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An Aggregate Study with a Comparison of European Community Members and Non-Members

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Agricultural Import Growth Markets: An Aggregate Study with a Comparison of European Community Members and Non-Members

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ABSTRACT

This study estimated agricultural import demand for the fifteen largest agricultural import markets using time series data from 1974 through 1990. Countries included in the study group included China, Hong Kong, Italy, Japan, France, the Netherlands, the Federal Republic of Germany, Belgium-Luxembourg, the United Kingdom, Egypt, Canada, the United States, Spain, Korea, and the USSR. A model was estimated for the entire study group regressing agricultural import volume against import unit value, gross domestic product, population, and domestic production. A modified model was estimated to determine if different parameters exist between groups for the following sub-groups : (1) high and low import growth groups and (2) European Economic Community members and non-members.

The empirical results indicate that categories within both sub groups have different responses to changes in import demand variables. Domestic production had an unexpected positive effect on agricultural import volume for high growth countries. The findings of the study suggest that a strategy to increase agricultural import demand in one subgroup may have no effect, or possibly even the opposite of the desired effect, if used for another subgroup.

INTRODUCTION

Increased U.S. agricultural exports are directly tied to growth in agricultural import markets. Growth in import markets for agricultural products is of interest to U.S. policymakers for several reasons: (1) the United States agricultural sector is heavily reliant on exports for income and stability; (2) one U.S. economic policy objective is to decrease the U.S. trade deficit; and (3) there is concern about the large expenses involved in overseas market promotion programs by the United States Department of Agriculture.

World Agricultural Import Growth

From 1984 to 1989, the world experienced a total increase in agricultural imports of 36.03 percent. The highest annual rate of growth for this time period was in 1987-88 when imports increased by 12.79 percent (Table I). World imports showed negative growth from 1984 to 1985, but rebounded later for an average annual growth rate of 6.5 percent over the five-year period (Table 1).

Table 1. Rates of Agricultural Import Growth, Major Regions, 1984-1989

Major Region		Percentage Growth Rates						
		1984-85	1985-86	1986-87	1987-88	1988-89	Annual Avg	Total 1984-89
Economy Type	DEVELOPED ALL	-0.97	12.26	11.58	10.72	2.37	7.19	40.59
	Oceania	0.94	2.67	5.76	18.34	22.34	10.01	58.69
	Western Europe	2.31	20.53	15.54	9.26	-0.03	9.52	55.62
	Other Developed	-10.97	7.24	15.31	27.07	7.85	9.30	50.88
	North America	0.39	6.04	-0.21	4.01	3.05	2.66	13.87
	E. Europe	-6.48	5.06	-1.69	16.84	-3.34	2.08	9.08
	USSR	-6.39	-14.25	6.35	8.60	13.05	1.47	4.80
	DEVELOPING ALL	-9.28	-3.86	7.95	19.68	10.51	5.00	24.52
	Far East	-8.70	0.33	22.28	27.97	9.46	10.27	56.91
	Other Developing	-5.31	9.47	11.34	2.05	3.87	4.29	22.34
	Latin America	-9.91	1.18	-4.67	17.71	10.49	2.96	13.02
	Africa	0.29	-7.28	-3.23	9.57	15.42	2.85	13.14
	Near East	-13.47	-9.71	2.64	13.83	10.45	0.75	0.82
Continent	EUROPE	1.63	19.43	14.47	9.66	-0.22	9.00	52.04
	OCEANIA	-1.04	4.01	6.62	14.34	18.75	8.53	48.99
	ASIA	-11.09	-0.55	15.61	23.38	9.93	7.46	38.64
	N/C AMERICA*	-0.50	2.74	0.42	7.95	5.92	3.31	17.37
	AFRICA	-4.19	-6.33	-2.08	17.53	8.94	2.77	12.52
	SOUTH AMERICA	-16.23	20.40	-12.45	3.22	-1.97	-1.41	-10.65
	WORLD	-3.33	7.96	10.72	12.79	4.37	6.50	36.03

* North and Central America

Note: Annual growth rates were computed as the change in a one-year period divided by the previous year's total agricultural imports and multiplied by 100 to obtain percentages. Absolute change in imports for the five-year period was calculated as 1989 total agricultural imports less 1984 total agricultural imports. Average annual growth rate is the average of the annual growth rates from each one-year period. Total agricultural import growth rate from 1984 to 1989 was determined by dividing the absolute change in imports by the 1984 imports and multiplying by 100 to obtain percentages. These calculations are used for Tables II and III also.

Source: FAO Trade Yearbook, various issues.

Economy Type

The agricultural imports of developed economies grew at a rate 66 percent faster than those of developing economies from 1984 to 1989. Developing economies are generally defined as countries with low per-capita incomes whose main imports are basic food requirements. Their infrastructure is typically characterized by underdeveloped capital markets, weak government institutions, and a poor transportation system. Developed economies, in contrast, have high per-capita incomes and a broader base of imports. Their infrastructures have well-developed capital markets, strong government institutions, and good transportation systems. The rate of agricultural import growth in major regions by economy type and continental groupings as defined by the Food and Agriculture Organization (FAO) of the United Nations are shown in Table 1. Total agricultural imports as measured by FAO include all raw or processed agricultural products purchased by a country, regardless of product origination. U.S. agricultural export data as measured by Foreign Agricultural Trade of the United States includes only U.S. agricultural sales to other countries.

High Volume Import Markets

The 15 largest agricultural import markets include seven countries from the European Economic Community (EEC). The average U.S. market share for 1989 in these seven countries was only 4.7 percent; however, the growth rate of these combined markets is approximately 10 percent. It is feasible that the U.S. could attain a part of that increase and thus increase its market share. The ramifications of these countries becoming one market make it a vital issue in future U.S. agricultural policy.

