanac*:1-16.

Almond Board of California (ABC). August 1997. "Almond Promotional Expenditures." Unpublished report. Modesto, CA.

Armah, B.K., Jr., and J.E. Epperson. 1997. "Export Demand for U.S. Orange Juice: Impacts of U.S. Export Promotion Programs." *Agribusiness An International Journal*. 13(1):1-10.

Aviphant, P., J. Lee, and J.L. Seale. 1990. "Trade Agreements and U.S. Citrus Exports to Japan." Paper presented at the joint annual meetings of the American and Western Agricultural Economics Associations, Vancouver, British Columbia, Canada.

Binkley, J. 1981. "The Relationship Between Elasticity and Least Squares Bias." *The Review of Economics and Statistics*. 63:307-309.

California Walnut Commission (CWC). August 1997. "Walnut Promotional Expenditures." Unpublished report. Sacramento CA.

Comeau, A., R.C. Mittelhammer, and T.I. Wahl. 1997. "Assessing the Effectiveness of MPP and TEA Advertising and Promotion Efforts in the Japanese Market for Meats." *Journal of Food Distribution Research*. 28(2):27-35.

Fuller, B., H. Bello, and O. Capps. 1992. "Import Demand for U.S. Fresh Grapefruit: Effect of U.S. Promotion Programs and Trade Policies of Importing Nations." *Southern Journal of Agricultural Economics*. 24(1):251-260.

Gujarati, D.N. *1995. Basic Econometrics*. New York NY: McGraw-Hill, Inc.

Hallberg, M.C. 1992. *Policy for American Agriculture: Choices and Consequences*. Ames: Iowa State University Press.

Halliburton, K., and R.S. Henneberry. 1995. "The Effectiveness of U.S. Nonprice Promotion of Almonds in the Pacific Rim." *Journal of Agricultural and Resource Economics*. 20(1):108-120.

Hibbert, E.P.1990. *The Management of International Trade Promotion*. London and New York: Routledge.

Howell, K. September 1997. "Budget Allocated to Pecan Promotion." Unpublished report. Western United States Agricultural Trade Association. Vancouver, Washington.

Johnson, D.C. 1997. "United States is World Leader in Tree Nut Production, Trade." *Fruit and Tree Nuts*. Washington, DC: U.S. Department of Agriculture, Economic Research Service. FTS-280.

Kinnucan, H., and J. Christian. 1997. "A Method of Measuring Returns to Nonprice Export Promotion with Application to Almonds." *Journal of Agricultural and Resource Economics*. 22(1):120-132.

Le, C.T., H.M. Kaiser, and W.G. Tomek. 1997. *Export Promotion and Import Demand for U.S. Red Meat in Selected Pacific Rim Countries*. National Institute for Commodity Promotion Research & Ev aluation, NICPRE 97-04, R.B. 97-12, Department of Agricultural Resource and Managerial Economics, Cornell University, Ithaca, NY.

Marsh, M. December 1998. "Matching Funds Program for the U.S. Almond Industry." Personal communication. Almond Board of California (ABC). Modesto, CA.

Nagrath, A. September 1997. "Budget Allocated to Pecan Promotion." Unpublished report. Southern U.S. Trade Association. New Orleans, LA.

Newey, W. and K. West. 1987. "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." *Econometrica*. 55:703-708.

Onunkwo, I.M., and J.E. Epperson.2000. "Export Demand for U.S. Pecans: Impacts of U.S. Export Promotion Programs." *Agribusiness An International Journal*. 16 (2):253-265.

Organization for Economic Cooperation and Development (OECD), Statistics Directorate. 1997. *National Accounts*. Paris, France. Vol.1.

Richards, T.J., P. Van Ispelen, and A. Kagan. 1997. "A Two-Stage Analysis of the Effectiveness of Promotion Programs for U.S. Apples." *American Journal of Agricultural Economics*. 79:825-837.

Rosson, C.P., III, M.D. Hammig, and J.W. Jones. 1986. "Foreign Market Promotion Programs: An Analysis of Promotional Response for Apples, Poultry, and Tobacco." *Agribusiness An International Journal*. 2(1):33-42.

Shaffer, J.D. 1964. "Advertising in the Marketing Process." in *Agricultural Market Analysis: Development, Performance, Process*. V.L. Sorenson, ed., East Lansing: Michigan State University.

Thursby, J., and M. Thursby. 1984. "How Reliable are Simple, Single Equation Specifications of Import Demand." *The Review of Economics and Statistics*. 66:120-127.

U.S. Department of Agriculture, Foreign Agricultural Service (FAS). June 1996. *Fact Sheet*. Washington, DC.

U.S. Department of Agriculture, Foreign Agricultural Service (FAS). October 4, 1996. "USDA Calls for Market Access Program Applications For Fiscal 1997." *News*. Washington, DC, Release No. 0442.96.

U.S. Department of Agriculture, Foreign Agricultural Service (FAS). October 1997. *World Horticultural Trade & U.S. Export Opportunities: Almond Situation and Outlook*. FHORT 10-97. Washington, DC.

U.S. Department of Commerce, Bureau of the Census. Various issues. *U.S. Exports, Schedule E. Commodity by Country*. Washington, DC.

U.S. Embassy. 1997. "Tree Nuts." AGR SP7036, Madrid, Spain.

Ward, R. 1996. "Commodity Promotions: A Global Perspective." *Proceedings of Research on Agricultural Commodity Promotion Policies and Programs in the Global Agri-Food System*. J. Ferrero, K.Z. Ackerman, and J.P. Nichols, eds. Ithaca, NY: Cornell University.

Ward, R.W., and J. Chang. 1990. "Theoretical Issues Relating to Generic and Brand Advertising on Agricultural Commodities." *Proceedings of Research on Effectiveness of Agricultural Commodity Promotion Seminar*. W.J. Armbruster and L.H. Myers, eds. Arlington VA: Farm Foundation and U.S. Department of Agriculture.

Weiss, K., R. Green, and A. Havenner. May 1996. "Walnuts in Japan: A Case Study of Generic Promotion Under the USDA's Market Promotion Program." *Agricultural Commodity Promotion Policies and Programs in the Global Agri-Food System*. Proceedings of NEC-63 Conference, Fiesta Americana, Cancun, Mexico.

White, H. 1980. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica*. 48:817-838.