

EXPORT DEMAND FOR U.S. PECANS: IMPACTS OF U.S. EXPORT PROMOTION PROGRAMS*

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ABSTRACT

The purpose of this study was to estimate the impact of the major factors affecting the export demand for U.S. pecans in Asia and the E.U. which together import about 27% of U.S. pecan exports. The primary objective was to estimate the impacts of federal promotion programs on the foreign demand for U.S. pecans. Based on previous literature, a single-equation framework was specified for estimation of the pecan model. Based on promotion elasticities, impacts on pecan export revenue from promotion were evaluated. The returns per dollar of promotion expenditure for pecans were \$6.45 for Asia and \$6.75 for the E.U. Further, some spillover benefits for pecan exports were detected from almond export promotion in Asia and walnut export promotion in the E.U. It appears that the U.S. pecan industry can benefit substantially from increased export promotion in both Asia and the E.U.

More than 85% of the world's supply of pecans are grown in the United States in 16 of the sunbelt states with Georgia being the largest producer. Mexico provides 10% of the total world supply (U.S. Department of Agriculture, *Agexporter* 1995). The dominant pattern in U.S. pecan exports over the past decade has been a rather rapid increase. Pecan export sales rose from \$6.1 million in 1986 to \$49.8 million in 1996, representing a 716% increase. However, in 1993, 1994, and 1995, export volume decreased by 4.46, 3.50, and 14.15%, respectively, rebounding 42% to 8,591 mt (shelled basis) in 1996. Pecans are used by manufacturers as ingredients in bakery, ice cream, and confectionery products, with small amounts being sold directly to consumers at retail (Gardberg 1993).

Reportedly, the government promotion programs have been valuable to the growth in the U.S. agricultural export market in general, and in particular, this also may be the case for the U.S. pecan export markets. Within an 11-year period from 1986 to 1996, total Targeted Export Assistance (TEA) and Market Promotion Program (MPP) allocations for the export promotion of pecans was about \$2 million (Nagrath 1997; Howell 1997). Of the total pecan funds, about 64% was allocated to the Western United States Agricultural Trade Association (WUSATA) for pecan promotion activities, mostly in Asia (Howell 1997). The Southern U.S. Trade Association (SUSTA) received \$727,329 for pecan promotion activities, mainly in the E.U. (Nagrath 1997).

This study estimates the impacts of the major factors affecting the export demand for U.S. pecans in Asia and the European Union which together import about 27% of U.S. pecan exports (U.S. Department of Commerce). The primary objective is to estimate the impact of federal promotion programs on the foreign demand for U.S. pecans. As most of the Asian and E.U. countries continue to consolidate positions in the top ten U.S. agricultural export markets, it has become increasingly important to place U.S. pecans in the best possible competitive position for growth in these markets.

Pecan 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).

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 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 (Ackerman 1991). About \$490,000 was allocated to pecan export promotion from TEA funds (Nagrath 1997; Howell 1997).

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). The farm bill authorized \$200 million for MPP for each of the years 1991 through 1995. Pecan promotion under MPP experienced an increased fund allocation to \$1.5 million (Nagrath 1997; Howell 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). Under the program, an annual sum of \$90 million is to be allocated for fiscal years 1996 through 2002. In 1996, export promotion allocation for pecans was \$233,329 (Nagrath 1997; Howell 1997).

SUSTA began promoting southern pecans in 1984 with a sales mission to Germany and the United Kingdom. Since that time, SUSTA has actively promoted pecans in the European market through activities such as sales missions, trade shows, and retail promotions. Although most of these promotions have been targeted towards the United Kingdom and Germany, promotion activities and market research have also been carried out in Spain and the Netherlands (Tyler 1995). In addition, WUSATA has provided foreign marketing assistance to pecan producers in California, Arizona, and New Mexico. Most of these promotional efforts have been targeted at the Japanese market.

Literature Review

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), fruit and fruit products (Armah and Epperson 1997; Rosson, Hammig, and Jones 1986), tree nuts (Halliburton and Henneberry 1995; Kinnucan and Christian 1997; Weiss, Green, and Havenner 1996), and tobacco (Rosson, Hammig, and Jones 1986).