Japan is the second largest agricultural import market and is critical to the U.S. because it is our largest agricultural export market. The U.S. market share in Japan is 28.05 percent, but with an average annual growth rate of 10.17 percent there is an opportunity to further increase market share (Table 2).

Market share figures indicate that Canada, the Korean Republic, and Egypt are major U.S. markets. In 1989, U.S. market share in Canada was 33.62 percent. Like the U.S., Canada's market is growing at a slow pace with an average annual growth rate of 5.55 percent. The Republic of Korea is another market for agricultural products in which the U.S. has a large market share. The possibility of expanding that market share is greater than in Canada because Korea's annual growth rate is more than twice that of Canada's at 13.93 percent. Egypt is important also with a U.S. share of 19.07 percent in that market. Total U.S. agricultural exports to Egypt are more than those to Hong Kong, which is considered a strong market for U.S. products.

The largest agricultural import markets and the fastest growing markets are two very distinct groups. China is the only country which

Table 2 Comparison of U.S. Market Share in 15 Largest Versus 15 Fastest-Growing Agricultural Import Markets, 1989

15 Largest Agricultural Import Markets (1989)

Country	Market Size ($100,000)	Avg Annual Growth Rate (percent)	U.S. Market Share (percent)	Total U.S. Exports ($100,000)
German Fed. Rep.*	308603	8.90	2.97	9179.44
Japan	290595	10.17	28.05	81518.83
United States	250658	2.02	N/A	N/A
Italy *	218627	11.16	2.79	6091.85
USSR	202566	1.47	16.29	32988.48
United Kingdom *	200020	8.32	3.68	7362.83
France *	198239	10.00	2.39	4741.10
Netherlands *	155810	9.20	11.85	18467.49
China	110748	15.74	13.10	14961.23
Belgium-Luxembourg*	107980	8.42	0.99	4311.68
Spain*	68185	13.76	12.84	8756.20
Canada	64905	5.55	33.62	21820.02
Korea Republic	63085	13.93	38.89	24532.20
Hong Kong	62933	12.50	9.14	5753.75
Egypt	50050	6.19	19.07	9546.79

15 Fastest-Growing Agricultural Import Markets (1989)

Country	Market Size ($100,000)	Avg Annual Growth Rate (percent)	U.S. Market Share (percent)	Total U.S. Exports ($100,000)
Laos	168	60.92	0.00	0
Cayman Islands	247	39.11	63.51	156.88
Ethiopia	2647	37.95	10.87	287.71
Equat. Guinea	98	29.96	0.10	0.10
Guinea-bissau	297	27.38	1.77	5.27
Guyana	528	22.10	21.70	114.60
Turkey	16128	21.93	14.74	2377.70
Albania	489	20.67	0.00	0
Sierra Leone	1005	20.23	8.96	90.09
Cameroon	2070	19.23	4.36	90.16
Faeroe Island	524	16.66	0.00	0
Brazil	19154	16.40	7.77	1488.01
Mexico	40164	16.04	68.80	27633.40
China	110748	15.74	13.10	14961.23
Thailand	12488	15.72	13.52	1688.46

* European Economic Community Members

Source: FAO Trade Yearbook, various issues. FATUS, Fiscal Year 1989 Supplement.

ranks among the leading 15 countries in both market size and in average annual growth rate (Table 2). The average annual growth rate for China over the five-year period was 15.74 percent with total growth of 93.05 percent. The 1989 U.S. market share of agricultural imports by China was 13.10 percent, making it an important export market for U.S. agriculture. As trade with China becomes less constrained, the U.S. may be able to secure a larger portion of the growing market. The U.S. has a market share of 9.14 percent in Hong Kong. Hong Kong is a crucial market because in 1997 it will become part of China. A strong foothold in the Hong Kong market could mean better U.S. access to Chinese markets after the merger takes place.

High Growth Import Markets

The fastest growing agricultural import markets tend to be small or very small countries. Laos is the fastest growing market as measured by average annual growth rate; however, it is also one of the smallest markets in the world. Turkey, Brazil, Mexico, China, and Thailand are the only large or medium-sized markets among those with high annual average annual growth rates (Table 2). The U.S. holds a market share of over 10 percent in each of those countries with the exception of Brazil. The relative market size has a larger bearing on the importance of a market than does market share. For example, the U.S. has a similar market share in the Cayman Islands (63.51 percent) and in Mexico (68.80 percent). However, total U.S. exports to the Cayman Islands in 1989 were $15.68 million as compared to $2.76 billion to Mexico in the same year. Exports to the Cayman Islands were 0.5 percent of those going to Mexico. Although the average annual growth rate of the Cayman Islands is over twice that of Mexico, the vast difference in market size makes Mexico a more suitable target for the promotion of U.S. agricultural goods.

Mexico is a valuable market for U.S. products for several reasons. It was the second largest market ranked among the fastest growing markets of the world with an average annual growth of 16.04 percent. The U.S. already holds a substantial market share of 68.80 percent, which makes total U.S. agricultural exports to Mexico higher than any other country in the high growth rate group. Mexico is a neighboring country to the U.S., so lower transportation costs have allowed the U.S. to be competitive. A free trade agreement with Mexico could increase agricultural exports to Mexico by a considerable amount.

Turkey is a smaller market than Mexico, but its location could make it an important one to the U.S.. Turkey is the gateway from Eastern Europe to the Middle East, and is located on the Mediterranean Sea. A large U.S. market share there could influence surrounding countries' choices or expose them to U.S. products, especially processed products. The market is considered medium-sized, but is growing rapidly at an annual rate of 21.93 percent.

Agricultural import demand is growing worldwide. This growing demand gives the U.S. opportunities to increase market share in several markets while also increasing total agricultural exports. Increased total agricultural exports may help to increase U.S. farm income, decrease the U.S. trade deficit, and justify large expenditures on export promotion programs.

