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- Enhance both public and private policy maker's understanding of the economics of commodity promotion programs.

- Facilitate the development of new theory and research methodology.

Export Promotion and Import Demand for U.S. Red Meat in Selected Pacific Rim Countries

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The Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture (USDA) administers two major nonprice export promotion programs: the Foreign Market Development program (FMD) and the Targeted Export Assistance program (TEA). The FMD program was created in 1955 and includes the Cooperator Market Development (Cooperator) program and the Export Incentive Program (EIP). Under the Cooperator program, FAS works together with others to promote U.S.-produced agricultural commodities in overseas markets, while the goal of projects under EIP is to promote specific commodities through brand promotion. Under EIP, FAS reimburses participating companies up to 50 percent of their promotion costs. Average annual expenditures for the FMD were $30 million during the period of 1986-1990.

The TEA program was authorized by the 1985 *Food Security Act*. Similar to FMD, the goal is to help U.S. exporters of agricultural commodities develop export markets. Three parties participate in the program: FAS, a cooperating domestic participant, and third parties within the importing country. The domestic participants can be either public or private organizations, private nonprofit firms, or profit-making firms. The essential difference between the FMD and TEA programs is that TEA program rules require commodity groups to be subjected to "unfair trade practices" in the world market, such as commodities getting subsidies from competing exporters' governments or receiving favorable tariff treatment when the commodity comes from a specific origin.

Each program has a different focus and level of expenditure. The TEA program concentrates on consumer promotion, accounting for 75 percent of total promotion expenditures, while the FMD program allocates relatively more resources (32 percent) to trade servicing and technical assistance. TEA also has significantly larger funding than FMD. However, the funding for this program decreased from $325 million in 1985 to $200 million in 1989 (Henneberry, Ackerman, and Eshleman, 1992).

A question that naturally arises is, are these programs effective? A related question is whether the effectiveness differs by country and commodity. In the research reported in this paper, we concentrate on evaluating FMD and TEA expenditures for promoting red meat exports from the U.S. to four newly industrialized countries: Hong Kong, South Korea, Singapore, and Taiwan. However, since second- and third-party expenditures cannot be obtained, our analysis is limited to promotion expenditures made by FAS.

We first review some related literature on estimating import and export demand functions. Then, an import demand equation is specified and estimated by pooling time-series data from the four countries. Pooling is required because of the limited number of time-series observations per country. But the equation is specified so that the "promotion effect" can differ by country, and tests are conducted for possible differences in the promotion effect itself. The econometric estimates are the basis for a simulation of scenarios involving the reallocation of promotion expenditures among countries. The basic conclusion is that promotion expenditure for red meat was most effective in South Korea, and reallocating funds to South Korea would likely have increased the total value of U.S. exports of meats to these countries.

Related Research

Several recent studies have evaluated the impact of U.S. export promotion programs for various commodities and importing countries. Our study is the first to examine U.S. red meat export promotion in newly industrialized countries. In general, previous studies have found that export promotion has had a positive impact on U.S. exports, i.e., on import demand for U.S. products. The results, however, have been mixed in terms of the statistical significance of promotion elasticities, as well as in overall rates of return. Because each study has examined different commodities and countries, as well as used different methodologies, it is difficult to generalize the overall performance of U.S. export promotion. Nevertheless, it is useful to summarize the results of these studies (Table 1).

Previous studies have either estimated import demand equations for countries importing the U.S. commodity, or have estimated a U.S. export demand equation for the commodity. In both cases, export promotion was included in the equation as an explanatory variable. To factor out the impact of other determinants of demand, these studies have included such variables as price, income, exchange rates, population, domestic production, substitute prices, and various measures of trade barriers.

Many analyses have used the import demand approach. Halliburton and Henneberry (1995) estimated an import demand equation for almonds in the Pacific Rim region. They found that export promotion had no impact for Singapore and South Korea, but had a positive and statistically significant impact in Japan, Taiwan, and Hong Kong. The gross rates of return for every $1.00 invested in U.S. almond export promotion was $4.95 in Japan, $5.94 in Hong Kong, and $8.59 in Taiwan[1].