Based on their study of Japanese consumer demand for meat, Comeau, Mittelhammer, and Wahl (1997) concluded that MPP/TEA advertising and promotion expenditures in support of U.S. beef demand had a significant influence on strengthening Japanese demand for U.S. beef. However, insufficient evidence was found to make a similar claim regarding advertising and promotion expenditures in support of either U.S. pork or poultry.

Armah and Epperson (1997) estimated the export demand for U.S. frozen concentrated orange juice for France, Germany, Japan, the Netherlands, and the United Kingdom. The gross rates of return per dollar of promotion investment were estimated to be \$7.44, \$37.09, \$5.61, \$51.92, and \$7.64 for France, Germany, Japan, the Netherlands, and the United Kingdom, respectively.

The results of research conducted by Rosson, Hammig, and Jones (1986) indicated that promotion activities boosted export sales of apples and tobacco. They found that export revenues of \$60 and \$31 were generated for U.S. apples and tobacco, respectively, per dollar of promotion expenditure.

Halliburton and Henneberry (1995) estimated the effectiveness of U.S. nonprice promotion of almonds 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.

Weiss, Green, and Havenner (1996) carried out an empirical study on the success of the promotion program for U.S. walnuts in Japan. They concluded that generally the program has been successful in the Japanese market with an overall gain of about \$5.85 in revenue per dollar of promotion.

Model Specification and Data

Simultaneity bias can occur when single-equation methods are used to estimate parameters in a simultaneous system of equations. However, Binkley (1981) has shown 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) is estimated, use of single-equation methods are justified on the basis that, due to 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.

As has been shown by Binkley (1981), single-equation methods are appropriate for estimating import demand when the supply faced by importers is exogenous, i.e., importers are price takers. As previously discussed, U.S. pecans have a variety of competing uses. Depending on the regional markets, Asia and the E.U., pecans face competition from foreign suppliers and in some cases local production. As reported by Johnson (1997), the export demand for U.S. pecans varies depending upon the available supply of competing nuts in the international markets. The institutional and retail market segments drive the export demand for the different forms, shelled and in shell, of pecans. For instance, while the E.U. is the traditional market for U.S almonds and pecans that are shelled, the Asian market prefers walnuts in shelled form. On the other hand, the significant market for U.S. almonds in the shell is Asia, while the E.U. prefers most U.S. walnuts in the shell. 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), and Aviphant, Lee, and Seale (1990).

In the classical linear regression model -- in which the disturbances are spherical -- the classical least squares regression function provides the best linear unbiased estimator (BLUE) of the expected value of the regressand y given the regressors X , and it also provides the best linear unbiased prediction of an individual drawing of y given X (Goldberger 1962). In the generalized least squares (GLS) model -- in which the disturbances are not spherical -- it is the GLS regression function which provides the best linear unbiased estimator of the expected value of y given X (Goldberger 1962). With interdependence of the disturbances, the pattern of sample

residuals contains additional information which may be used to modify the regression function so as to reduce the prediction variance. GLS takes such information into account explicitly and is therefore capable of producing estimators that are BLUE (Gujarati 1995, p.362). Single-equation GLS was used to garner more degrees of freedom through stacking the regional observations and using dummy variables.

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

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

and

$$(2) \quad Pp_t^* = \frac{Pp_t}{I_{at}}, \quad Pw_t^* = \frac{Pw_t}{I_{at}}, \quad Pa_t^* = \frac{Pa_t}{I_{at}}, \quad Y_{rt}^* = \frac{Y_{rt}}{I_{rt}}, \quad Prop_{rt}^* = \frac{Prop_{rt}}{I_{at}},$$

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

The dependent variable (Q_{rt}) represents the total volume of U.S. pecan exports 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 Pp, price of U.S. pecans; Pw, price of U.S. walnuts; and Pa, price of U.S. almonds. 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 indices of consumer prices (base year 1990) in the importing region (I_r) and the United States (I_a); promotion expenditures on U.S. pecans (Prop); promotion expenditures on U.S. walnuts (Prow); and

promotion expenditures on U.S. almonds (Proa). 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 own-prices of pecans on quantity demanded is expected to be negative according to economic theory. To account for complementary/substitutional relationships among the three nuts, prices of U.S. walnuts and almonds 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. pecans. All else equal, a higher (lower) level of income implies higher (lower) disposable income allowing for increased expenditure on U.S. pecan exports. To evaluate the influence of promotion programs on the export demand for pecans, U.S. export promotion expenditures on pecans, walnuts, and almonds were included separately in the model. Export promotion expenditures on pecans are expected to have a direct effect on U.S. pecan exports (Hallberg 1992, p.139-158). U.S. export promotion expenditures on walnuts and almonds may impact positively on U.S. exports of the pecan 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 in the model 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: $Pp*D$, $Pw*D$, $Pa*D$, $Y*D$, $Prop*D$, $Prow *D$, and $Proa*D$.