The importance of understanding the largest agricultural import markets cannot be overstated. The promotion of U.S. agricultural products in foreign markets results in large government expenditures. Export promotion funds could be utilized more effectively if the import demand function of importers was more transparent. A great deal of interest exists in high growth agricultural import markets, but statistically the highest growth markets tend to be developing countries with a small import base. Large markets are often so sluggish in their growth that they are discouraging targets for market development expenditures. This study focuses on a highly desirable customer group: large, rapidly growing agricultural import markets. These markets are analyzed in comparison with their slower growth counterparts. The study group consists of the 15 largest agricultural import markets: Federal Republic of Germany, Japan, United States, Italy, USSR, United Kingdom, France, Netherlands, China, Belgium-Luxembourg, Spain, Canada, Korea Republic, Hong Kong, and Egypt. As mentioned earlier, seven of the fifteen largest agricultural import markets are EEC members, a fact which has implications for U.S. agricultural policy. The large importers are divided into EEC members and non-members for further analysis.

IMPORT DEMAND THEORY

Import demand may be defined as the difference between domestic demand and domestic supply when domestic and imported goods are perfect substitutes. Because import demand is a function of domestic demand, shifts in the domestic demand function will cause a shift in import demand. Consumer theory suggests that income, the price of imports, and the price of other consumable commodities will determine the quantity of imports purchased. The production capacity of import-competing industries is included as a supply side variable in import demand (Leamer and Stern, 1970). The appropriate measurement of these import demand variables has been an important issue in previous studies.

Inflation is an important consideration in modelling import demand. Khan and Ross (1975) estimated an equation for aggregate import demand using the import unit value of country i deflated by the domestic price level. Leong and Elterich (1985) used real wholesale prices in their analysis of Japanese import demand for U.S. broilers. Arnade and Dixit (1989) tested for the effect of imposed zero homogeneity using real versus nominal prices in several import demand equations and found that when zero homogeneity is imposed, prices should be expressed in real terms.

In Leong and Elterich's analysis, U.S. broilers were considered a perfect substitute for Japanese broilers and domestic production was used as a proxy for domestic supply. Jabara (1982) included domestic wheat production in her analysis of import demand for wheat in middle-income developing countries. Konandreas, Green, and Bushnell (1978) found that domestic wheat production had an unexpected positive impact on U.S. wheat exports to some regions. In these regions, increased domestic production may lead to increased exports and thus increased availability of foreign exchange used to purchase imports. Jabara, Islam (1978), and Abbott (1979) included foreign reserves as a variable in their respective import demand studies. Islam found that rice imports in several Asian countries had foreign reserve elasticities greater than one. The elasticity suggests that increased exports imply increased foreign reserves, which in turn induces increased imports (Islam, p. 534). Abbott found that foreign exchange availability has a large impact on the import volume of wheat and feed grains for small traders.

Population has been included in many import demand models, either incorporated into per capita measurements of income and production or as a separate variable. Leong and Elterich used per capita GNP in their study, while Jabara included population as a separate variable.

SELECTION OF COUNTRIES

Countries were selected for the empirical analysis based on market size for agricultural imports in 1989. The original intent of the study was to analyze the 15 largest agricultural import markets; however, the actual study group consists of 12 countries. The USSR was excluded because of the uncertainty recent political changes have brought for the newly independent Soviet countries. Spain and Korea were excluded from the study because accurate measurements of agricultural import volume were unavailable.

The selected countries were further categorized into high growth, medium growth, and low growth groups as determined by average annual growth rates of agricultural imports from 1985 to 1989. Countries were ranked in descending order by growth rate. The growth rate range of the study group was determined by subtracting the highest growth rate from the lowest growth rate in the group. The lowest growth rate was added to one-half of the range to determine a ceiling for the low growth group. The ceiling for the middle growth group was determined as ten percent of the highest growth rate in the study group added to the low group's highest rate. Countries with growth rates below the middle group ceiling, but above the low group ceiling, were included in the middle growth group. The middle growth group serves as a buffer zone between the high and low growth groups and contains two countries.

The high growth group consists of the remaining countries. China, Hong Kong, Italy, Japan, and France comprise the high growth group; the Netherlands and the German Federal Republic make up the middle growth group; and Belgium-Luxembourg, the United Kingdom, Egypt, Canada, and the United States are in the low growth group. A second categorization of the study group was formed by designating EEC members as one subgroup and non-members as another subgroup.

POOLED CROSS-SECTIONAL AND TIME SERIES ESTIMATION MODEL

An analysis of import demand in several countries as a group over time introduces the pooling of cross-sectional and time-series data. A typical problem in cross-sectional data is non-constant variances in the error term, while with time-series data the errors may be correlated over time. Pooling the data creates the possibility of both problems occurring simultaneously (Dielman, 1989). Kmenta (1985) presents a method which deals with both problems concurrently and is the model used for empirical analysis in this particular study. This cross-sectionally heteroskedastic and timewise autoregressive model assumes

(1) heteroskedasticity, as in $E(\varepsilon_{it}^2) = \sigma_i^2$ (1a)

(2) cross-sectional independence, as in $E(\varepsilon_{it}\varepsilon_{jt}) = 0 \quad (i \neq j)$ (1b)
and

(3) autoregression, as in $\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + U_{it}$ (1c)

where $u \sim N(0, \sigma_{ui}^2)$, $\varepsilon_{i1} \sim N(0, \frac{\sigma_{ui}^2}{1-\rho_i^2})$

The correlation coefficient ρ, which measures the correlation of error terms through time, is allowed to vary between cross-sectional units. This implies that the error terms for one cross-sectional unit across time are correlated in that

$$E(e_{it}\varepsilon_{is}) = \rho^{t-s}\sigma_i^2 \quad (t \geq s), \tag{2}$$

and that the error terms between cross-sectional units across time are not correlated as in

$$E(\varepsilon_{it}\varepsilon_{js}) = 0 \quad (i \neq j). \tag{3}$$

The first step in the model applies ordinary least squares (OLS) to the data. These regression coefficient results are used to calculate residuals, e_{it}, and estimate ρ_i by

$$\hat{r}_i = \frac{S e_{it} e_{i,t-1}}{\sqrt{S e_{it}^2} \sqrt{S e_{i,t-1}^2}} \quad (t=2,3,\ldots,T). \qquad (4)$$

This method confines the estimator of ρ_i to the interval from -1 to +1 for any sample size (Kmenta).