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[1] All references to dollar amounts throughout this paper are in U.S. dollars.

Table 1: Export Promotion Elasticities

Commodity/Region	Promotion Elasticities
Red Meat **(De Brito, 1991)**	
Japan	**0.0100**
Almonds **(Halliburton and Hennebery, 1995)**	
Japan	**0.2890*****
South Korea	**-0.1576**
Taiwan	**0.5004*****
Hong Kong	**0.3996*****
Singapore	**0.1469**
Apples **(Rosson, Hammig, and Jones, 1986)**	
South America	**0.51**
Tobacco **(Rosson, Hammig, and Jones, 1986)**	
East Asia	**0.05****
Poultry **(Rosson, Hammig, and Jones, 1986)**	
South America	**0.25**
Grapefruit **(Fuller, Bello, and Capps, 1992)**	
Japan	**0.109***
France	**0.234***
Netherlands	**0.153***
Frozen Potatoes[a] **(Lanclos, Devadoss, and Guenthner, 1997)**	
Japan	**0.03**
Mexico	**0.04**
Philippines	**0.06**
Thailand	**0.08**
Concentrated Orange Juice **(Armah and Epperson, 1997)**	
France	**0.014***
Germany	**0.044***
Japan	**0.014***
Netherlands	**0.302***
United Kingdom	**0.014***

Notes: *Single asterisk(*), double asterisk (**), and triple asterisk (***) denote rejection of H_0 at 0.10, 0.05, and 0.01 significant levels, respectively, as reported by the authors.*
[a] *Promotion elasticities with respect to the Potato Board promotion expenditures*

Fuller, Bello, and Capps (1992) estimated an import demand equation for U.S. fresh grapefruit in Canada, Japan, France, and the Netherlands based on quarterly time-series data from 1969 to 1988. The authors found that promotion elasticities for Japan, France, and the Netherlands were 0.109, 0.234, and 0.153, respectively, and all were statistically significant at the 0.1 level of significance. The promotion elasticity for Canada was not reported in their study.

Lanclos, Devadoss, and Guenthner (1997) estimated import demand equations for U.S. frozen potatoes in Japan, Mexico, the Philippines, and Thailand. Marginal gross rates of return to promotion expenditures were calculated and ranged from $1.13 to $1.51 for the American Potato Board, and from $1.29 to $16.36 for third-party advertising expenditures.

Rosson, Hammig, and Jones (1986) estimated export demand equations for U.S. apples, poultry, and tobacco exports. Export promotion was found to have a significant and positive impact on the exports of apples and tobacco, but did not have a statistically significant impact on poultry exports. The study found the marginal rates of return for apples and tobacco were $60 and $31, respectively.

Armah and Epperson (1997) estimated an export demand equation for U.S. frozen concentrated orange juice to France, Germany, Japan, the Netherlands, and the United Kingdom. All promotion coefficients were positive and statistically significant at a 0.1 level of significance. The gross rates of return to 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 Model and Data

In our research, a single equation model is used to estimate the impact of various factors on import demand for U.S. red meat in Pacific Rim countries. The number of time-series observations available on promotion expenditures is small, and consequently, country data are pooled to estimate an import demand equation. A double logarithmic functional form is used.

The dependent variable is per capita imports of red meat measured in U.S. dollars. The import demand model is specified as follows:

$$\begin{aligned} \ln M_{i,t} = {} & \beta_0 + \beta_{1i} \ln P_{i,t} + \beta_{2i} \ln P_{pl\,i,t} \\ & + \beta_{3i} \ln GDP_{i,t} + \beta_{4i} \ln EX_{i,t} + \beta_{5i} \ln Q_{d\,i,t} \\ & + \beta_{6i} \ln PRO_{i,t} + \beta_{7i} \ln PROL_{i,t} + \Sigma^3_{j=1} \beta_{8j} D_{j,t} \\ & + \Sigma^3_{j=1} \beta_{9j} DPRO_{j,t} + \Sigma^3_{j=1} \beta_{10j} DPROL_{j,t} + e_{i,t}, \end{aligned}$$

where M is per capita imports of U.S. red meat in real U.S. dollars. Subscripts i and j represent the importing Pacific Rim countries (i = Hong Kong, South Korea, Singapore, and Taiwan; j = Hong Kong, South Korea, and Singapore); and subscript t refers to time (t =1984...1994). All data used in the study are on an annual (calendar year) basis. The original data set contains 11 time-series observations for each of the countries. As noted below, a lagged variable is used, so that one observation is lost for each country. Therefore, only ten time-series observations (1985-1994) for each country are actually used for estimation and simulations.

