Predicting The Potential for Agricultural Imports of The Middle East in 1990

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This paper develops the theoretical framework and methodology for predicting the potential for agricultural imports in a group of reasonably homogeneous countries. The cross-section model proposed is economical in data needs and gives a good fit when applied to a group of 17 Middle Eastern countries. A method is presented for treating heteroscedasticity problems in some equations. The model should be particularly useful to exporters contemplating large investments in market expansion in specific countries and needing information on long-term sales potential. A practical application suggests important guidelines for efforts to expand sales of U.S. agricultural products in the Middle East.

Expansion of U.S. agricultural exports has received high priority from policymakers in the last two decades for a number of reasons. In the 1960's, it was clear that the productive potential of U.S. agriculture was growing more rapidly than domestic demand so that export markets were needed to prevent serious price declines. In the 1970's, agricultural exports began to play a major role in offsetting the mounting cost of petroleum imports.

However, protectionist sentiment in major traditional markets such as the European Community and Japan, and the political uncertainties of trade with new partners such as the Soviet Union and Mainland China, forced U.S. exporters to seek additional markets for their products. Exporters needed to know what criteria to look for in identifying best potential markets and to have tools for quantifying the expected size of those markets over the number of years required to offset the costs of breaking into and expanding sales in those markets.

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The methodology presented in this paper was applied in assessing the agricultural import potential of 17 Middle Eastern countries for whom growth in wealth from oil has been the biggest single common factor affecting their development. Even those Middle Eastern countries not themselves oil producers have benefited through loans, grants, gifts and increased demand for workers, goods and services from the oil-rich countries. While the countries share many similarities in geography, climate, religion, language and customs, in many other respects they vary; population, income level, level of foreign exchange reserves, political philosophy, etc. Total population of the 17 countries in 1977 was over 143 million, ranging from Qatar with 100,000 to Egypt with almost 39 million. Per capita income ranged from a meager $220 (U.S.) in the People's Democratic Republic of Yemen to $22,460 in Qatar (Table 1).

However, in all countries imports of both agricultural and nonagricultural products have been growing rapidly, both to broaden the economic base and to provide a better standard of living for the people. All have development plans of varying sophistication designed to ensure continued economic

TABLE 1. Population, Gross National Product Per Capita, Total Agricultural Imports and Agricultural Imports from the United States for 17 Middle East Countries.

Country	1977 Population (thousands)	1977 Gross National Income Per Capita (U.S. $)	Total Agricultural Imports (millions of U.S. $)	Agricultural Imports From U.S. (millions of U.S. $)
Bahrain	270	2500	109.62	4.359
Egypt	38740	384	1361.96	472.893
Iran	34270	2214	1844.36	361.530
Iraq	12171	1550*	710.05	70.051
Israel	3610	3529*	636.01	291.834
Jordan	2789	665	243.27	23.232
Kuwait	1130	12064	433.74	13.151
Lebanon	3060	3337[2]	372.11	30.065
Libya	2516	6957	588.72	13.279
Oman	820	2580[3]	74.03	1.459
Qatar	100	22460[3]	75.55	1.358
Saudi Arabia	9520	4459[4]	981.93	151.051
Sudan	16950	283	150.29	23.334
Syria	7840	844[4]	370.80	35.991
United Arab Emirates[1]	694	18500	262.34	11.665
Yemen Arab Republic	7080	248[3]	178.27	6.463
People's Democratic Republic of Yemen	1800	220[5]	85.66	0.737
Total	143260		8478.41	1512.452

[1]Population in 1976; [2]GNP per capita in 1975; [3]GNP per capita in 1976; [4]Gross domestic product per capita; [5]GNP in 1974.

Source: International Financial Statistics (IFS) Volume XXXI, No. 9, Sept. 1978.