The $o(\hat{\rho}_i)_i$'s are then used to transform the observations to be nonautoregressive. This is done by applying

$$Y_{it}^* = \sqrt{1-\hat{r}_1^2}\, Y_{it} \quad t=1, \qquad (5)$$

$$Y_{it}^* = Y_{it} - \hat{r}_i Y_{i,t-1} \quad t=2,3,\ldots,T,$$

to the dependent variable observations, and

$$X_{it,k}^* = \sqrt{1-\hat{r}_1^2}\, X_{it,k} \quad t=1 \qquad (6)$$

$$X_{it,k}^* = X_{it,k} - \hat{r}_i X_{i,t-1,k} \quad t=2,3,\ldots,T,$$

$k = 1, 2, \ldots, K$, and $i = 1, 2, \ldots, N$ to the independent variable observations where T represents the number of time periods observed, N represents the number of cross-sectional units and K represents the number of explanatory variables to obtain

$$Y_{it}^* = b_1 X_{it,1}^* + b_2 X_{it,2}^* + \ldots + b_k X_{it,k}^* + u_{it}^*. \qquad (7)$$

Ordinary Least Squares is applied to the transformed observations in order to obtain a consistent estimate of σ_{ui}^2, which is s_{ui}^2, the variance of u_{it}.

The variables are then further transformed to remove heteroskedasticity. This is done by dividing each transformed observation by s_{ui} as in

$$Y_{it}^{**} = \frac{Y_{it}^{*}}{s_{ui}}, \quad (8a)$$

$$X_{it,k}^{**} = \frac{X_{it,k}^{*}}{s_{ui}} \quad (k=1,2,...,K), \quad (8b)$$

$$u_{it}^{**} = \frac{u_{it}^{*}}{s_{ui}} \quad (8c)$$

where t = 1, 2, . . . , T, and i = 1, 2, . . . , N to obtain

$$Y_{it}^{**} = b_1 X_{it,1}^{**} + b_2 X_{it,2}^{**} + \ldots + b_K X_{it,k}^{**} + u_{it}^{**} \quad (9)$$

The final estimates of the regression coefficients are then obtained by applying OLS to the final transformation of variables. The resulting disturbance term u_{it}^{**} is asymptotically nonautoregressive and homoskedastic.

Aggregated Import Demand Model

Kmenta's cross-sectionally heteroskedastic and timewise autoregressive method was used to estimate the following model representing total agricultural import demand for twelve countries using time-series data from 1974 through 1990.

$$IMPORT_t = \beta_0 + \beta_1 UVAL_t + \beta_2 GDP_t + \beta_3 POP_t + \beta_4 PROD_t + u_t \quad (10)$$

where IMPORT = agricultural import volume index,
UVALUE = agricultural import unit value index,
GDP = gross domestic product index,
POP = population index,
PROD = domestic agricultural production index,
u = random disturbance, and
t = year.

A volume index for net agricultural imports was not available, and the aggregation of products made it impossible to obtain the necessary information to calculate an accurate measure of the volume of net imports. Therefore, the FAO index for gross agricultural import volume was used as a proxy for net agricultural imports and the assumption is made that a one percent change from the base in gross imports would approximate a one percent change from the base in net imports. Domestic supply is a function of many factors such as land availability, input prices, and output prices. It is difficult to obtain consistent measurements of these factors across countries; thus, domestic agricultural production was used as a proxy for the factors which affect domestic supply.

Import Demand Model for Growth Groups

The model in Equation 10 assumes that the parameters for each variable are identical across groups. However, it is possible that the parameters are distinctly different for each growth group. A modified version of the basic model was used to estimate separate coefficients for each growth group. The modified model is

$$\begin{aligned} IMPORT_t = {} & \beta_0 + \beta_{0H} HDUM + \beta_{0L} LDUM + \beta_1 UVAL_t \\ & + \beta_{1H} HUVAL_t \beta_{1L} LUVAL_t + \beta_2 GDP_t + \beta_{2H} HGDP \\ & + \beta_{2L} LGDP_t + \beta_3 POP_t + \beta_{3H} HPOP_t + \beta_{3L} LPOP_t \\ & + \beta_4 PROD_t + \beta_{4H} HPROD_t + \beta_{4L} LPRODt \end{aligned} \quad (11)$$

where dummy variables and dummy interaction variables are used to capture differences in the parameters for each growth group. A separate model could be estimated for each subgroup. However, if dummy variables are used, the t-ratio for the estimated coefficients of each dummy or interaction variable indicates whether or not that coefficient is significantly different from the corresponding base variable. The model assumes that the intercept and the slope of each coefficient is different for each growth group. The middle growth group is used as a base group. The definitions of UVAL, GDP, POP, and PROD remain the same; however, the estimated parameters on these variables now represent the parameters for the middle growth group. The estimated parameters for the dummy variables, HDUM and LDUM, represent the intercept for the high and low growth groups, respectively. The estimated parameters for dummy interaction variables (HUVAL, LUVAL, HGDP, LGDP, HPOP, LPOP, HPROD, and LPROD) represent the difference in the particular growth group's coefficient from the corresponding base coefficient. The parameters for subgroups can be calculated by summing the values of corresponding parameters for the base group and the group in question.

