

**Foreign Direct Investment and Advertising  
in the Frozen Potato Industry**

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**A.E. Research Series No. 95-16**

December 1995

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## FOREIGN DIRECT INVESTMENT AND ADVERTISING IN THE US FROZEN POTATO INDUSTRY

### EXECUTIVE SUMMARY

Consumer preference for meals away from home, particularly in fast food restaurants, has increased domestic demand for frozen fries. Development activities by US fast food and potato industries are leading consumers in some export markets to develop similar preferences. The objective of this study was to determine the impacts on frozen potato markets of US Potato Board advertising and US fast food industry investment.

We analyzed US frozen potato exports to four countries -- Japan, Mexico, Philippines and Thailand -- representing four tiers of export volume. Export demand equations were estimated using ordinary least squares with data for the 1978-93 period. Domestic demand functions were estimated for retail and foodservice markets using 1970-93 data.

Results suggest a strong link between the fast food industry and demand for frozen potatoes. The number of McDonald's restaurants was a proxy variable to represent foreign direct investment in the fast food industry. The highest returns for this variable were in Japan and Mexico, the tier 1 and 2 countries.

We found that each dollar of US Potato Board advertising returns the following in terms of grower sales: Japan \$11, Mexico \$167, Philippines \$76, Thailand \$24 and US \$7. Returns are lowest in the mature markets (Japan, US) and the smaller, newer market (Thailand). Returns were highest in Mexico (tier 2) and Philippines (tier 3).

Potato Board export programs also include third party advertising by processors and restaurants. Each dollar of third party advertising returns the following to growers sales: Japan \$91, Philippines \$221 and Thailand \$57. The Board did not conduct a third party program in Mexico during the study period. Board efforts to encourage third party programs multiply the impact of its expenditures.

We estimated export growth curves for all four markets, using time as the explanatory variable. We then used the quadratic equations to predict the following rates of growth in exports from 1993 to 2000: Japan 74 percent, Mexico 164 percent, Philippines 169 percent and Thailand 161 percent.

The forecast is certainly optimistic for future growth of US frozen potato exports. However, the keys to getting foreign markets on these steep growth curves are foreign direct investment by the US fast food industry and US Potato Board advertising.

## INTRODUCTION

The US frozen potato industry has grown rapidly. Processors packed 0.9 billion pounds of frozen potatoes in 1963, 2.7 billion pounds in 1973, 4.5 billion pounds in 1983 and 7.3 billion pounds in 1993. Production increased eight-fold in three decades. About 85% of the 1993 frozen potato pack was fries. Exports accounted for 8 percent of production in 1994, an increase of nearly 90 percent in five years (USDA Potato Facts).

US consumers enjoy the convenience of frozen fries, especially when they buy them at restaurants. Americans spend half their food money on meals away from home, but consume nearly 90 percent of frozen fries in the away-from-home market. The increasing popularity of fast food restaurants is the driving force behind the growth in demand for frozen potatoes. Although some restaurants use fresh potatoes for fries, McDonald's, Burger King and most of the large fast food chains use the frozen product.

Foreign consumers are developing similar preferences for hamburger-and-fries meals at US-style fast food restaurants. In 1993 McDonald's opened 324 new restaurants in the US and 576 in other countries. Since 1989 the company has grown more rapidly in foreign markets than in the US (McDonald's annual reports). Fast food firms can purchase frozen fries locally in some of those markets, such as Western Europe. In other markets, such as the Asian Pacific Rim, they rely on frozen potatoes imported from the US.

The US government has helped the potato industry in overseas markets. Beginning in 1986 the US Potato Board received money from USDA's Targeted Export Assistance (TEA) program. The Board used the initial \$2 million and subsequent grants to build potato advertising and promotion programs in the Asian Pacific Rim, with an emphasis on frozen potatoes.

Funding of agricultural export assistance programs has been diminishing and may disappear altogether. The Potato Board has responded by increasing internal spending on export programs and by developing joint promotion programs with US potato processors and fast food firms in some countries. The Board would like to know where their potato promotion programs have the biggest impact on frozen potato sales.

Other researchers have conducted studies on frozen potato exports. Guenther, Jones, Gentillon and Withers (1990) analyzed Japanese at-home and away-from-home markets for frozen potatoes. They concluded that US Potato Board advertising and the growth of the Japanese fast food industry helped increase demand, but they did not quantify the impacts.

Lin, Guenther and Levi (1991) analyzed Japanese imports of frozen potatoes during the 1978-89 period. They found that consumer preferences changed in favor of imported frozen potatoes, especially in more recent years. This study, however, did not examine the influences of the fast food industry and advertising.