Red meat is defined as beef, veal, and pork, and M is estimated as follows. Quantities and unit prices of each individual commodity are collected from Economic Research Service (ERS)/USDA. The value of import is the product of quantity and unit price, and products, beef/veal and pork, are summed to obtain the import value of red meat. This value is then divided by the corresponding population and consumer price index (CPI) for all food for the importing country. The food CPI is provided by the Asian Development Bank (ADB) statistical yearbook, 1996.

P is the price ratio of U.S. red meat imports to the average price of red meat imports from other countries; P_{pl} is the price ratio of the U.S. poultry import price to the average poultry import price from other countries.[2] The red meat price ratio is calculated by dividing the importing price for U.S. red meat by the average import price for red meat from other countries. The U.S. red meat price is collected from ERS/USDA, while the average import price of red meat (excluding the U.S.) is collected from FAO's (United Nations Food and Agriculture Organization) trade yearbooks for Hong Kong, South Korea, and Singapore, and Taiwan's agricultural trade statistics. Similarly, the substitute price ratio is the U.S. poultry import price divided by the average price of imported poultry (excluding the U.S.) in each country. The price of U.S. poultry is collected from ERS/USDA, and the prices of poultry imports from other countries are collected from FAO and Taiwanese (Republic of China) agricultural trade statistics yearbooks.

The effect of income on import demand is measured by each country's gross domestic product. GDP is real per capita gross domestic product in U.S. dollars. Several steps are taken to remove the effect of inflation and differences in currencies across countries. First, nominal GDP is converted from national currencies, as reported by the Asian Development Bank, into a U.S. dollar standard. Second, the converted GDP is deflated by GDP deflators provided in the ADB statistical yearbook for Pacific Rim countries. Finally, the converted and deflated GDP is divided by the total population.

Due to the large differences in the absolute value of national currencies to U.S. dollars across the four countries, an exchange rate index is used to account for the exchange rate effect on import demand. EX is an exchange rate index, measured as the national currency required to buy one U.S. dollar. This index is defined as the change of the exchange rate relative to the previous period's exchange rate. The original exchange rate is reported in the ADB statistical yearbook in current market prices.

Q_d is domestic production of red meat in metric tons per person. Domestic production of red meat includes beef and pork in metric tons. The variable is obtained by dividing the total sum of red meat production by total population. Data on domestic production of beef and pork are collected from FAO production statistical yearbooks for Hong Kong, South Korea, and Singapore. The same data for Taiwan are obtained from the Taiwanese (Republic of China) agricultural production statistical yearbooks.

PRO is U.S. export promotion expenditures for red meat in U.S. dollars per thousand people deflated by the CPI for the country; PROL is the same variable lagged one year to capture the carryover effect of promotion investments. As noted earlier, PRO is based on FAS expenditure and does not include other sources of promotion funds. Promotion expenditures are unpublished numbers provided by USDA/FAS. All data on promotion are actual amounts spent for the period of 1984-1994. Due to limited categorization of data by FAS, only a portion of FAS's promotion expenditure is available for each country. Therefore, the estimated promotion elasticities in this research should be considered as upper bounds of the true parameters.

The variable D is an intercept dummy variable intended to capture the country effect, where the base country is Taiwan. DPRO is an interaction term and is equal to D multiplied by PRO; and DPROL is the interaction term lagged one period.

