Impacts of Foreign Direct Investment and Advertising on the Export Demand for U.S. Frozen Potatoes

Kent Lanclos
Stephen Devadoss
Joseph Guenthner

Impacts of Foreign Direct Investment and Advertising on the Export Demand for U.S. Frozen Potatoes

Kent Lanclos, Stephen Devadoss, and Joseph Guenthner*

*Kent Lanclos is an economist with National Cotton Council, Memphis, Tennessee. Stephen Devadoss and Joseph Guenthner are professors in the Department of Agricultural Economics and Rural Sociology, University of Idaho, Moscow, Idaho.

Impacts of Foreign Direct Investment and Advertising on the
Export Demand for U.S. Frozen Potatoes

Abstract

Import demand for U.S. frozen potatoes is estimated for Japan, Mexico, Philippines, and Thailand. Import demand in Japan is primarily influenced by own-price and income. In the other three countries, however, potato industry advertising and foreign investments by the U.S. food service industry are found to be significant factors influencing import demand.

**Impacts of Foreign Direct Investment and Advertising on the
Export Demand for U.S. Frozen Potatoes**

The U.S. frozen potato industry has grown rapidly. In 1963, frozen potato production

totaled 0.9 billion pounds; by 1993, it had increased to 7.3 billion pounds (USDA). The primary

frozen potato product is french fries, which has accounted for about 83 percent of frozen pack

in recent years. Products such as hash browns and tater tots comprise the remainder. The

driving force behind the increase in frozen potato production has been the growth of the food

service industry, particularly fast food restaurants. The frozen potato industry has benefitted

greatly from this expansion -- approximately 90 percent of U.S. frozen french fry production is

destined for the food service market (Lucier et al.) There is growing evidence, however, that

the domestic food service market is maturing, with the result that future growth opportunities

will be limited (National Restaurant Association). As a result, many food service firms are

looking abroad for new markets. McDonald's, in particular, has been at the forefront of foreign

expansion by food service firms and, since 1989, has grown more rapidly in foreign markets than

in the United States (McDonald's Corporation).

Maturation of the U.S. food service market will also limit domestic growth of frozen

potato consumption. Recent trends indicate slowing growth. Between 1960 and 1988, per

capita consumption of frozen potatoes increased at an average annual rate of 7.0 percent. Since

1989, however, growth has averaged only 3.9 percent (Lucier et al.). As a result, the U.S.

frozen potato industry also is seeking foreign markets for continued growth. Fortunately, many

foreign markets appear to present growth opportunities (U.S. Potato Board). In particular,

most are characterized by very low per capita consumption of frozen potatoes; furthermore, the

early performance of foreign subsidiaries of U.S. food service firms has been encouraging (for

example, McDonald's).

Exports have historically been a very small market for the U.S. frozen potato industry. However, this is changing. In 1994, the frozen potato industry exported 638 million pounds of frozen potatoes (8 percent of production), an increase of 76 percent in five years (USDA). The largest export market for U.S. frozen potatoes is Japan, which accounted for 53 percent of export volume in 1994. The next largest export market, Mexico, accounted for less than 7 percent. Given the symbiotic relationship between the food service and frozen potato industries, growth in frozen potato exports will be closely tied to foreign expansion by the food service industry.

The U.S. Potato Board, which represents the U.S. potato industry, has long engaged in market development activities in Japan, with an emphasis on frozen potatoes. Initially, the Potato Board maintained sole responsibility for these activities. However, in 1986 the Potato Board established a third party program to develop joint advertising activities with fast food restaurants and potato processors, in addition to continuing its own promotional activities. The third party program consists of promotional activities (for example, radio, TV, and postal advertisements, and in-store displays) organized by the Potato Board in concert with individual food service chains and potato processors. Thus, third party activities promote both restaurants and frozen potato products. These endeavors have been successful, as exports of U.S. frozen potatoes to Japan increased from 32.4 million pounds in 1978 to 281.7 million pounds in 1993 (USDA).

Guenthner et al. analyzed Japanese imports of U.S. frozen potatoes and concluded that Potato Board advertising and the growth of the Japanese fast food industry helped increase demand, but they did not quantify the impacts. Lin et al. found increased consumer preference for imported frozen potatoes, especially in more recent years; however, they did not examine the

influence of advertising and investments by the food service industry. Gao and Guenthner found that price, consumer income and currency exchange rates influenced Japanese imports of frozen potatoes for the 1978-90 period.

The Potato Board has recently expanded its promotional activities to other export markets, again focusing on frozen potatoes. These activities have largely been concentrated on other Asian countries. Similarly, the U.S. food service industry also has recently made a concerted effort to expand in these newer markets. This provides an interesting opportunity to examine the consequences of advertising and foreign investment on the export demand for U.S. frozen potatoes. Therefore the objective of this study is to examine the impacts of factors, such as advertising, foreign investments by the U.S. food service industry, income, and prices, on the export demand for U.S. frozen potatoes.