Gao and Guenther (1993) found that price, consumer income and currency exchange rates influenced Japanese imports of frozen potatoes during the 1978-90 period. They used a mathematical model of growth through time to predict the exports of frozen potatoes to the rest of the world. They found that US demand for frozen potatoes was influenced by processor advertising and Potato Board advertising.

Jones and Ward (1989) and Guenther, Levi and Lin (1992) also found positive impacts of advertising on US frozen potato markets. None of the researchers estimated the impact on frozen potato demand of US Potato Board advertising in foreign markets or the impact of foreign direct investment in the fast food industry.

The objectives of this study were to:

- (1) estimate domestic and foreign demand functions for US frozen potatoes,
- (2) determine impacts of US Potato Board advertising and US fast food investments,
- (3) evaluate returns to US Potato Board advertising in different markets.

## METHODS

We put the countries that import US frozen potatoes into four tiers based on 1993 import volume. Japan is alone in the first tier as the largest importer by a wide margin. The second tier consists of Hong Kong, Mexico and South Korea. Tier three includes Australia, Malaysia, Philippines, Singapore and Taiwan. The fourth tier includes China, India, Indonesia and Thailand as well as smaller customers. All of the countries listed above, except India and Mexico are in the Asian Pacific Rim.

We selected one representative country from each of the four tiers. The countries and their 1993 imports of US frozen potatoes (million lb) are:

Tier One	Japan	281.7
Tier Two	Mexico	18.8
Tier Three	Philippines	13.8
Tier Four	Thailand	5.1

We estimated demand equations using ordinary least squares covering the 1970-93 period for US retail and foodservice markets and 1978-93 for the four foreign markets. Foreign market price and quantity data were not available before 1978.

Demand theory focuses on own-price and four factors that can shift the demand for a product: (1) population, (2) consumer income, (3) prices of other goods and (4)

tastes and preferences. We attempted to include own-price as well as variables in all four demand shifter categories.

The US Bureau of Census provided population data for all of the markets. Per capita quantity variables captured the influence of population, but total population was included as a potential explanatory variable. We also considered another population variable, the percentage of the population in the 0 to 29 age group, hypothesizing that demand for frozen potatoes would be higher when the percentage of "young" people increases.

The US Department of Commerce provided consumer income data. In the export market we used gross domestic product (GDP) as a proxy for consumer income. We hypothesized that frozen potatoes are a normal good. We expected a positive coefficient, indicating that as income goes up, consumers purchase more frozen potatoes.

A variety of sources provided data on prices of other goods (see Appendix). We expected positive coefficients, indicating a substitute relationship, for fresh potatoes, rice and corn. We expected negative coefficients, indicating a complement relationship, for hamburger and beef.

Several advertising variables represented changes in tastes and preferences. One variable in the US market was annual advertising expenditures by frozen potato processors. Another variable was generic advertising expenditures by the US Potato Board together with state potato associations such as the Idaho Potato Commission. Although the generic advertising does not focus on frozen potatoes, we expected the coefficients of both variables to be positive.

There were also two types of advertising variables for the export markets. One variable was the annual amount of money spent by the US Potato Board for advertising in the country. The other variable was third party advertising for US frozen potatoes. This is from a Board program that develops joint advertising programs with fast food restaurants and US processors. We expected positive coefficients for all advertising variables.

We also used fast food variables to capture the influence of changing consumer tastes and preferences. In the US markets the variable was the annual sales for fast food restaurants. For the foreign markets we used the number of McDonald's restaurants in the country. We expected positive coefficients, hypothesizing that both variables would represent changing consumer preferences for away-from-home hamburger and fries meals.

Two other variables in the US markets represented tastes and preferences: the percentage of females in the labor force and the percentage of households that own microwave ovens. We hypothesized that an increase in female laborers would

increase the demand for frozen potatoes because women employed outside the home might prefer the convenience of frozen potatoes. We expected a negative coefficient for the microwave oven variable. Microwave ovens make it more convenient to prepare fresh potatoes, a substitute for frozen potatoes.

Complete data sets for all six markets, including variable definitions and sources, are in the appendix.

## RESULTS

Table 1 contains the demand equations for the two US markets. The foodservice equation does not include a price variable because data was not available. The Bureau of Labor Statistics provides data for frozen fries in the retail market, but not the foodservice market. It would be difficult to estimate foodservice prices because of "meal deal" pricing strategies that include a sandwich, fries and a beverage for one price.