*Foreign Economic Trends and Their Implications for the United States, United Nations Food and Agricultural Organization Trade Yearbooks. U.S. Foreign Agricultural Trade Statistical Report, Calendar Years 1976 and 1977.

growth when the oil is depleted. All have faced severe constraints on increased agricultural production because of shortages of fertile land, water, and skilled manpower, severe weather and disease problems, and competition for resources from the nonfarm sector. Of the nine Middle East countries for which agricultural productivity data were available, only four, Libya, Sudan, Iran and Israel have been able to increase agricultural output per capita in the last two decades [USDA, 1980]. Thus, in most countries, increased demand for agricultural products has been met from imports.

Rationale for Study Method

As governments have become more concerned about forward planning of agricultural supplies and import needs, various methodologies have been applied in numerous studies to project demand for agricultural imports. In "A Survey of Agricultural Economics Literature, Volume 1," D. Gale Johnson's review of postwar policies relating to trade in agricultural products references (p.320-324) 86 studies conducted by the USDA or under USDA sponsorships on this topic.

These USDA studies are representative of the variety of methodologies used by the economics profession. They range from descriptive analysis of recent import experience and likely future trends in individual countries to ambitious undertakings like the USDA's World GOL model, a simulation

analysis of demand, supply and trade in many countries under alternative scenarios.

In almost all cases, a serious limiting factor has been lack of data. Researchers have met this challenge by combining statistical analysis of available time series with coefficients estimated from other countries or other studies to develop a workable model. In many cases, the only test of the resultant model is the reasonableness of results.

Where the problem has been narrowly defined in terms of commodity or country, and time series data were available, econometric analysis has been used to make forecasts. However, the result of such forecasting has not been particularly accurate, especially through the turbulent 1970's. GOL and other "world" models have been an attempt to endogenize some of the major external shocks within the system. While they have been useful in analyzing the ramifications of alternative policies, they have not been reliable tools for forecasting.

In the case of Middle Eastern countries, reliable time series of sufficient length were not available to permit econometric analysis. However, cross-section analysis has been successfully used in comparable situations. The quantitative model presented here to predict import potential using cross-section data drew upon a small group of previous studies. In a pathbreaking article in 1956, Jureen used multi-country data from the advanced economies to investigate long-term trends in food consumption. He concluded that "In spite of the abnormal price structure in 1949-51, the slope of the (income-consumption) curves fitted to cereals and to animal foods is almost unchanged (from pre-war results) (p.4)." And again, "differences in the average animal consumption levels are, not only between classes of the population but also between countries, primarily determined by the average income level, while differences in geographical position, consumption habits, and income distribution seem to have a relatively small influence on consumption (p.5)." On the applicability of his method to prediction he suggested that "judging from the time series available multi-country curves of the type chosen can be used as a framework for outlining what happens with food consumption in the long run in a country when average income rises. They afford a possibility of showing roughly- but in concrete terms- the probable trends of main groups of food items at a certain income level (p.7)."

In another seminal article, Houthakker used multi-country data drawn from nations at varying levels of development to examine household expenditure patterns for food, housing, clothing and all other items. Due to lack of data, prices were not included as factors determining consumption. However, Houthakker concluded that "there are meaningful propositions which appear to be valid in nearly all the countries considered, without reference to their climatic or cultural condition (p.533)."

Mackie's path-breaking 1965 study on market potentials for U.S. agricultural products overseas argued that economic growth is the major determinant of a nation's imports. Economic growth is associated with greater diversity of consumption, specialization of production, greater industrialization and urbanization, which in turn are related to increased trade both internal and international. Since per capita income is the "end result of the interplay of all economic forces that generate economic growth and economic progress (p.9)," Mackie suggested using per capita income to explain changes in total and in agricultural imports. Mackie correctly predicted the very large growth in total and agricultural imports that was to occur in many countries in the 1970's.

The underlying assumption of the cross-section model presented here is that the countries of the Middle East are sufficiently homogeneous that observations on different countries with differing income levels represent different points of the same basic, long-run income-import expenditure relationship. Given their similarities in culture, religion, climate, etc., this appears to be a reasonable assumption.

Objectives

The major purposes of the model were determining (a) the factors that influenced total demand for agricultural imports in the Middle East, (b) the demand for major categories of agricultural imports, (c) the relationship between demand for agricultural imports from the U.S. and from competing sources, and (d) quantitative estimates of future trends in Middle East agricultural imports.