DATA AND SOURCES

In this study, aggregated agricultural imports are assumed to be perfect substitutes for domestic agricultural products. Agricultural import demand then becomes a function of price, income, population, and domestic supply. Factors such as trade barriers and other policy variables are excluded from the model because (1) policy variables are not consistent across the study group and (2) the addition of unique variables for each country would change the comparability of other variables across countries or between subgroups. Data sources varied in the base year used to calculate indices; therefore, each index was transformed using 1974 as the base year. Data descriptions contain information about the method each source used in calculating the original index.

The FAO volume index for IMPORT measures the import volume of all agricultural products, including both food and non-food components[1]. The index is calculated using the price-weighted sum of quantities imported. The FAO index of import volume was not available for China. A reasonable estimate of the import volume index was obtained by dividing the FAO import value index by the FAO import unit value index and multiplying by 100. The aggregation of all agricultural products made the measurement of import volume impossible without the use of an index. Caution should be exercised in translating increases in the index to measured increases in imports because the base import volume is different for each country.

UVAL was calculated using the World Bank Consumer Price Index (CPI) for the United States and the FAO unit value index which measures changes in the 1979-1981 quantity-weighted unit values in U.S. dollars of aggregated agricultural imports. The U.S. CPI is used to convert the FAO index from nominal figures to real figures. The U.S. CPI is used rather the individual country's CPI because (1) FAO data is in U.S. dollars, (2) the U.S. dollar is commonly used by other countries as an international trade currency (Madura, p. 23), and (3) it is assumed that the import price is assessed at the border before domestic inflation affects the price of goods.

The index for real GDP was calculated using values given in the World Bank World Tables. The World Bank values are measured in the country's local currency in constant prices[2].

POP was calculated using the FAO rural and urban population figures. Rural and Urban populations were summed to obtain total population.

The FAO index for PROD within a country is reported on a calendar year basis, with crops being reported in the year during which the bulk

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1 It should be noted that some countries included in the study report imports on the basis of general trade which includes all imports regardless of destination, while others report imports on the basis of special trade which includes only those products intended for domestic consumption or use. Those countries reporting on the basis of general trade are Canada, China, Hong Kong, United States, United Kingdom and Japan. Those countries reporting on the basis of special trade are Belgium-Luxembourg, Egypt, France, Federal Republic of Germany, Italy, Republic of Korea, Netherlands and Spain.

2 GDP figures for 1990 were not available for any of the countries included in the study; also, 1989 figures were not available for the Federal Republic of Germany. Estimated GDP figures were calculated using each country's average annual rate of growth in GDP from 1986 to 1989 with the exception of the Federal Republic of Germany for which the average annual rate of growth in GDP from 1986 to 1988 was used.

of harvest takes place. It includes only disposable production, thus excluding feed and seed use.

The FAO Trade Yearbook provided data for IMPORT and UVAL. PROD, along with information used to calculate the POP, was taken from the FAO Production Yearbook. The World Bank World Tables provided GDP figures and the CPI for the United States.

IMPORT DEMAND MODEL: AGGREGATE ESTIMATES

The index for IMPORT was regressed against indices for UVAL, real GDP, POP, and PROD to estimate a total agricultural import demand equation for the study group. Country groupings are given in Table 3. A linear model, a double log model, and a log-linear model were estimated for the data set. The linear model was chosen for the study because the resulting statistical measures indicated a better fit of the model to the data set. Table 4 contains results for this aggregated model, along with results for the import demand model which allows for different parameters among growth groups.

The estimated linear model for the aggregated groups is

$$IMPORT_t = -1367.3 - 0.37UVAL_t + 2.62GDP_t + 11.71POP_t + 1.09PROD_t. \quad (12)$$

The t ratios of the aggregated model indicate that all parameter estimates are statistically significant at five percent or less. The signs on the coefficients are consistent with economic theory with the exception of production, which is discussed in a later section. All interpretations of coefficients assume *ceteris paribus* conditions. The coefficient for UVAL indicates that a one-point increase in the import unit value index will decrease total agricultural imports by approximately .37 percent of the base year import volume. The GDP coefficient indicates that a one-point increase in the gross domestic product index will lead to a 2.6218 percent increase in imports from the base year. One index point increase in population will lead to an increase in agricultural imports of 11.71 percent as measured from the base year, 1974. If production increases by one index point, the PROD coefficient indicates that agricultural imports will increase by roughly 1.09 percent of the base.

IMPORT DEMAND MODEL: ESTIMATES FOR GROWTH GROUPS

The model presented in Equation 11 was estimated to determine differences in coefficients on independent variables for the high and low import growth groups. The index for agricultural import volume was regressed against indices for UVAL, GDP, POP, and PROD, along with dummy variables to represent the difference in the intercept term for the

Table 3. Country Groupings of Large Agricultural Import Markets as Determined by Average Annual Agricultural Import Growth Rates From 1984-1989

Growth Group	Country	Growth Rate (%)	1989 Market Size ($100,000)
High	China	15.74	110748
	Hong Kong	12.50	62933
	Italy*	11.16	218627
	Japan	10.17	290595
	France*	10.00	198239
Middle	Netherlands*	9.20	155810
	Fed. Rep. Germany*	8.90	308603
Low	Belgium-Luxembourg*	8.42	107980
	United Kingdom*	8.32	200020
	Egypt	6.19	50050
	Canada	5.55	64095
	United States	2.02	250658

*European Economic Community Members

Source: FAO Trade Yearbook.

HDUM and the LDUM. Dummy interaction variables (HVAL, HGDP, HPOP, HPROD, LVAL, LGDP, LPOP, and LPROD) were included to capture differences in coefficients on the independent variables for the high and low growth groups.