All coefficients in Table 1 have the expected signs. We dropped the female labor force variable from both equations because of incorrect signs. The advertising variables have mixed signs. Frozen advertising has a positive impact in the retail market where the advertising is targeted and a negative impact in the foodservice market. Apparently the advertising influences people to buy more frozen potatoes in the retail market at the expense of the foodservice market. Generic advertising has the opposite impact -- increased sales in the foodservice market but reduced sales in the retail market. Adding the two coefficients for generic advertising yields a net positive impact.

Table 2 shows demand equations for the four export markets. The equations are simple but powerful, with  $R^2$  values ranging from 0.91 for Japan to 0.99 for Thailand. The equations contain only three variables: the number of McDonald's restaurants, US Potato Board expenditures, and third party advertising expenditures. The equation for Mexico does not include the third party advertising because the US Potato Board had not implemented that program in Mexico during the period of study.

We attempted to develop more complete demand equations for each country by using own-price and other variables to represent all four demand shifters. We were unsuccessful because of serious problems with incorrect coefficient signs, low  $t$ -values, multicollinearity and negligible improvement in explanatory power.

We used the equations in Table 1 and Table 2 for further analysis. It seems that tastes and preferences dominate the demand for frozen potatoes in the four countries. The two advertising variables and the number of McDonald's restaurants appear to be the driving forces that determine the demand for frozen potato imports

from the US. When the markets become more mature, consumer demand behavior may be more like that in the US demand equations.

Table 3 shows the impact of US Potato Board advertising in the US and the four export markets. Calculations are based on 1993 values of deflators and frozen potato prices in each country. The results show dramatic differences in the impact of US Potato Board advertising expenditures. The biggest impacts are in Mexico and Philippines, Tier 2 and Tier 3 markets where exports are growing rapidly. The market in Japan (Tier 1) is more mature, while the market in Thailand is quite new, with significant volume beginning only in 1991 (see Appendix Table 4). The impact in the US market is the smallest, but that is not surprising, since the Potato Board does not specifically target frozen potatoes in its domestic advertising programs.

Table 4 shows the impact of third party advertising for three of the export markets. The US Potato Board did not have a third party advertising program in Mexico during the period of study. Results of third party advertising are similar to US Potato Board advertising in that the impact is smaller in the Tier 1 and Tier 4 markets.

The impacts of both types of advertising are quite large, but the third party advertising is larger. For example, returns to growers for a dollar of Potato Board advertising in Japan is \$11, but the return to a dollar of third party advertising is \$91. Advertising programs that promote potato products as well as particular restaurants in which they can be purchased seem to be more effective.

Third party advertising programs multiply the impact of US Potato Board money invested in foreign markets. For each dollar of US Potato Board money spent in Japan during the 1991-93 period, \$1.70 was spent on advertising by third parties. The ratio was much larger in The Philippines: \$4.20 of third party advertising to \$1.00 of US Potato Board advertising. In Thailand the ratio was \$6.30 to \$1.00. Potato Board efforts that help raise third party advertising obviously provide benefits beyond those in Table 3.

## **DISCUSSION**

Results of this study verify that advertising and foreign direct investment in the fast food industry are important factors in the demand for US frozen potatoes. We also found that US Potato Board advertising has the most impact in the countries that are in the middle ranks of total export volume.

We also found that the fast food variables influenced frozen potato demand in both the domestic and export markets. In the US markets the explanatory variable was the sales volume of the fast food industry. In the export markets the number of



McDonald's restaurants had a positive impact on imports of US frozen potatoes. The impact per restaurant was largest in Japan and Mexico, the Tier 1 and Tier 2 countries. Perhaps the impact per restaurant accelerates as the fast food industry becomes larger and has more influence on consumer tastes and preferences.

As a follow-up to estimating demand equations, we analyzed export volume through time. The graph for the most mature export market, Japan, shows a typical quadratic growth pattern (Fig 1). An equation that fits the Japan data well is:

$$Y = 1,712,546 - 1,742.95T + 0.443(T^2) - 102D$$

(2.28)            (2.31)            (6.68)

$$R^2 = 0.97$$

where

Y = Japanese imports of US frozen potatoes (million lb)

T = Year

D = 1 for 1989 and 0 elsewhere (accounting for the 1989 US crop shortage).

We developed similar equations for the other three countries. Their growth patterns also fit quadratic equations well, with the following  $R^2$  values: Mexico 0.83, Philippines 0.95 and Thailand 0.72. The fit with these markets is not as good as with Japan, probably because they are in the early stages of growth.

We expect that growth in the other export markets will follow a pattern similar to that in Japan. Per capita consumption of US frozen potatoes in 1993 was: Japan 2.26 lb, Mexico 0.21 lb, Philippines 0.21 lb and Thailand 0.09 lb. This suggests that the Tiers 2-4 countries have a lot of room for additional growth.