Promotion expenditures (both current and lagged), price of substitutes, and income are expected to have a positive effect on import demand, while the price of red meat, the exchange rate, and domestic production of red meat are expected to be negatively correlated to import demand. The interaction variables for current and lagged promotion permit the slope coefficients for these variables to differ by country, which is a key issue addressed in this research. The promotion effect is expected to be positive, but could differ by country. The model's overall intercept represents Taiwan's, and the

[2] Another possible substitute for red meat could be fish, but data on domestic production, prices, and international trade of fish are not available for all four countries. Therefore, only poultry is specified as a substitute commodity in the model.

Table 2: Estimated Import Demand Equations for the Pacific Rim Countries

Variables	Hong Kong	South Korea	Singapore	Taiwan
Constant	**-7.2664 (-1.2087)**	**-8.3378 (-1.3931)**	**-7.7786 (-1.3079)**	**-7.7624 (-1.330)**
$P_{i,t}$ (Price Ratio)	**-0.0092 (-0.036)**	**-0.0092 (-0.036)**	**-0.0092 (-0.036)**	**-0.0092 (-0.036)**
$P_{pl\ i,t}$ (Poultry Price Ratio)	**0.4281 (2.2823)**	**0.4281 (2.2823)**	**0.4281 (2.2823)**	**0.4281 (2.2823)**
$GDP_{i,t}$ (Per Capita GDP)	**0.9337 (3.7155)**	**0.9337 (3.7155)**	**0.9337 (3.7155)**	**0.9337 (3.7155)**
$Ex_{i,t}$ (Exchange Rate Index)	**-0.8148 (-0.834)**	**-0.8148 (-0.834)**	**-0.8148 (-0.834)**	**-0.8148 (-0.834)**
$Q_{d\ i,t}$ (Domestic Production)	**-1.0067 (-2.444)**	**-1.0067 (-2.444)**	**-1.0067 (-2.444)**	**-1.0067 (-2.444)**
$PRO_{i,t}$ (Current Promotion)	**-0.0174 (-0.553)**	**0.4529 (11.574)**	**-0.0725 (-0.791)**	**0.0329 (0.8459)**
$PROL_{i,t}$ (Lagged Promotion)	**-0.0019 (-0.060)**	**0.1452 (3.0009)**	**0.1061 (1.2473)**	**0.0139 (0.4358)**

model's slope coefficients for promotion and promotion lagged are Taiwan's coefficients.

Empirical Results

The estimated import demand equation for the four countries is presented in Table 2. The separate columns show the differing country intercept coefficients and promotion slope coefficients. Since the double-log functional form was used, the estimated coefficients were estimated elasticities of corresponding variables.

The estimated elasticity of per capita import value with respect to the own-price ratio was -0.0092, but not statistically different from zero.[3] In contrast, the estimated coefficient for the substitute (poultry) price ratio was positive with a value of 0.43 and a t-ratio larger than 2. The lack of an important own-price effect may reflect the omission of a variable to represent fish, or other possible problems in the data set.

The elasticity of per capita import demand with respect to income was estimated to be 0.93, and the t-ratio was 3.7. The relatively large effect of income on U.S. import demand seems logical, i.e., as income increases, countries (especially those more industrialized) are more willing to spend their foreign exchange to import high-value food products like red meat. The income coefficient also may be capturing other "trend effects."

As expected, the exchange rate index had a negative effect on import demand of U.S. red meat. The elasticity of red meat import with respect to the exchange rate index was estimated to be -0.81. When the exchange rate index increased, U.S. red meat became more expensive. However, this coefficient had a small t-ratio.

Domestic production of red meat also had a negative effect on import demand with a t-ratio of 2.4. Moreover, domestic production of red meat was the most elastic factor affecting import demand of red meat with a value of -1.01. Domestically-produced red meat was an important substitute for imported red meat.

The intercept, current promotion, and lagged promotion coefficients for each country were calculated from the estimated overall intercept, intercept dummy coefficients, and current and lagged promotion slope dummy coefficients. Current promotion expenditures had a positive effect in Taiwan and South Korea, but were only statistically important in South Korea. The elasticities for import demand with respect to current promotion expenditures for South Korea and Taiwan were 0.453 and 0.033, respectively. In contrast, promotion expenditures had a negative, but statistically insignificant impact on import demand of red meat in Hong Kong and Singapore.