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.

Annual observations from 1986-1996 for U.S. export volume of pecans to Asia and the E.U. were obtained from U.S. Department of Commerce. However, since there were no recorded

pecan exports to Asia in 1986, the number of observations for Asia was less by one year. Thus, the total number of observations in the pecan equation was 21. 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. Though Kravis and Lipsey (1974) claimed that these implicit prices may cause estimation bias, Shiells (1991) reported no significant difference between elasticity estimates from the highly accurate Bureau of Labor Statistics (BLS) importer survey data base and estimates from BLS unit-value indices. The evidence suggests that such a problem may be minor for all countries in general and developed economies in particular. 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. Pecan promotion budget allocations were obtained from SUSTA and WUSATA. Export promotion expenditures on U.S. almonds and walnuts were obtained from the Almond Board of California and the California Walnut Commission, respectively. In this study, only federal promotion monies from the U.S. Department of Agriculture, Foreign Agricultural Service (FAS) were used in estimating the model as it provided almost all monies used for pecan export promotion activities. As such, the estimated dollar returns due to export promotion expenditures are to be attributed to the federal share of export promotion funds.

Econometric Analysis

The measure of goodness-of-fit, which is adjusted r-square, for the estimated equation was excellent at 0.96 indicating that 96% of the variation in U.S. exports of pecans was explained by the model. The F-value for the model was 36.16 with 5 degrees of freedom. Generally, the region-specific elasticity estimates displayed in table 1 appear reasonable. For example, the own-price elasticities for pecan exports were negative, the cross-price elasticities of pecans with respect to walnut prices were positive, indicating substitutes, and the pecan promotion elasticities were positive, indicating the possible benefits from pecan promotion. However, other elasticity signs were not anticipated, requiring explanation.

The cross-price elasticity for pecans with respect to almond export prices for Asia was negative and elastic, indicating a strong complementary relationship with pecan exports. This is consistent with the positive almond export promotion elasticity for Asia, table 1. Thus, there is the appearance of a positive spillover effect from the promotion of almond exports on the demand for pecan exports to Asia. In reality, almond promotion expenditures trended down, while pecan exports trended up over the study period. However, the year-to-year directional changes in almond promotion expenditures and pecan exports are positively correlated. Further, it is common for almonds and pecans to be jointly used in bakery, snack-mix, and confectionery products (Gardberg 1993; U.S. Embassy, Tokyo, Japan 1992).

The income elasticity for Asia was negative, indicating on the surface that pecans are an inferior good, while positive and highly elastic for the E.U., indicating a luxury good. Indeed, pecans are more expensive than walnuts and almonds. Over the study period, the average export price of shelled pecans was \$5.22 per kg, while those for shelled walnut and almond exports were \$3.86 and \$3.20 per kg, respectively, in 1990 dollars. The anomaly of a negative income elasticity for Asia is due to macroeconomic forces causing a mostly flat GDP, while pecan exports trended up over the study period.

The negative sign for the walnut promotion elasticity for Asia is consistent with the finding that pecan and walnut exports are substitutes. However, the case is different for the walnut promotion elasticity for the E.U. Although pecans and walnuts appear to be substitutes, walnut promotion expenditures are directly related to pecan exports. In reality, walnut promotion expenditures were trending down while pecan exports were trending up during the study period. However, the year-to-year directional changes in walnut promotion expenditures and pecan exports are positively correlated. The negative sign for the almond promotion elasticity for the E.U. is an indication that almond and pecan exports are to some extent substitutes, but no complementary or substitutional relationship was actually found between

them in the E.U., table 1. Nonetheless, as almond promotion expenditures trended down over the study period, pecan exports to the E.U. trended upward.