The middle growth group (which contains only two countries) was used as a base for the regression so that high and low groups (which contain five countries each) could be more easily compared. Regression results are summarized in Table 4. Because the dummy interaction variables capture only the difference in the actual coefficient from the coefficient for the base group, coefficient estimates for high and low groups can be obtained by adding the appropriate dummy interaction variable to the appropriate base coefficient. These computed coefficients are reported in Table 4. The computed coefficients are equal to those estimated when separate regressions are run for each group.

There are two methods used to determine if the group of dummy variables and dummy interaction variables contribute to the explanation of the variation in agricultural import volume: (1) the change in the percentage of variation explained by the model (R_2) can be noted, and (2) an F test (for the significance of the entire model) can be conducted. The the percentage of R^2 for the model improves from .51 to .74 when dummy variables and dummy interaction variables are used to capture the effects of each group on import volume. The F statistic of 7.61 for the comparison of these two particular models is significant at less than one

Table 4. Estimated Coefficients for Agricultural Import Demand in Large Agricultural Markets, 1974-1990, in Aggregate and by Growth Groups and Trade Groups.

Model[a]	Intercept	UVAL	GDP	POP	PROD	R^2	Standard Error	Degrees of Freedom
	-1367.30	-0.37	2.62	11.71	1.09	.51	0.605	199
Aggregate	(-3.43)[b]**	(-2.76)**	(3.78)**	(2.59)**	(1.82)**			
Growth Groups						.75	0.299	189
Middle (Base)	-455.17	0.17	0.19	3.21	2.64			
	(-1.27)	(0.487)	(0.121)	(0.837)	(2.072)**			
High[c]	-289.24	-0.16	2.28	-2.98	5.23			
	(-0.604)	(-0.729)	(3.016)**	(-0.613)	(5.402)**			
Low[c]	-1421.8	-1.24	11.53	7.07	-2.53			
	(-2.532)**	(-3.82)**	(5.903)**	(0.992)	(-1.80)**			
Trade Groups						.82	0.592	194
Non-EEC Members	-2656	-1.11	3.26	23.05	1.42			
	(-2.33)**	(-2.61)**	(1.74)**	(1.78)**	(0.88)			
EEC Members[c]	-1171.2	-0.26	3.01	8.92	-1.41			
	(-4.67)**	(-2.62)**	(6.24)**	(3.20)**	(2.81)**			

a Dependent variable: Import = Agricultural Import Volume Index

b t-values are reported in parentheses below the coefficient estimate.

* Significant at 10%

** Significant at 5% or less

c Coefficients shown represent final coefficients obtained by summing the base group coefficient and the dummy interaction coefficient for the corresponding variable.

percent, and the dummy variables do contribute to the explanation of agricultural import demand.

With the exception of PROD, the intercept and all calculated coefficients are significantly different from zero for the low growth group at the five percent level or less. Significant coefficients in the high growth group include the intercept coefficient, GDP, and PROD.

High Growth Group

The estimated equation for the high growth group can be written as

$$IMPORT_t = -289.24 - 0.16UVAL_t + 2.28GDP_t - 2.28POP_t + 5.23PROD_t. \quad (13)$$

The effects of changes in variables are interpreted assuming that other variables are held constant. The signs of computed coefficients are as expected for UVAL and GDP; however, the signs for PROD and POP are not as expected. An increase of one index point in the UVAL would decrease agricultural import volume by .16 percent as measured from the base year of 1974. GDP has a positive effect on agricultural import volume, with a one index point increase in GDP leading to a 2.28 percent increase from the base in imports. If population increases by 1 index point, the coefficient estimate would indicate that agricultural import volume decreases by 2.98 percent of the base. An increase in domestic production volume ofonel index point will increase agricultural import volume by 5.23 percent of the base volume.

Low Growth Group

The equation for the low growth group is estimated as

$$IMPORT_t = -1421.84 - 0.92UVAL_t + 11.53GDP_t + 7.07POP_t - 2.53PROD_t \quad (14)$$

An increase in UVAL of one index point will lead to a decrease of agricultural import volume of 1.24 percent from the base year. The coefficient on GDP indicates that a one- point increase in the GDP index will increase import volume 11.53 percent from the base volume. An increase of one index point in POP implies an increase of 7.07 percent from the base year's import volume. An increase of one index point in domestic agricultural production will lead to a decrease in agricultural import volume of 2.53 percent of the base volume.

Comparison of High and Low Growth Groups

The results of t tests conducted to determine if the final coefficients for each growth group are significantly different from the corresponding coefficient for the other group are reported in Table 5. The final coefficients for each group are the sum of the base group coefficient and the corresponding growth group coefficient. The estimated coefficients for the intercept and independent variables are significantly different at

Table 5. Results of Significance Testing for Differences Between High and Low Growth Groups

Variable	Test	Test Value	Standard Error	t-ratio
Intercept	DUML=DUMH	-1132.6	737.75	-1.54*
Import Unit Value	DLVAL=DHVAL	-1.083	0.39	-2.77**
Gross Domestic Product	DLGDP=DHGDP	9.25	2.09	4.42**
Population	DLPOP=DHPOP	10.05	8.63	1.16
Production	DLPROD=DHPROD	-7.76	1.71	-4.55**

*significant at 10 percent
**significant at 5 percent

10 percent or better between the groups, with the exception of POP. Specific differences are discussed in the following sections.

Effects of Import Unit Value

Import Unit Value has a negative effect on agricultural import volume in both high and low growth groups. The coefficient is highly significant for the low growth group, but is insignificant for the high growth group. This implies that import prices do not affect purchase decisions as much in high growth countries as in low growth countries. Hong Kong and Japan, both high growth countries, have little agricultural land available for production; therefore, import demand may be more inelastic in these countries than in low growth countries such as Canada and the United States, who have vast agricultural resources.