We used the quadratic equations to predict US frozen potato exports in the year 2000 (Table 5). A significant increase is forecasted in all four markets, ranging from 74 percent growth in Japan to more than 160 percent growth for the other markets. The forecast is certainly optimistic for future growth of US frozen potato exports.

The two catalysts for growth are advertising and foreign direct investment in the fast food industry. The US Potato Board has done an excellent job of bringing together these two forces by developing third party advertising programs, which multiplies the impact of Board efforts. The results of this study suggest that the Board should continue to put new export markets on steep growth curves with help from the fast food industry.

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**Table 1. Domestic Demand for US Frozen Potatoes**

<b>Variable</b>	<b>Foodservice</b>	<b>Retail</b>
Intercept	-2.77 (0.22)	2.73 (3.52)
Price		-133 (2.23)
Income	1.71 (0.76)	0.11 (1.43)
Substitute price - fresh potatoes	7.44 (0.76)	2.43 (4.32)
Complement price - hamburger	-0.05 (2.01)	
Microwave ovens	-0.05 (1.06)	-0.01 (4.31)
Fast food sales	0.08 (0.69)	0.01 (2.11)
Advertising - generic	0.08 (2.34)	-0.002 (1.01)
Advertising - frozen	-0.007 (1.12)	0.0003 (9.90)
R <sup>2</sup>	0.92	0.74
F Value	25.7	6.40

Dependent variable is billion pounds of frozen potatoes

T-values are in parentheses

Variable descriptions and units are in the appendix

**Table 2. Export Demand for US Frozen Potatoes**

<b>Variable</b>	<b>Japan</b>	<b>Mexico</b>	<b>Philippines</b>	<b>Thailand</b>
Intercept	-7.68 (0.30)	-0.13 (0.50)	0.15 (0.36)	0.015 (1.86)
McDonald's restaurants	0.24 (3.63)	0.23 (12.0)	0.09 (2.13)	0.0008 (0.24)
Advertising - USPB	0.12 (0.11)	2.32 (0.63)	1.02 (0.42)	0.28 (4.73)
Advertising - third party	0.93 (1.02)	NA	2.17 (3.59)	0.58 (62.9)
R <sup>2</sup>	0.91	0.98	0.97	0.99
F Value	38	320	120	20162

NA = not applicable; third party program was not conducted for Mexico  
 Dependent variable is million pounds of frozen potatoes  
 T-values are in parentheses  
 Variable descriptions and units are in the appendix

**Table 3. Impact of an Additional Dollar of US Potato Board Advertising**

<b>Country</b>	<b>Quantity (lb)</b>	<b>Processor Value</b>	<b>Grower Value</b>
Japan	115	\$37	\$11
Mexico	1669	\$559	\$167
Philippines	761	\$259	\$76
Thailand	244	\$78	\$24
United States	70	\$23	\$7

Note: assumes 1993 frozen potato prices, a 2:1 raw to final product conversion rate and a grower price of \$5.00 for raw product.

**Table 4. Impact of an Additional Dollar of Third Party Advertising**

<b>Country</b>	<b>Quantity (lb)</b>	<b>Processor Value</b>	<b>Grower Value</b>
Japan	915	\$289	\$91
Mexico	NA	NA	NA
Philippines	2213	\$753	\$221
Thailand	573	\$183	\$57

Note: assumes 1993 frozen potato prices, a 2:1 raw to final product conversion rate and a grower price of \$5.00 for raw product.