Since export promotion can have a carryover effect, promotion expenditures lagged one year were also included as independent variables. Lagged expenditures had a positive effect in South Korea with a t-ratio over 3, and were positive with a t-ratio of 1.25 in Singapore. Lagged promotion expenditures were negative, but statistically insignificant in Hong Kong and Taiwan. The sums of current and logged promotion elasticities were –0.019 for Hong Kong, 0.598 for South Korea, 0.034 for Singapore, and 0.047 for Taiwan.

Diagnostic Tests

Experience suggests that econometric results can be fragile. Thus, multicollinearity was evaluated, and errors were tested for autocorrelation and

[3] Price dummy variables were initially included in the model to see if the relative price of red meat had different impacts on import demands in the four countries studied. However, these variables were all statistically insignificant and were therefore dropped from the final model.

heteroskedasticity. The existence of nonspherical errors would suggest the model is misspecified. Also, given the importance of promotion coefficients in our analysis, we examined whether these estimates were especially dependent on one or two observations.

Pairwise, simple, correlation coefficients were computed for the variables. These correlations were small. In order to detect more complicated patterns of multicollinearity, which are linear combinations of the independent variables, auxiliary regressions were used. Each independent variable was sequentially regressed on all remaining variables in the original model. The resulting R^2_ks were then compared to the original full model R^2. The auxiliary regression R^2_ks are reported in Table 3 and all were less than R^2, which was 0.975. Together with the pairwise, simple, correlation coefficients, the evidence suggested multicollinearity was not a problem in this data set.

Table 3: Auxiliary Regression R^2_k for Detection of Multicollinearity Problems

Regressor X_k	R^2_k
LN $P_{i,t}$	**0.652**
LN $P_{pl\ i,t}$	**0.218**
LN $GDP_{i,t}$	**0.911**
LN $EX_{i,t}$	**0.538**
LN $Q_{d\ i,t}$	**0.971**
LN $PRO_{i,t}$	**0.901**
LN $PROL_{i,t}$	**0.877**

A Lagrangian multiplier test was used to test for first-order autocorrelation. To perform this test, the error term was assumed to have the form

$$e_t = \rho e_{t-1} + v_t$$

where e_t is the error of the unrestricted full model, e_{t-1} is the lagged error, and ρ is the true autocorrelation coefficient. The test procedure made the residuals from the original model, lagged one period, an additional variable in the model.[4] The estimated coefficient of the lagged residuals gave an estimate of the autocorrelation parameter, ρ. The estimated coefficient for the lagged residual variable was -0.384 and the t ratio was -1.661. Thus, the evidence for autocorrelation was marginal.

White's test for heteroskedasticity was used. It assumes true error variance is related to all or some variables in the regression in the form

$$\sigma^2_t = \gamma_0 + \gamma_1 X_{1,t} + \gamma_2 X_{2,t} + ...+ \gamma_k X_{k,t} + \gamma_{k+1} X^2_{1,t} + \gamma_{k+2} X^2_{2,t} +...+ \gamma_{2k} X^2_{k,t} + \gamma_{2k+1} X_{1,t} X_{2,t} + ...$$

where σ^2_t is the variance, and $X_{i,t}$ are the independent variables (Gujarati, 1995). The hypothesis was that all slope coefficients in this regression were zero. The squared residuals, u_t^2, were used as a proxy for the true error variance, and an "artificial regression equation" was estimated using the regressors, squared regressors, and five interaction terms. The computed White statistic was 14.17, while the critical value for a χ^2 distribution, with 19 degrees of freedom at the 5 percent level of significance, was 30.14. Consequently, the null hypothesis could not be rejected, suggesting no heteroskedasticity.

An influential data points analysis was conducted to detect whether any observation had an unusually large influence in determining the magnitude of key slope coefficients. The key variables were promotion (PRO_t), promotion lagged one period ($PROL_t$), and slope dummy variables for promotion in Korea ($DPRO_{j,t}$, j=2) and lagged promotion in Korea ($DPROL_{j,t}$, j=2). In addition, this process was also conducted on gross domestic products and domestic red meat production, which were shown to be statistically important.