Effects of Gross Domestic Product

Gross Domestic Product has a positive and significant effect on agricultural import volume in both high and low growth groups. The low growth group exhibits more sensitivity to changes in income than does the high growth group. For example, an increase of one index point in GDP leads to a 11.53 percent increase from the base year's imports for the low growth group, while the same change in GDP for high growth group increases imports by only 2.28 percent from the base year. Developing countries such as China in the high growth group import basic food requirements which may be relatively income inelastic compared to the broader base of agricultural imports purchased by more developed countries such as the United Kingdom and the United States.

Effects of Population

Population was included in the model rather than incorporated as per capita data for GDP and PROD to separate the effects of population from income and production. According to the estimates, the effects of population as a separate parameter on agricultural import volume are negligible in both groups.

Effects of Domestic Production

Domestic production is significant for all study groups; however, the sign is not as expected for the high growth and aggregate groups. General economic theory leads to the expectation that increases in domestic production increase domestic supply and therefore decrease the demand for imports. Low growth countries follow this pattern, but high growth and the aggregate do not. Increased domestic production may act as a demand side rather than supply side variable in some countries by increasing the capacity to export, thus increasing the availability of foreign currency for import purchases. In this case, the expected sign for domestic production would be positive, as it is for aggregate and high growth groups. A breakdown of the countries within groups further illustrates this point.

The high growth group includes China, a low-income country that has increased imports greatly in recent periods due to policy changes. Domestic agricultural production in the past has been typically a high-labor, low technology operation, but technological improvements have added efficiency to the agricultural sector. Soybeans are a primary export of China and typically generate foreign currency income used to purchase wheat and rice for use as food. Italy is also in the high growth group. Agricultural land for general use in Italy is not plentiful, but specialty crops such as grapes for wine are produced and other goods are imported, representing a case where domestic goods are not a perfect substitute for imported goods. Increased domestic production may translate to increased import capacity that is not directly captured by increases in GDP.

The low growth group includes Canada and the United States which are agriculturally developed, self-sustainable countries. Agricultural imports, in aggregate, are considered perfect substitutes for domestic goods. In this situation it is expected that domestic production would follow economic theory and be negatively related to imports.

COMPARISON OF EEC MEMBERS AND NON-MEMBERS

Member countries of the European Economic Community as a group form the largest market for agricultural imports in the world. The opening of the internal borders of Europe to free trade is seen by many outsiders as a great opportunity and by some as a threat. The following section examines the differences that market variables have on import demand in EEC members and non-EEC members in the study group. Again, the model was estimated with the same method as the growth group's model with dummy and dummy interaction variables used to estimate coefficient differences for the EEC members. Non-EEC members were used as the base group. The equation for non-EEC members was estimated as

$$IMPORT_t = -2656 - 1.11UVAL_t + 3.26GDP_t + 23.05POP_t + 1.42PRODt \quad (15)$$

and the estimated equation for EEC members is

$$IMPORT_t = -1171.2 - 0.26UVAL_t + 3.01GDP_t + 8.92POP_t + 1.41PROD_t \quad (16)$$

Only UVAL was significantly different between the groups at 10 percent or less.

Effects of Import Unit Value

The coefficient for import unit value is negative and significant for both groups. EEC members are less sensitive to changes in UVAL than are non-members. Separately, the members are not self-sufficient in agricultural production. Highly industrialized countries such as Germany and the United Kingdom rely heavily on imports, whether the source of imports is from member countries or non-member countries. This partially explains the import price inelasticity of the EEC countries.

Effects of Gross Domestic Product

Changes in gross domestic product have the same effect in both EEC members and non-members. An increase in GDP will lead to an increase in agricultural import volume. The estimated coefficient is positive and significant for both groups, but the magnitude of the impact is not significantly different between groups.

Effects of Population

Population changes also impact EEC members and non-members in the same way with respect to agricultural imports. Increases in population will induce increases in import volume. The coefficient is positive and significant for both groups. Again, the magnitude of the impact is not significantly different between groups.

Effects of Domestic Production

The coefficient for domestic production is positive for both groups, but is significant only for EEC members. As mentioned earlier, many members of the EEC are not self-sufficient agriculturally when considered individually. This could affect their behavior with respect to domestic production. Increases in domestic production may have an agricultural income effect, not captured by gross domestic product, that affects the demand for agricultural imports included in the dependent variable. Through this income effect, increased domestic production will lead to increased agricultural imports.

EFFECT OF INTERNAL FACTORS

Import demand behavior may vary by country groupings and within countries because of internal factors not considered in this study. The aggregation of data from several countries makes it impossible to include such factors as government policies, economic development stages, technological differences, and degree of agricultural sustainability. Other factors not measured in this study are the distribution of income and purchasing power and the availability of credit to governments.

High import growth rates may not be sustainable over time because of the influence of population and income. If these factors increase at a slower rate than current import growth rates, then import growth must also decrease over time. The behavior of EEC members may change as the economic union of the individual countries solidifies.

POLICY IMPLICATIONS

For U.S. agriculture, searching for methods to increase exports is an ongoing business. The strategy of marketing, whether in domestic markets or abroad, is to find and create customers. Once customers are discovered or created, the marketer must be attentive to the customer's needs in order to maintain or increase sales volume. This strategy has specific implications in U.S. export marketing policy and for U.S. agriculture in general.