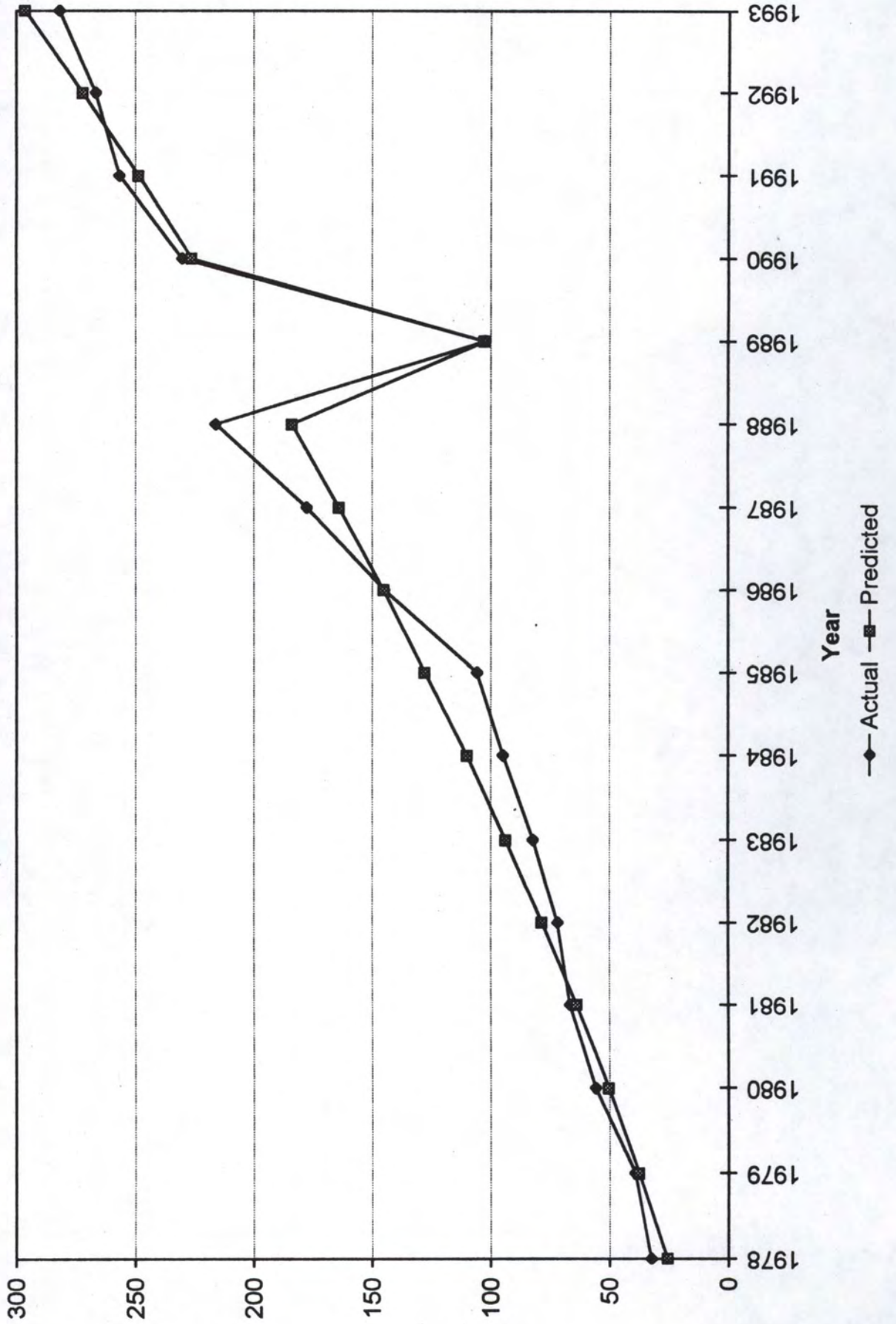
NA = not applicable; third party advertising program not conducted in Mexico.

**Table 5. Predicted US Frozen Potato Exports in 2000**

<b>Country</b>	<b>Actual 1993</b>	<b>Predicted 2000</b>	<b>Increase</b>
Japan	281.7	489.5	74%
Mexico	18.8	49.7	164%
Philippines	13.8	37.1	169%
Thailand	5.1	13.3	161%

Note: Quantity is million pounds

Figure 1. US Frozen Potato Exports to Japan





**APPENDIX**

**Appendix Table 1. Frozen Potato Data - Japan**

Year	ER	GDP	DEFL	N	Q	P	MCD	APB	AF3	AGE	RICE	HAMB	FRESH
1978	210	204	78.8	114.9	32.4	0.260	161	75	0	48.5	4380	501	156
1979	219	222	80.9	115.9	39.2	0.284	212	75	0	48.0	4390	514	160
1980	227	240	84.6	116.8	55.7	0.291	268	50	0	47.2	4427	567	198
1981	221	258	87.8	117.7	66.6	0.309	302	65	0	46.7	4578	600	247
1982	249	271	89.2	118.5	71.8	0.354	346	25	0	45.9	4776	617	220
1983	238	282	90.5	119.3	82.1	0.358	395	60	0	45.0	4921	630	209
1984	238	301	92.6	120.1	94.8	0.326	455	60	0	44.2	5078	634	259
1985	239	320	94.0	120.8	105.7	0.320	532	120	0	43.4	5220	650	199
1986	169	335	95.7	121.5	144.8	0.310	573	1860	275	42.6	5238	677	222
1987	145	348	95.7	122.1	177.6	0.321	604	1903	950	41.9	5235	706	238
1988	128	371	96.0	122.6	216.1	0.307	653	1703	1505	41.2	5167	705	231
1989	138	396	97.8	123.1	102.4	0.703	704	2884	1780	40.9	5328	735	230
1990	145	425	100.0	123.5	230.2	0.323	776	3528	2663	40.3	5364	759	261
1991	135	451	102.0	123.9	256.6	0.325	865	4257	5737	39.9	5373	771	312
1992	127	464	103.6	124.3	266.6	0.317	956	3193	5184	39.5	5489	799	280
1993	111	469	104.6	124.7	281.7	0.316	1040	2253	4598	39.2	5409	776	284