The Model

A complete model of import demand and supply would take account of total demand and total supply of agricultural products in the Middle East. However, such a model would require specification of aggregate domestic production or supply functions for each or all of the Middle Eastern countries, of domestic demand curves for each country and, at the minimum, of excess supply curves for the United States and for all other competing suppliers. However, data to quantify such a complete model were neither available nor likely to become available in the near future. Only a few outdated household budget surveys or consumption studies were available. Good absolute or relative price series for products or product groups were not available over time or across countries. In addition, as the productivity data for agriculture already cited would suggest, preliminary analysis indicated that domestic supply response was not a significant factor in providing increased total supply or satisfying increased total demand.

It appeared that dollar expenditure on agricultural imports could best be quantified by a model of the type used by Mackie, where level of imports was explained primarily by level of per capita incomes. The impact of price changes are included in the expenditure data and thus could not be analyzed separately. Several previous studies e.g. Ball and Mavwah, Houthakker and Magee, and Jureen, used an income, but not a price, variable to explain a country's imports. In preliminary analysis it was found that imports were not significantly influenced by land per capita, availability of foreign exchange, or rates of growth in productivity or incomes. An hypothesis to be tested by our empirical analysis was whether the countries being studied are positioned at different stages on the same income-import expenditure relationship so that one can generate estimates of long-term relationships from the results.

The basic model used was of the form:

$$(1) \qquad Yijk = f(Xi, D_1, D_2,)$$

where:

Y is per capita expenditure on agricultural imports in U.S. dollars

X is per capita gross national product in U.S. dollars

i = 1,....17 represents the 17 countries studied (see Table 1)

j = 1,...5 represents the five categories of agricultural imports

analyzed, namely, animals and animal products; grain and grain products; fruits, nuts and vegetables and their products; all other agricultural imports; and total agricultural imports, and

k = 1,..3 represents the source of agricultural imports, United States, non-U.S. and total sources.

D_1 is a zero-one variable for Bahrain

D_2 is a zero-one variable for Israel

Average data for all import expenditure and income variables for each of the seventeen countries for the six years 1972-77 were used to reduce the impact of aberrations due to temporary factors. Separate regional relationships were estimated for each combination of import category and source, giving 15 equations in all. Only 15 observations were used to estimate the equation for fruit, nut and vegetable imports from the U.S., since two countries had no imports from the U.S. in 1972-77.

Because of Israel's special relationship with the United States, it became necessary to include a zero-one variable in certain

equations, notably that for grain and grain products, where U.S. trade is influenced by noncommercial factors. Imports into Bahrain were also in many cases found to lie above the common income-import expenditure relationship. Bahrain has a very small agricultural sector and is an important financial, trading and seaport center which may account for its abnormal level of imports. Thus, in some instances, observations for these two countries were assumed to have the same slope, but different intercepts from the general income-import expenditure relationship. Accordingly, it seemed appropriate to take account of that factor by means of a separate zero-one variable.

Adjustments for Heteroscedasticity

The equations were tested for heteroscedasticity with Bartlett's test for nonhomogeneity of variances [Intriligator p.157-158]. Heteroscedasticity (or nonhomogenous variances) was found to be present in 10 of the 15 models. The equations were then tested for heteroscedasticity again using a test suggested by Glejser and detailed by Johnston (p.220). The Glejser test supported the findings of Bartlett's test and also allowed us to distinguish between pure and mixed heteroscedasticity and to determine the functional form of the variable causing the heteroscedasticity.[1] In Glejser's test the absolute values of the residuals are regressed against the independent variable suspected of causing the heteroscedasticity. A model of the form

$$(2) \qquad |e| = a_0 + a_1 X_i^2 + u$$

was found to be most appropriate, where X_i is per capita income and $|e|$ is the absolute value of the residuals of the original heteroscedastic equations. Both a_0 and a_1 were found to be significantly different from zero, thus indicating mixed heteroscedasticity.