Partial-regression leverage plots were used (Belsley, Kuh, and Welsch). These plots suggested slope coefficients of gross domestic product, domestic production of red meat, and the dummy variable for promotion in Korea did not depend on any single influential data point. However, the leverage plots for current and lagged promotion, and dummy variables for lagged promotion for Korea, showed a potential large influence of one data point (1986 in Taiwan). When this observation was excluded, and the model re-estimated, the slope coefficients of current promotion, lagged promotion, and dummy lagged promotion variables changed from 0.03 to 0.0128, from 0.0139 to 0.0377, and from 0.131 to 0.103, respectively. The set of adjusted coefficients for current promotion was slightly smaller than the original estimated coefficients. To be conservative in interpreting the impact of promotion on U.S. red meat exports to the Pacific Rim countries, these adjusted coefficients were used in simulations and calculations of rates of return to promotion investment.

Simulations

Reallocation of Promotion Expenditures

The econometric results indicated promotion investment was most significant and effective in the South Korean market. Therefore, the logical question to ask is, what would have happened if promotion expenditures were reallocated by taking money from less effective markets and putting it into the effective one?

[4] The lagging procedure we used allowed for pooling of the time-series observations for the different countries.

Following this reasoning, nine scenarios were simulated over the sample period, 1985 to 1994. First, 10 percent of current promotion expenditures was taken out of Hong Kong, Singapore, and Taiwan and the resulting

Table 4: Simulation Results, Per Capita U.S. Red Meat Import Values (in U.S. Dollars)

SCENARIOS	HONG KONG	S. KOREA	SINGAPORE	TAIWAN
BASELINE	**29.12**	**20.34**	**30.28**	**7.51**
10 %	**29.12**	**25.81**	**29.95**	**7.47**
20 %	**29.12**	**30.07**	**29.57**	**7.42**
30 %	**29.12**	**33.85**	**29.19**	**7.37**
40 %	**29.12**	**37.33**	**28.69**	**7.31**
50 %	**29.12**	**40.57**	**28.14**	**7.25**
60 %	**29.12**	**43.64**	**27.47**	**7.17**
70 %	**29.12**	**46.55**	**26.65**	**7.06**
80 %	**29.12**	**49.34**	**25.53**	**6.92**
90 %	**29.12**	**52.02**	**23.72**	**6.68**

Note: Figures in table are the sum of per capita import values in the ten-year period, 1985-94

Table 5: Simulation Results, Total Import Values of U.S. Red Meat (in U.S. Millions Dollars)

SCENARIOS	HONG KONG	S. KOREA	SINGAPORE	TAIWAN
BASELINE	**167.38**	**884.83**	**82.84**	**153.10**
10 %	**167.38**	**1118.8**	**81.91**	**152.29**
20 %	**167.38**	**1301.24**	**80.90**	**151.39**
30 %	**167.38**	**1463.71**	**79.76**	**150.37**
40 %	**167.38**	**1621.96**	**78.47**	**149.20**
50 %	**167.38**	**1752.39**	**76.96**	**147.84**
60 %	**167.38**	**1884.04**	**75.16**	**146.18**
70 %	**167.38**	**2009.30**	**72.70**	**144.07**
80 %	**167.38**	**2129.18**	**69.83**	**141.15**
90 %	**167.38**	**2244.41**	**64.88**	**136.29**

Note: Figures in table are the sum of total import values in the ten-year period, 1985-94

money put into export promotion in South Korea. Second, the estimated import demand equations for each country were used to predict the new import demand for each country under the new allocation of promotion expenditures. The process was repeated in 10 percent increments until the marginal rate of return for promotion became zero, or promotion expenditures approached 100 percent in South Korea. The simulated value of import demand with original promotion expenditures was the baseline for comparisons. The simulated values of import demand with the reallocated promotion expenditure levels were compared with the baseline both on a per capita and total export sales basis.[5]

Table 4 presents the change in per capita import demand after reallocating promotion expenditures in the four markets. The import values of U.S. red meat, of course, decreased in Singapore and Taiwan when promotion investments decreased. For Singapore, imports decreased from $30.28 per capita in the baseline to $23.72 per capita in the 90 percent reduction scenario. In Taiwan, import values slightly declined from $7.51 per capita in the baseline to $6.69 in the 90 percent reduction scenario. In Hong Kong, per capita import values were constant across all nine scenarios since the promotion coefficients were set to zero.