Theoretical Model

Using consumer utility maximization, a theoretical specification of per capita U.S. frozen potato import demand in a country can be written as:

$$M_i = f_i \ (P_i, \ P_i^s, \ P_i^c, \ Y_i, \ Z_i)$$

where M_i is country i's per capita imports of U.S. frozen potatoes, P_i is the real price of U.S. frozen potatoes in country i, P_i^s and P_i^c are the real prices of substitutes and complements in country i, Y_i is country i's real per capita income, and Z_i is a vector of other explanatory variables in country i. In this context, Z_i denotes variables, such as advertising and foreign direct investment, which may impact the tastes and preferences of consumers in the importing country, and hence, the import demand for U.S. frozen potatoes. Based on demand theory, negative coefficients are expected for the own and complements price variables, positive coefficients for the substitutes price variables, and a positive coefficient for the income variable (assuming

frozen potatoes are a normal good). Positive coefficients are expected for the advertising and foreign investment variables. An effective advertising campaign will shift the demand curve for U.S. frozen potatoes outward, and foreign direct investment should, by exposing foreign consumers to 'hamburger and fries' meals, also increase the import demand for U.S. frozen potatoes.

Empirical Analysis

The time period used for this study covers from 1978 to 1993. The information on data and their sources are available upon request. Importers of U.S. frozen potatoes are placed into four tiers based on 1993 import volume. Japan is alone in the first tier with 1993 imports of 127,778 metric tons (MT). The second tier consists of Hong Kong, Mexico and South Korea, each with 1993 imports between 10,000 and 25,000 MT. The third tier is comprised of Australia, Malaysia, Philippines, Singapore and Taiwan, each importing between 5,000 and 10,000 MT. The fourth tier includes China, India, Indonesia and Thailand, as well as other smaller customers, each having 1993 imports of less than 5,000 MT. All of the countries listed above, except Mexico, are in Asia. A representative country from each tier is used for the analysis: Japan (tier 1); Mexico (tier 2); Philippines (tier 3); and Thailand (tier 4).

Two types of advertising data are available from the Potato Board, both denominated in U.S. dollars. The first variable is annual Potato Board advertising expenditures in each country. The second variable is third party advertising for U.S. frozen potatoes. Foreign direct investment by U.S. food service firms also is likely to play a role in changing tastes and preferences. Unfortunately, data on foreign direct investments by U.S. firms are quite limited. Hence, the number of McDonald's restaurants in each country is used as a proxy for total foreign direct investment by the food service industry.

Given the limited number of observations, the 'newness' of some of the markets, and the measurement error inherent in some of the explanatory variables, the usual estimation procedures will have difficulty generating satisfactory or defensible results. Initial attempts to estimate the models using OLS supported this assertion. Hence, Geweke's Bayesian estimation procedure is used to estimate the per capita demand equations of the four countries. In the Bayesian estimation procedure, all information available about the vector of parameters (Θ) prior to estimation is summarized in a prior density function, $p(\Theta)$. This information set includes inequality constraints on the parameters (e.g., own-price elasticities are negative). Using Bayes' theorem, prior and sample information are used to generate a posterior distribution for the vector of parameters, $f(\Theta|y) \propto p(\Theta)L(\Theta|y)$, where $f(\Theta|y)$ is the posterior distribution, $L(\Theta|y)$ is the likelihood function based on sample data, and $\propto$ denotes 'is proportional to'. All information available about the vector of parameters (both prior and sample information) is summarized in this posterior distribution. As noted by Chalfant, Gray and White, "Unlike the sampling-theoretic approach to estimation, the Bayesian approach recognizes that posterior beliefs are conditional on the observed data set rather than emphasizing the performance of estimators in repeated samples."

Empirically, a Monte Carlo integration technique is used to estimate the posterior distribution of the vector of parameters. The parameter estimates and covariance matrix from a previous estimation (e.g., OLS) and a large number of random sample points are used in the Monte Carlo integration technique to generate a randomized distribution of coefficients. The model is then solved for this randomized distribution of coefficients to obtain the posterior distribution of the vector of parameters. The Bayesian procedure is implemented in SHAZAM, version 7.0.

Based on economic theory and preliminary OLS results, a core set of explanatory variables is identified. These core variables are variables of particular interest (i.e., advertising and investment) and variables which have a strong influence on the import demand for U.S. frozen potatoes (i.e., income and own-price). A number of variables initially considered for the regressions are dropped from the final models because of low significance and negligible contribution to the explanatory power of the models.