[1]Pure and mixed heteroscedasticity is explained in Johnston, p. 220 as "... pure heteroscedasticity ($a_0 = 0$, $a_1 = 0$) and mixed heteroscedasticity ($a_0 = 0$, $a_1 = 0$)."

The assumption is that $u_i = v_i \cdot (\alpha_0 + \alpha_1 X_i^2)$ and that $E(v_i) = 0$ and $E(v_i^2) = \sigma^2$, where v is a scalar. Then $E(uu') = \sigma^2 \Omega$

$$= \sigma^2 \begin{matrix} (\alpha_0 + \alpha_1 X_{i1}^2)^2 & 0 & \cdots & 0 \\ 0 & (\alpha_0 + \alpha_1 X_{i2}^2)^2 & \cdots & 0 \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ 0 & 0 & \cdots & (\alpha_0 + \alpha_1 X_{in}^2)^2 \end{matrix}$$

We then replaced α_0 and α_1 by their estimated value (from $|e| = a_0 + a_1 X_i^2 + u$) which gives the appropriate matrix to be used in the correction: $b = (X' \Omega^{-1} X)^{-1} X' \Omega^{-1} Y$.

Estimation and Results

In general, the linear formulations of equation (1) had higher R^2 than nonlinear formulations when the data were analyzed using ordinary least squares regression. The model explained 99% of the variation in all agricultural imports, lending support to the hypothesis that, in terms of expenditure on agricultural imports, the selected countries are positioned on the same income-import expenditure curve. The model explained 79 percent or more of the variation in 14 of the 15 categories of imports examined (Table 2). All the equations were significant at the 1 percent level. The signs of the coefficients conformed to theoretical expectations. Income alone explained most of the variation in the dependent variables and was significant at the 5% level in all but one subcategory, imports of grain and grain products from the U.S., where PL480 aid and the special relationship with Israel have severely altered trade flows.

The binary variable for Bahrain was positive and significant at the 5% level for all categories of imports except U.S. grain products and total U.S. agricultural imports. This indicates that, in general, Bahrain has a higher propensity for imports at each income level than other Middle Eastern countries.

TABLE 2. Estimated Equations and Income Elasticities for Agricultural Imports for 17 Middle Eastern Countries. 1972-77 average data.

Dependent Variable Per Capita Expenditures on Imports of:	Import Source	Constant	Per Capita Income	Bahrain Binary	Israel Binary	R^2	F-Value	Income Elasticity
Animal and Animal Products Imports	U.S.	+0.343 (2.18)	+0.000057 (2.09)	+1.274 (2.46)		0.40	4.75	0.32
	[b]Non-U.S.	+0.2443 (0.50)	+0.0084515 (7.45)	+57.6399 (11.64)		0.93	98.96	0.79
	[b]Total	+032047 (0.65)	+0.00851 (7.81)	+58.9909 (12.57)		0.94	113.87	0.78
Grain and Grain Products	[b]U.S.	+3.424 (4.16)	+0.000016 (0.11)		+38.224 (13.99)	0.93	97.85	0.01
	Non-U.S.	+8.9935 (2.51)	+0.004576 (7.34)	+63.794 (5.39)		0.84	38.04	0.55
	Total	+15.036 (3.58)	+0.004546 (6.23)	+60.116 (4.34)		0.79	26.51	0.45
Fruit, Nut, Vegetables And Their Products	[b]U.S.	−0.2697 (−0.40)	+0.000256 (2.90)	+3.706 (10.04)		0.90	54.88	0.80
	[b]Non-U.S.	+0.4329 (0.85)	+0.00413 (3.13)	+55.1165 (6.93)		0.80	28.38	0.73
	[b]Total	+0.4086 (0.81)	+0.00443 (3.36)	+58.832 (7.47)		0.82	32.99	0.75
Other Agricultural Products	U.S.		+0.000326 (18.29)	+8.087 (19.88)	+1.142 (2.79)	0.98	272.0	0.68
	[b]Non-U.S.		+0.0129 (8.16)	+71.2915 (4.94)		0.88	54.81	0.76
	[b]Total		+0.01326 (8.35)	+79.346 (5.47)		0.89	60.35	0.76
Total Agricultural Products	[b]U.S.	+1.0988 (2.24)	+0.001371 (1.63)		+61.6343 (11.62)	0.92	75.56	0.40
	[b]Non-U.S.	+1.061 (2.10)	+.031 (10.84)	+281.375 (15.05)		0.96	166.49	0.72
	Total	+12.607 (1.77)	+0.038071 (30.67)	+285.028 (12.10)		0.99	513.09	0.81