**DEFINITIONS:**

ER = currency exchange rate, yen/\$

GDP = gross domestic product (proxy for income)

DEFL = price deflator

N = Population (million)

Q = quantity of frozen potatoes imported from US (million lb)

P = price of frozen potatoes imported from US (\$/lb)

MCD = number of McDonald's restaurants

APB = advertising by US Potato Board &amp; industry (\$1,000)

AF3 = advertising by foreign third party (\$1,000)

AGE = percent of the population that is 0 to 29 yr old

RICE = price of rice

HAMB = price of hamburger, meals away from home

FRESH = price of fresh white potatoes

**SOURCES:**

IMF

IMF

IMF

IMF

USDA ERS

USDA ERS

McDonald's Annual Reports

US Potato Board

US Potato Board

US Bureau of Census

Japan Statistical Yearbook, 1978-93

Japan Statistical Yearbook, 1973-93

Japan Statistical Yearbook, 1973-93

**Appendix Table 2. Frozen Potato Data - Mexico**

Year	ER	GDP	DEFL	N	Q	P	MCD	APB	AF3	AGE	CORN	BEEF
1978	0.0228	2337	1	65.66	0.20	0.27	0	0	0	71.9	128	1152.1
1979	0.0228	3068	1	67.52	0.23	0.23	0	0	0	71.8	149	673.6
1980	0.0230	4470	1	69.66	0.30	0.30	0	0	0	71.7	156	1000.0
1981	0.0245	6128	1	71.35	1.03	0.28	0	0	0	71.4	148	2163.7
1982	0.0564	9798	2	73.02	0.59	0.43	0	0	0	71.4	162	2000.0
1983	0.1201	17879	3	74.67	0.04	0.44	0	0	0	71.1	135	194.8
1984	0.1678	29472	5	76.31	0.27	0.32	0	0	0	70.7	150	199.5
1985	0.2569	47392	7	77.94	0.25	0.35	2	0	0	70.5	148	211.0
1986	0.6118	79191	13	79.57	0.22	0.36	3	0	0	70.3	110	244.6
1987	1.3782	193312	31	81.20	0.14	0.29	5	0	0	69.9	79	177.8
1988	2.2731	390451	61	82.84	0.17	0.28	7	0	0	69.6	129	231.1
1989	2.4615	507618	77	84.49	0.49	0.68	8	0	0	69.3	131	225.1
1990	2.8126	686406	100	86.15	4.32	0.33	21	0	0	69.0	115	250
1991	3.0184	865166	122	87.84	7.31	0.35	35	0	0	68.4	126	267.7
1992	3.0949	1019156	139	89.54	14.63	0.32	56	20	0	68.1	141	299.1
1993	3.1156	112758	153	91.21	18.83	0.33	80	74	0	67.7	331	237.3

**DEFINITIONS:**

ER = currency exchange rate

GDP = gross domestic product (proxy for income)

DEFL = price deflator

N = Population

Q = quantity of frozen potatoes imported from US (million lb)

P = price of frozen potatoes imported from US (\$/lb)

MCD = number of McDonald's restaurants

APB = advertising US Potato Board &amp; industry (\$1,000)

AF3 = advertising by foreign third party (\$1,000)