Based on the promotion elasticities shown in table 1, promotion impacts on pecan exports were evaluated for Asia and the E.U., table 2. Generally, the results were quite favorable, showing significant increased demand for pecan exports. The returns per dollar of promotion expenditure for pecans were \$6.45 for Asia and \$6.75 for the E.U. Because of substitution, a mild negative effect on pecan exports from the promotion of walnut exports to Asia was found, all else equal. And because of a complementary relationship, a mild positive effect on pecan exports from the promotion of almond exports to Asia was found, all else equal. The impacts of walnut and almond export promotion in the E.U. were unexpected, as previously indicated in the discussion of the elasticity signs in table 1. The positive impact of walnut export promotion is based on the positive correlation of year-to-year directional changes in walnut export promotions with pecan exports, even though the trends for each were negatively related. The negative impact of almond export promotion on pecan exports to the E.U. appears to be of significance, though not based on any degree of substitution. Pecan and almond exports to the E.U. were not found to be related either as substitutes or as complements. The negative impact of almond promotion on pecan exports to the E.U., in reality, appears to be based on a negative trend in almond export promotion while pecan exports trended up during the study period.

Summary and Conclusions

This study estimated the impacts of the major factors affecting the export demand for U.S. pecans in Asia and the E.U. which together import about 27% of U.S. pecan exports. The primary objective was to estimate the impacts of federal promotion programs on the foreign demand for U.S. pecans. Only federal promotion monies from the U.S. Department of Agriculture, Foreign Agricultural Service (FAS) were used in estimating the model. As such, the estimated dollar returns due to export promotion expenditures are to be attributed to the federal

share of export promotion funds.

Promotion impacts on pecan exports were evaluated for Asia and the E.U. Generally, the results were quite favorable, showing significant increased demand for pecan exports. The returns per dollar of promotion expenditure for pecans were \$6.45 for Asia and \$6.75 for the E.U. Further, some spillover benefits for pecan exports were detected from almond export promotion in Asia and walnut export promotion in the E.U.

Based on the findings of the study, the U.S. pecan industry should benefit substantially from increased export promotion in both Asia and the E.U. It appears that the export promotion of pecans is in an early stage of the product life cycle in the burgeoning markets for Asia and the E.U. In addition to federal assistance, the U.S. pecan industry perhaps should consider increasing self-help means to increase export promotion funds. U.S. pecan promotion efforts should be crafted in such a way as to maximize the positive spillover effects from the export promotion of walnuts and almonds. Further research will likely require a different functional form of the model, one more suitable for a more advanced stage of the product life cycle. Greater emphasis on market segmentation will be important in the use of promotion expenditures among and within regions of the world emphasizing different forms of pecan products.

Table 1. Elasticity Estimates for Asia and the E.U. for U.S. Pecan Exports

| Variable | Asia | E.U. |
|-------------------------|-------|----------------|
| Price of Pecans | -0.72 | -0.73 |
| Price of Walnuts | 0.91 | 0.91 |
| Price of Almonds | -3.90 | — ^a |
| Income | -1.01 | 10.52 |
| Promotion Expenditures: | | |
| Pecans | 0.98 | 0.06 |
| Walnuts | -1.64 | 0.48 |
| Almonds | 1.38 | -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 (Chiang 1984, p. 292-293). ^a Elasticity estimate not significantly different from zero.

Table 2. Estimated Annual Impacts of Promotion Expenditures on U.S. Pecan Export Demand by Region, 1986-1996

| Region/Product | Real Mean Pecan Export Value | Real Mean Promotion Expenditures | Marginal Return to Promotion Expenditures ^a |
|----------------|---------------------------------|--|--|
| | -----(\$'000)----- | | ------(dollars)----- |
| Asia: | | | |
| Pecans | 729.27 | 110.63 | 6.45 |
| Walnuts | 729.27 | 1,929.61 | -0.62 |
| Almonds | 729.27 | 2,180.63 | 0.46 |
| E.U.: | | | |
| Pecans | 7,228.16 | 62.01 | 6.75 |
| Walnuts | 7,228.16 | 2,955.51 | 1.17 |
| Almonds | 7,228.16 | 618.08 | -1.69 |

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

where

\bar{N}_r = real mean pecan export value in region r ,

\bar{E}_{nr} = real mean promotion expenditures of nut, n , in region, r , and

ξ_{pn} = appropriate promotion elasticity (Richards, Van Ispelen, and Kagan 1997).

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