Results and Discussion

In table 1, the estimated income, price, advertising, and foreign investment elasticities are reported. The estimated income elasticity is highest for the Philippines at 2.50, followed by Japan at 2.17. In Mexico and Thailand, the income elasticities are significantly smaller at 0.38 and 0.04, respectively. Comparing the own-price elasticities across countries, the Japanese market is the most sensitive to changes in U.S. frozen potato prices, with an estimated price elasticity of -0.68. The Philippines and Thailand markets are very price inelastic. Compared to the other markets, Japan imports a considerable amount of U.S. frozen potatoes for the retail (at-home) market, in which frozen potatoes are a separate purchase item. Thus, price is likely a more important factor in the Japanese import decision than in the other markets because of significant retail sales.

The estimated Potato Board advertising elasticities are very small in all four markets, ranging from 0.03 in Japan to 0.08 in Thailand. The general pattern appears to indicate that the effectiveness of Potato Board advertising is decreasing with the degree of market development, i.e., the least developed market (Thailand) is the most responsive to Potato Board advertising while the most developed market (Japan) is the least responsive. A similar pattern is evident with respect to the third party advertising program, with the smallest elasticity estimate found in

Japan and the highest in Thailand. Also, with the exception of Japan, third party advertising appears to be much more effective than the Potato Board's own advertising efforts. In the Philippines and Thailand, the estimated third party advertising elasticity is approximately ten times greater than the estimated Potato Board advertising elasticity. An explanation may be that third party advertising promotes both frozen potatoes and the establishments in which they can be consumed. The Potato Board's own advertising efforts, however, do not draw this link between frozen potatoes and restaurants, perhaps hobbling the effectiveness of Potato Board advertising in markets with insignificant retail sales.

With the exception of Thailand, imports of U.S. frozen potatoes appear to be fairly responsive to investments by the U.S. food service industry. The largest elasticity of import demand for U.S. frozen potatoes with respect to foreign investment is found in Mexico at 0.97, with the Philippines and Japan somewhat lower at 0.59 and 0.33, respectively. In Thailand, however, the investment elasticity is almost zero. A possible reason is that McDonald's has only very recently begun to make significant investments in the Thailand market, and in the final year of the dataset (1993), the per capita number of McDonald's in Thailand is still less than half of that of the next smallest market (Philippines).

Looking at the results for the individual countries, the seeming ineffectiveness of advertising in the Japanese market is mildly surprising given the substantial advertising expenditures by the Potato Board and third party advertising programs in Japan. However, three possible explanations present themselves. First, by 1978, the starting period of the analysis there was already a substantial Potato Board promotion program in Japan. Thus, the largest impacts on Japanese tastes and preferences may have occurred prior to 1978. A second possibility is that the Japanese market for frozen potatoes is maturing, such that the marginal

impacts of additional advertising and market promotion activities are relatively small.

Discussions with members of the Potato Board indicate that they have reached a similar

conclusion. Examination of the advertising data also supports this assertion as both the Potato

Board and third party advertising expenditures have been declining since their high point in

1991. A third possibility is that, because Japan has a highly developed, consumer oriented

economy, substantial consumer good advertising is present, which detracts from the

effectiveness of individual advertising messages.

The major factor affecting Mexico's imports of U.S. frozen potatoes appears to be

investments by food service firms, that is, providing outlets in which Mexican consumers can

purchase U.S. frozen potato products. The Potato Board only began its market development

activities in Mexico in 1992, and any impact these have had seems to be dominated by the

investment variable. In addition, the Potato Board had not implemented the third party program

in Mexico during the period of study. The importance of investment also helps explain why the

income and price variables appear to have smaller impacts on Mexico's imports of U.S. frozen

potatoes. Until recently, there were few food service outlets available in Mexico where

consumers could purchase U.S. frozen potato products. Thus, changes in income and prices

could not have much impact.

The same observations regarding the impacts of price on frozen potato demand in

Mexico also apply to the Philippine market. Availability and coverage of the food service firms

are significant determinants of Philippine demand for U.S. frozen potatoes, as suggested for

Mexico. The Potato Board implemented both its own promotional activities and the third party

program in the Philippines beginning in 1989. However, only the third party variable appears to

have a significant impact. Previous observations regarding effectiveness of third party

advertising vis-a-vis Potato Board advertising would seem to apply, i.e., third party advertising may be more effective because it promotes both frozen potatoes and the establishments in which they can be consumed.

Thailand is the newest, and smallest, market for U.S. frozen potatoes of the four examined, with sustained and appreciable imports beginning only in 1991. The investment elasticity is negligible, possibly because the U.S. food service industry has only very recently begun to invest in Thailand, as discussed previously. Advertising seems to have had a larger impact, particularly third party advertising. The rise in Thailand's imports coincides with the year in which the Potato Board instituted its own and the third party advertising programs. Thus, advertising in Thailand seems to have been successful in raising consumer awareness regarding U.S. frozen potatoes and influencing tastes and preferences.