[a]t-values in parentheses. Value of 2.65 or greater indicates significance at the 99 percent level.

[b]Adjusted for heteroscedasticity using Glejser's method.

The binary variable for Israel was positive and significant for all categories of U.S. imports except fruits, nuts and vegetables (where it was nonsignificant), reflecting the special economic and political links between the two countries. Israel have given extensive encouragement and protection to its fruits, nuts and vegetables sector and has discouraged imports of these products even from the United States. Equations without an intercept term gave best results for other agricultural imports.

Income elasticities were derived for each category of import expenditure using the estimated income coefficient and the mean values of each import expenditure category and of income per capita. These measured income elasticities conformed to previous findings. They were lowest for grains and grain products, highest for animals and animal products and other agricultural products — a category which includes miscellaneous convenience and snack foods and other processed items.[2] The weighted sum of the elasticities for U.S. imports and non-U.S. imports approximated the elasticity of total imports derived by direct estimation.

The income elasticity of imports from the U.S. was lower than that for non-U.S. imports in all categories except fruits, nuts and vegetables and was significantly lower for grain products and for all imports. The U.S. is recognized as a producer of high quality apples, almonds, and other specialty fruit and nut products popular in the Middle East. The U.S. has no comparable quality advantage in most animal or grain products where product differentiation is difficult, or in processed products where European firms have been long established suppliers to the Middle East. Our analyses suggest that Middle Eastern countries may actually show a higher propensity to purchase non-U.S. imports of these products. Indeed, anti-American policies have been pursued with more or less intensity by Arab countries protesting the U.S. special relationship with Israel. It may be that support of Israel has economic as well as political costs.

[2]In the absence of a constant term, if the income elasticity is calculated at any point on the estimated relationship it will always equal 1.0.

Applications of Demand Models

The estimated demand models can be used to provide quantitative estimates of potential imports of all agricultural products or of selected commodity groups under alternative assumptions about passage of time, income and population growth.

Table 3 presents one such estimate of potential imports by country in the year 1990 assuming: (a) the population of each country in 1990 equals that suggested by the most recent United Nations' population studies, (b) per capita income in each country increases between 1977 and 1990 at an annual average rate of 5 percent. (Many other variants of income growth could have been tried. Clearly, some countries may exceed or fail to reach this level. However, a 5 percent growth rate is conservative by past standards achieved in the Middle East.) (c) the base for agricultural production in these countries remains fairly constant e.g. no new technologies are developed to overcome present soil, water and climatic limitations, and (d) no new political developments in the area.

These estimates, too, are only valid if the structure of supply and demand, and thus the propensity to import, is not seriously altered by war or political or social upheaval. The further into the future projections are made, the greater the chance that unforeseen disruptions will upset forecasts. However, analysis of cross-section data does permit identification of permanent relationships which can be used to make longer-term projections.

Under the given assumptions, then, projections indicate that total agricultural imports could almost triple between 1975-77 and 1990. Iran and Saudi Arabia would be the largest importers, but eight countries would be expected to import agricultural goods in excess of a billion U.S. dollars at 1975-77 prices. Animal and animal product imports would grow more rapidly than either

TABLE 3. Imports of Agricultural Commodity Groups (1975-77 Average), and Projections of Imports (1990) of 17 Middle Eastern Countries.