Targeting large markets where agricultural import markets are growing at high rates may be a task deserving of pursuit. This study indicates that increased domestic production and gross domestic product have significant positive impacts on agricultural imports in countries with high rates of import growth. This has interesting implications for U.S. policy toward both developing and developed countries in the high growth group. Foreign aid to developing countries is an indirect, long-term method of export promotion and represents a large proportion of annual expenditures. Development assistance in underdeveloped countries with high rates of agricultural import growth would be beneficial to the U.S. in two ways. First, specific development assistance in the production agriculture sector in non-competing commodities would increase domestic agricultural production and would likely increase gross domestic product, too. Improvements in the production agriculture sector are likely to improve the marketing chain from producer to consumer, thus improving the infrastructure. Development assistance in high growth countries with a small agricultural resource base could be implemented in other sectors of the economy. The resulting repercussions on agricultural import demand variables should be the same. Second, development assistance from the U.S. is likely to create customer loyalty. An increase in agricultural imports in these countries does not necessarily mean increased exports for the U.S., since there are competing producers of agricultural products. However, countries would possibly purchase a greater percentage of increased imports from the U.S. if development assistance is provided.

EEC integration could have positive impacts on agricultural imports to member countries. The European Community Commission has conducted numerous economic studies, both internally and with outside consultants, that suggest full integration of the European market will lead to increases in gross domestic product of as much as seven percent for member countries (Quelch, 1991). Increases in gross domestic product have a significant impact on agricultural imports for both high and low growth countries, and for EEC member countries. Four of the six EEC members included in the study group fall into either the high or low growth group. This does not necessarily imply that agricultural imports to EEC members from non-members will increase, because the study does not consider the source of the product. However, it is reasonable to assume that the United States could increase total agricultural exports to the EEC by maintaining or increasing the current U.S. share in those markets. Typically, as income increases, so does the demand for high-value and processed products (HVP). Though the EEC is a fierce competitor of the U.S. in the HVP export market, they also offer an import market for specialty high value and processed products from the U.S. Accordingly, increased emphasis on the marketing of HVP's to the EEC could conceivably increase U.S. agricultural exports to the region.

Non-EEC members are more sensitive to changes in import unit value than are EEC members. In 1989, the United States held 34 percent of the agricultural import market in Canada. The North American Free Trade Agreement could potentially lower prices and increase U.S. agricultural exports to Canada, particularly in exports of fruits, vegetables, and HVP's.

U.S. policy cannot effectively control or influence the market variables of agricultural import demand in particular situations. For example, the low growth group and non-EEC members are both highly responsive to changes in import unit value. Though the U.S. is a large exporter of many agricultural products, the world price cannot be greatly affected by one producer in most product markets. Global production will dictate the world price at which commodities are sold. Thus the U.S. has little control over price in most markets.

Agricultural import demand in low growth countries is responsive to changes in gross domestic product. If low growth countries are typically developed countries, then U.S. agricultural exports depend partially on the internal economic growth of those countries.

High growth countries' agricultural imports are sensitive to fluctuations in domestic agricultural production and, therefore, are partially dependent on internal policies which protect or stabilize production. Ironically, the U.S. criticizes price supports and subsidies in other countries or trading blocks, but the results of this study indicate that increased domestic production in high growth countries will result in increased agricultural exports to those countries.

Suggestions for Further Research

A large amount of money is spent each year on the promotion of U.S. agricultural products in foreign markets. A useful continuation of this research would be to overlap market promotion expenditures with statistics on U.S. market shares in growth markets to determine the effectiveness of promotion. If the U.S. maintains or increases market share in a growing market, an increase in total U.S. agricultural exports to that market will result. The commodity composition of agricultural trade was not considered in this study, but it would be useful in determining what commodity or product purchases are increasing the fastest in markets where imports are growing. Implications could then be made as to which products have the greatest possibility for capturing the growth in those markets.

CONCLUSIONS

Agricultural import demand in large agricultural markets follows the expected behavioral model, with the exception of the coefficient for domestic production, which is positive. Each estimated coefficient is significant at five percent or less.

High and low growth subgroups have significantly different parameters for import unit value, gross domestic product, domestic production, and the intercept. Agricultural import demand for the low growth group is more responsive to changes in import unit value and gross domestic product than the high growth group. Domestic production has an unexpected positive relationship with agricultural import demand in the high growth group. The high growth group's agricultural import demand is more sensitive to changes in domestic production than the low growth group.

Import unit value is the only coefficient that is significantly different between EEC members and non-members. Non-members are more sensitive to changes in import unit value than EEC members.

Import unit value, gross domestic product, population, and domestic production affect agricultural import demand in different magnitudes when compared between high and low growth groups, and EEC members and non-members. The results of the study suggest that a strategy to increase agricultural import demand in one subgroup may have no effect, or possibly even the opposite of the desired effect, if used for another subgroup. This implies that for export marketing strategies to be successful, they should be tailored for a targeted group of countries by considering the relationship of the market variables that affect agricultural import demand in that group.

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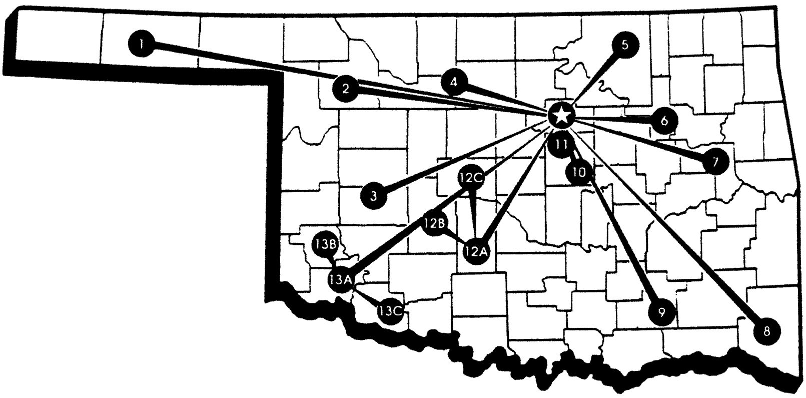

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