AGE = percent of the population that is 0 to 29 yr old

CORN = price of imported corn

BEEF = price of imported beef

**SOURCES:**

IMF

IMF

IMF

IMF

USDA ERS

USDA ERS

McDonald's Annual Reports

US Potato Board

US Potato Board

US Bureau of Census

FAS

FAS

**Appendix Table 3. Frozen Potato Data - Philippines**

Year	ER	GDP	DEFL	N	Q	P	MCD	APB	AF3	AGE	RICE	BEEF
1978	7.37	178	21.68	45.79	0.000	NA	0	0	0	70.9	NA	848
1979	7.38	218	24.98	47.04	0.020	0.359	0	0	0	70.8	625	1499
1980	7.51	244	26.60	48.32	0.053	0.525	0	0	0	70.7	667	2150
1981	7.90	282	29.88	49.54	0.048	0.979	2	0	0	70.5	2000	2400
1982	8.54	317	32.48	50.78	0.036	0.331	3	0	0	70.3	923	2295
1983	11.11	369	37.10	52.06	0.082	0.367	5	0	0	70.2	NA	2446
1984	16.70	525	56.89	53.35	0.000	NA	8	0	0	70.0	448	2702
1985	18.61	572	66.92	54.67	0.000	NA	10	0	0	69.6	487	1681
1986	20.39	609	68.89	56.00	0.000	NA	12	0	0	69.3	199	1390
1987	20.57	683	74.06	57.36	0.448	0.263	13	0	0	68.8	433	1473
1988	21.10	799	81.20	58.72	1.660	0.293	18	0	0	68.6	399	1699
1989	21.74	925	88.54	60.10	2.592	0.553	25	29	119	68.1	279	1704
1990	24.31	1073	100.00	61.48	7.100	0.314	32	38	178	68.0	215	1808
1991	27.48	1244	116.55	62.87	8.971	0.329	38	47	225	67.6	555	1598
1992	25.51	1346	125.94	64.26	10.379	0.317	47	123	317	67.1	476	1628
1993	27.17	1458	134.11	65.65	13.831	0.335	50	112	570	66.8	444	1672

**DEFINITIONS:**

ER = currency exchange rate

GDP = gross domestic product (proxy for income)

DEFL = price deflator

N = Population

Q = quantity of frozen potatoes imported from US (million lb)

P = price of frozen potatoes imported from US (\$/lb)

MCD = number of McDonald's restaurants

APB = advertising by US Potato Board &amp; industry (\$1,000)

AF3 = advertising by foreign third parties (\$1,000)

AGE = percent of the population that is 0 to 29 yr old

RICE = price of imported rice

BEEF = price of imported beef

**SOURCES:**

IMF

IMF

IMF

IMF

USDA ERS

USDA ERS

McDonald's Annual Reports

US Potato Board

US Potato Board

US Bureau of Census

FAS

FAS

**Appendix Table 4. Frozen Potato Data - Thailand**

Year	ER	GDP	DEFL	N	Q	P	MCD	APB	AF3	AGE	RICE	BEE
1978	20.3	488	55.4	45.1	37.8	0.212	0	0	0	69.1	77.8	29.5
1979	20.4	559	60.2	46.1	3.8	0.520	0	0	0	68.9	82.6	33.2
1980	20.5	659	67.7	46.7	75.2	0.333	0	0	0	68.6	92.7	48.8
1981	21.8	760	73.5	47.7	2.2	0.461	0	0	0	68.2	117.0	55.7
1982	23.0	820	76.2	48.7	2.7	0.374	0	0	0	67.8	115.4	56.7
1983	23.0	910	78.8	49.7	3.7	0.548	0	0	0	67.3	109.8	56.4
1984	23.6	973	78.7	50.6	2.7	0.753	0	0	0	66.7	109.2	56.7
1985	27.2	1014	79.3	51.6	0.0	NA	1	0	0	66.0	106.5	50.7
1986	26.3	1095	81.6	52.5	0.0	NA	2	0	0	65.3	106.6	56.3
1987	25.7	1253	85.2	53.4	35.7	0.280	2	0	0	64.7	105.7	56.0
1988	25.3	1507	90.5	54.3	0.0	NA	3	0	0	64.1	128.7	57.5
1989	25.7	1776	95.2	55.2	8.2	0.735	4	0	0	63.2	141.2	63.6
1990	25.6	2051	100.0	56.1	31.6	0.442	6	0	0	62.5	146.8	66.2
1991	25.5	2368	105.8	56.9	1126.6	0.315	8	50	173	61.8	149.6	67.9
1992	25.4	2547	110.1	57.8	3614.0	0.311	16	110	625	61.1	153.9	70.1
1993	25.3	2739	114.6	58.6	5079.8	0.320	20	97	943	60.2	145.1	46.8

**DEFINITIONS:**

ER = currency exchange rate

GDP = gross domestic product (proxy for income)

DEFL = price deflator

N = Population

Q = quantity of frozen potatoes imported from US (1000 lb)

P = price of frozen potatoes imported from US (\$/lb)

MCD = number of McDonald's restaurants

APB = advertising by US Potato Board &amp; industry (\$1,000)

AF3 = advertising by foreign third party (\$1,000)