When the promotion expenditures were reallocated to the South Korean market, U.S. export sales increased dramatically. In the baseline scenario, the import value for South Korea was $20.52 per capita. This value reached $52.02 when Korea received 90 percent of the three remaining markets' promotion expenditures--a 156 percent increase.

Moreover, since South Korea has the largest population in the four markets, the effect on U.S. export sales of red meat was large; specifically, total import values increased from $884.83 million in the baseline to $2.24 billion in the 90 percent scenario, a 159 percent increase (Table 5). In contrast, the total import values in Singapore and Taiwan decreased in response to the declining of the promotion expenditures. Comparing the ninth scenario to the baseline, values decreased from $82.84 million to $64.88 million, and from $153.10 million to $136.29 million for Singapore and Taiwan, respectively. However, the loss of export revenue in these two countries was only $34.77 million compared to the gain of $1.36 billion in South Korea. Therefore,

[5] Since the promotional coefficients in Hong Kong were negative and statistically insignificant in both the current and lagged periods, these coefficients were set equal to zero in the simulations. The same was true for the coefficient on current promotion for Singapore, which was subsequently set to zero. Also, recall that the estimated coefficients without the influential point were used rather than the original coefficients.

reallocating export promotion from the three countries to South Korea was estimated to be profitable.

Return to Promotion Investments

In order to calculate rates of return to promotion investments in each country and the entire region, an additional simulation was conducted to see how much red meat sales would increase in response to a 50 percent increase in promotion expenditures in every market. The sales increase was divided by the increases in promotion expenditures in the corresponding markets and the entire region, i.e.:

$$RPI = \frac{\Delta M}{\Delta PRO},$$

where RPI is the rate of return to promotion investments, ΔM is the change in the export sales, and ΔPRO is the change in promotion expenditures. RPI was interpreted as the gross change in red meat imports (from the U.S.) for each dollar change in promotion.

Three different sets of elasticities were used to estimate the rate of return to promotion investment. First, the set of estimated coefficients, adjusted for the influence of influential points, was used. The second and third sets were obtained from the lower and upper limits of a 95 percent confidence interval on the promotion coefficients. The three estimates provided an average rate of return (using point estimate coefficients) and a range of rates of return (using the lower and upper limits of the promotion coefficients).

Rates of return to promotion (with a 50 percent increase in promotion expenditures in all four markets) are reported in Table 6. These rates of return for South Korea, Singapore, and Taiwan were $201.00, $4.17, and $2.16, respectively. The rate of return for promotion investment for the entire region was $47.86. With the lower confidence interval limits of the promotion variable coefficients, these rates of return were $0.00, $99.95, $0.00, and $0.00 for Hong Kong, South Korea, Singapore, and Taiwan, respectively. For the whole region, the rate of return was $23.14. When using the upper confidence interval limits of the promotion variable coefficients, the rates of return were $6.89, $385.02, $54.38, and $27.84 for Hong Kong, South Korea, Singapore, and Taiwan, respectively. For the whole region, the average rate of return to promotion was $108.46

These returns were gross rates, which do not account for the cost incurred in increasing exports. As is the case in most export promotion studies, we did not have all the data necessary to compute a net rate of return to promotion investment. Furthermore, FAS only contributed to a portion of the increase in promotion expenditures. These were not necessarily the rates of return to U.S. government promotional spending. Assuming that FAS contribution corresponded to one-third of the total export promotion expenditures in this region, the true gross rate of return was about $15.62. Moreover, the quality of the estimates was uncertain, because of data limitations.