Summary and Conclusions

The objectives of this study are to analyze the import demand for U.S. frozen potatoes in various markets, examine the impacts of potato industry advertising and U.S. food service industry investments on these import demands, and assess the growth pattern of frozen potato imports in each market. For purposes of the analysis, importers are placed into four tiers based on 1993 import volume (tier 1 largest, tier 4 smallest). A representative country is selected from each tier for the analysis: Japan (tier 1), Mexico (tier 2), the Philippines (tier 3), and Thailand (tier 4).

In the largest, most mature market (Japan), the primary determinants of demand for U.S. frozen potatoes appear to be income and own-price, conventional economic factors. In the three newer and smaller markets, however, changes in tastes and preferences appear to have much greater importance. Third party advertising and foreign investments by the U.S. food

service industry, in particular, have significant positive impacts on the import demand for U.S.

frozen potatoes in the newer markets. As discussed above, the impacts of food service industry

investments on the demand for U.S. frozen potatoes actually encompass two factors. First,

there is the simple matter of availability, that is, providing consumers an outlet (for example,

McDonald's) in which frozen potatoes can be purchased, even with tastes and preferences

constant. The second factor is that investments by the U.S. food service industry and the

advertising can impact the tastes and preferences of foreign consumers, leading to increased

demand for U.S. frozen potatoes. The investment by the food service industry is required in

order to provide the outlets (restaurants) in which frozen potato products can be purchased.

Until these outlets are readily available, changes in prices and incomes cannot have much impact.

Once a market is established, however, conventional economic factors, such as income and

prices, may become more important, as appears to have happened in Japan. This also suggests

that the impact of promotional activities may be large when markets are relatively new, but

decrease as markets become more mature.

Table 1. Estimated Income, Own-Price, Advertising, and Foreign Investment Elasticities of Per Capita Import Demand for U.S. Frozen Potatoes[1]

Elasticity	Japan	Mexico	Philippines	Thailand
Income	2.16	0.38	2.49	0.04
	(.22E-02)	(.35E-08)	(.12E-04)	(.13E-06)
Own-Price	-0.68	-0.43	-0.13	-0.02
	(.10E-02)	(.60E-04)	(.12E-04)	(.73E-05)
Potato Board[2]	0.03	0.04	0.06	0.08
	(.20E-04)	(.12E-03)	(.10E-03)	(.13E-04)
Third Party[3]	0.03	NA[4]	0.53	0.87
	(.66E-05)		(.26E-04)	(.18E-05)
Investment[5]	0.33	0.97	0.59	0.02
	(.38E-03)	(.55E-04)	(.14E-04)	(.23E-04)

[1] Numerical standard errors in parentheses.

[2] U.S. Potato Board advertising expenditures in the importing country's market.

[3] Third party advertising expenditures in the importing country's market.

[4] NA - Not applicable. The U.S. Potato Board had not implemented the third party program in Mexico during the period covered by the study.

[5] Investment by U.S. food service firms in the importing country's market.

REFERENCES

Chalfant, J., R. Gray, and K. White, "Evaluating Prior Beliefs in a Demand System: The Case of Meat Demand in Canada," *American Journal of Agricultural Economics, 73*, 476-489 (1991).

Gao, Y. and J. Guenthner, "The Global Demand for US Frozen Potatoes in Year 2000," *HortTechnology*, *13*, 239-244 (1993).

Geweke, J., "Exact Inference in the Inequality Constrained Normal Linear Regression Model," *Journal of Applied Econometrics, 1*, 127-141 (1986).

Guenthner, J., J. Jones, J. Gentillon, and R. Withers, *The Potato Export Market*, Agricultural Experiment Station Bulletin No. 710, University of Idaho, Moscow, Idaho, 1990.

Lin, B-H, et al., "Forecasting Japan's Frozen Potato Imports." *Journal of International Food & Agribusiness Marketing*, *3*, 55-67 (1991).

Lucier, G. et al., *U.S. Potato Statistics, 1949-89*, Statistical Bulletin No. 829, CED/ERS/USDA, Washington, D.C., August 1991, and computer download of update to 1993.

McDonald's Corporation, *Annual Business Reports*, Oak Brook, Illinois (1987-1994).

National Restaurant Association, Research and Information Services Department, *Foodservice Numbers: A Statistical Digest for the Foodservice Industry*, Washington, D.C., various issues.

U.S. Department of Agriculture, Economic Research Service, Unpublished data, 1995.

U.S. Department of Agriculture, Economic Research Service, *Potato Facts*, U.S. Department of Agriculture, Washington, DC., November 1995.

U.S. Potato Board, Unpublished data and information, 1995.

White, K., D. Wong, D. Whistler, and S. Haun, *SHAZAM User's Reference Manual, Version 7.0*, McGraw-Hill, New York, 1993.