AGE = percent of the population that is 0 to 29 yr old

RICE = price of rice

BEEF = price of beef

**SOURCES:**

IMF

IMF

IMF

IMF

USDA ERS

USDA ERS

McDonald's Annual Reports

US Potato Board

US Potato Board

US Bureau of Census

Statistical Yearbook, Thailand

Statistical Yearbook, Thailand

Appendix Table 5. Frozen Potato Data - United States

YEAR	AF	AG	CPI	DPI	FAST	FRESH	FLF	MW	N	PFS	PHB	PR	QFS	QR	QR	RICE
1970	0.37	0.41	38.8	9.88	6.19	9.0	43.3	0.0	204	41.9	46.9	29.5	1.52	579	709	0.23
1971	1.67	0.31	40.5	10.11	7.01	8.6	43.3	0.0	207	41.6	48.4	29.0	1.64	581	740	0.24
1972	1.34	0.12	41.8	10.41	8.04	9.3	43.7	0.0	210	43.9	52.7	29.6	1.71	532	781	0.24
1973	2.30	1.43	44.4	11.01	9.68	13.7	44.4	1.2	212	46.8	66.6	30.7	1.81	507	830	0.29
1974	4.01	1.76	49.3	10.83	11.36	16.6	45.3	2.2	214	60.7	67.5	39.6	1.85	583	803	0.45
1975	2.61	1.83	53.8	10.91	13.60	13.4	46.0	3.2	216	64.7	62.3	45.6	2.04	583	777	0.41
1976	1.76	1.42	56.9	11.19	16.35	14.6	47.0	5.1	218	65.7	61.6	48.8	2.16	638	794	0.38
1977	5.65	1.12	60.6	11.41	19.30	15.0	48.1	6.7	220	67.6	60.2	50.0	2.44	606	851	0.35
1978	7.58	2.23	65.2	11.85	22.22	14.0	49.5	7.1	223	71.0	76.2	53.8	2.69	591	859	0.40
1979	7.54	1.37	72.6	12.04	24.94	13.4	50.6	7.6	225	75.0	101.7	56.8	2.90	506	865	0.42
1980	7.78	1.10	82.4	12.01	28.70	19.1	51.3	14.3	228	78.9	104.6	53.5	2.56	610	898	0.51
1981	9.35	1.38	90.9	12.16	32.12	25.0	52.1	17.0	230	91.3	102.6	62.8	3.01	533	919	0.56
1982	10.12	2.20	96.5	12.15	35.36	21.1	52.7	20.7	232	100.0	102.1	64.5	3.00	516	896	0.50
1983	6.35	1.81	99.6	12.35	39.49	20.6	53.1	25.0	234	101.8	99.4	62.1	3.24	468	896	0.47
1984	8.94	2.28	103.9	13.03	43.72	24.2	53.7	36.0	236	108.2	98.4	67.3	3.23	501	896	0.48
1985	10.09	4.62	107.6	13.26	47.48	20.8	54.6	45.0	238	113.0	95.9	70.6	3.66	446	890	0.47
1986	12.92	3.70	109.6	13.55	50.48	24.1	55.5	58.0	241	113.5	94.8	69.6	3.83	548	877	0.45
1987	19.51	3.83	113.6	13.55	54.25	27.6	56.2	66.0	243	115.2	100.1	69.0	3.77	561	881	0.40
1988	41.38	2.18	118.3	13.89	61.40	26.1	56.8	76.0	245	114.9	103.4	69.8	3.94	585	912	0.48
1989	21.30	3.50	124.0	14.01	65.78	34.2	57.7	83.0	247	119.4	108.6	75.1	4.25	633	971	0.50
1990	26.99	5.73	130.7	14.07	69.46	37.1	57.9	87.0	250	125.5	118.1	83.6	4.35	729	971	0.50
1991	20.25	4.86	136.2	13.89	71.89	33.0	57.1	90.0	253	127.8	119.9	85.3	4.50	686	963	0.50
1992	5.76	3.02	140.3	14.04	75.63	30.5	58.4	92.0	255	126.1	118.9	86.9	4.74	614	961	0.53
1993	16.18	6.48	144.5	14.34	80.24	35.0	58.4	94.0	258	134.7	120.1	86.0	5.08	633	976	0.51

## DEFINITIONS:

AF = Advertising for frozen potatoes (\$million)  
 AG = Advertising for potatoes, generic (\$million)  
 CPI = consumer price index (1982-84 = 100)  
 DPI = disposable per capita income (1987 \$1,000)  
 FAST = revenue of fast food restaurants (\$ billion)  
 FRESH = retail price of fresh white potatoes (cents/lb)  
 FLF = female (at least 20 years old) participation in labor force  
 MW = percentage of homes with microwave ovens  
 N = US population July, including military (millions)  
 PFS = producer price index, frozen french fries (1982 = 100)  
 PHB = retail hamburger price index  
 PR = retail price of frozen french fries (cents/lb)  
 QFS = quantity of frozen french fries, foodservice (billion lb)  
 QR = quantity of frozen french fries, retail (million lb)  
 RICE = retail price of white, long grain uncooked rice (\$/lb)

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