Table 6: Return to Promotion Investment (RPI) with a 50 percent Increase in Promotion Expenditures

Coeff. sets	Hong Kong	S. Korea	Singapore	Taiwan	Region
Point Estimates	**0**	**201.00**	**4.17**	**2.16**	**47.32**
Lower Limits	**0**	**99.95**	**0**	**0**	**23.14**
Upper Limits	**6.89**	**385.02**	**54.38**	**27.84**	**108.46**

Conclusion

The purpose of this research was to estimate the impact of U.S. red meat export promotion on import demand in Hong Kong, South Korea, Singapore, and Taiwan. While there have been several recent studies on the impacts of U.S. export promotion programs, this was the first to examine red meat export promotion in the newly industrialized countries (NICs) of the Pacific Rim. Pooled time-series and cross-section data were used to estimate an import demand model for red meat for this region that included export promotion expenditures by the U.S. as one of the independent variables.

The statistical results indicated that U.S. export promotion had a positive and significant impact on red meat imports by South Korea, which is the largest of the four markets. The coefficients on current (as well as one year lagged) promotion expenditures indicated that promotion had an immediate and carryover effect on imports. However, U.S. export promotion did not have a statistically significant impact on red meat imports in the other three countries. Hence, this study suggests that U.S. red meat export promotion has had a positive impact in South Korea, but not in the other three NICs of the Pacific Rim.

Given these results, we estimated how red meat imports to this region would have changed had the U.S. allocated more of the promotion budget to South Korea at the expense of the three other countries. A set of in-sample simulations over a ten-year period was conducted. These simulations suggest that total value of U.S. red meat exports would have increased by about $1.32 billion from 1985 to 1994 had promotion expenditures in Hong Kong, Singapore, and Taiwan been reduced 90 percent with the proceeds invested in the South Korean market. This represented an increase of 102 percent in the value of exports to these four countries.

Finally, a gross rate of return from export promotion was estimated for each country and the entire region by simulating an in-sample 50 percent increase in promotion expenditures for each country. The gross rate of return for the entire group was estimated to be $47.32 for every dollar invested in the program. However, this return represents an upper bound of the true figure since only FAS's contribution to promotion activities was included in the model estimation, due to lack of data categorization and availability. Assuming that FAS contribution corresponded to one-third of the total export promotion expenditures in this region, the true gross rate of return was about $15.62.

References

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

Asian Development Bank, *Statistical Yearbook for the Pacific Countries*. Various Issues 1984-1996.

Belsley, D.A., E. Kuh, and R.E.Welsch. Regression Diagnostics. John Willey and Sons, 1980.

De Brito, M. "The Impact of Nonprice Promotion Activities on United States Red Meat Exports to Japan: A Market Share Analysis." *Masters' Thesis,* Oklahoma State University, December 1991.

ERS/USDA, *Foreign Agricultural Trade of the United States (FATUS)*. Various Issues 1984-1994.

F.A.O. Statistics Division, *Production Yearbook.* Various Issues 1984-1994.

F.A.O. Statistics Division, *Trade Yearbook.* Various Issues 1984-1994.

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

Gujarati, D. Basic Econometrics. McGraw Hill, Third Edition, 1995.

Halliburton, K. and S. Henneberry. "The Effectiveness of U.S. Nonprice Promotion of Almonds in the Pacific Rim." *Journal of Agricultural and Resource Economics* 20(1995):108-121.

Henneberry, S., K. Ackerman, and T. Eshleman. "U.S. Overseas Market Promotion: An Overview of Nonprice Programs and Expenditures." *Agribusiness* 8(1992):57-78.

Lanclos, D., S. Devadoss, and J. Guenthner. "Impacts of Foreign Direct Investment and Advertising on the Export Demand for U.S. Frozen Potatoes." *Agribusiness* 13(1997): 273-284.

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

Statistics Office of Republic of China, *Agricultural Production Statistics of Republic of China.* Various Issues 1985-1994.

Statistics Office of Republic of China, *Agricultural Trade Statistics of Republic of China.* Various Issues 1985-1994.

USDA Staff, Data on U.S. Export Promotion for Red Meat in the Pacific Rim Countries, unpublished data.

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