Country	Total Agricultural Imports		Imports of Animals and Animal Products		Imports of Grains and Grain Products		Imports of Fruits, Nuts, Vegetables and Their Products		Imports of Other Agricultural Products	
	1975-77 Average	1990	1975-77 Average	1990	1975-77 Average	1990	1975-77 Average	1990	1975-77 Average	1990
	Millions of U.S. $						Millions of U.S. $			
Bahrain	109.62	183.24	27.53	38.05	16.84	37.84	6.56	31.24	17.69	54.02
Egypt	1361.96	1934.22	186.98	300.85	663.16	943.21	242.50	169.34	152.97	442.51
Iran	1844.36	7871.77	308.86	1629.79	460.28	1642.14	342.97	860.97	495.04	2513.67
Iraq	710.05	2010.34	102.26	403.68	237.28	487.35	90.73	214.56	240.04	619.90
Israel	636.10	1356.57	72.65	288.74	255.78	240.33	38.00	151.71	128.35	447.04
Jordan	243.27	239.07	34.71	42.45	61.30	88.04	61.44	23.16	67.55	63.96
Kuwait	433.74	1717.33	123.04	378.27	80.39	235.22	53.66	197.45	39.64	588.32
Lebanon	372.11	1127.73	78.23	240.48	105.14	197.40	37.59	126.31	74.57	452.71
Libya	588.72	1614.15	115.27	351.81	215.05	241.32	100.33	184.01	120.97	546.41
Oman	74.03	225.01	22.21	47.22	21.84	43.52	3.68	24.88	12.32	72.96
Qatar	75.55	221.12	23.88	49.05	8.68	28.41	4.81	25.57	4.70	76.36
Saudi Arabia	981.93	4125.25	228.89	886.83	229.49	683.28	152.67	465.06	212.11	1374.84
Sudan	150.29	888.65	51.13	126.36	30.62	504.90	4.70	72.89	112.39	182.20
Syria	370.80	776.06	57.68	143.93	74.44	252.64	48.99	77.78	122.99	218.37
United Arab Emirates	262.34	418.20	74.46	92.58	56.25	54.75	22.88	48.28	30.87	144.09
Yemen Arab Republic	178.27	302.28	18.61	41.48	70.17	177.42	14.05	24.12	63.47	59.41
Peoples Democratic Republic of Yemen	85.66	72.00	13.44	9.60	32.92	43.79	8.43	5.63	18.45	13.66
Total	8478.71	25082.98	1539.83	5071.17	2619.63	5901.57	1233.99	2702.96	1802.20	7870.40

grain products or fruits, nuts and vegetables. However, imports of all other agricultural products (including convenience foods) would grow most rapidly. Even when post-revolutionary Iran is excluded the region's imports show similar trends. The absolute magnitudes of the projected increases in imports are not as important as the general upward movement of expected imports in most product groups and most countries. Clearly, if Middle Eastern economic growth in the next decade approximates that of the last decade, one can expect very large and widespread increases in demand for agricultural imports.

Similar assumptions were used in forecasting demand for imports of agricultural products from U.S. and from non-U.S. sources to the year 1990. Total imports from the U.S. of all agricultural products, were expected to decrease by 8 percent (although this estimate should be treated with caution because of the low explanatory power of that equation) while imports of animals and animal products, and of grains and grain products, are expected to increase very little over the 1975-77 average levels; by 1.2 percent and 4 percent respectively. Imports of fruits, nuts and vegetables and of other agricultural products are forecast to increase by 974 percent and 141 percent respectively.

Imports from non-U.S. sources are expected to increased more rapidly in the case of animals and animal products, grains and grain products, and other agricultural imports so that U.S. share would be expected to fall from 7 percent to 2 percent for animal products, from 35 percent to 16 percent for grain products and from 4 percent to 2 percent for other agricultural imports. In contrast, the U.S. share of Middle East imports of fruits, nuts and vegetables would be expected to rise from 3 percent to 5 percent. The U.S. share of all agricultural imports would be expected to decline by two-thirds from 18 percent in 1975-77 to 6 percent in 1990. Again, the magnitude of the forecast decline is not as important as the fact that such a decline would occur for all positive levels of growth in income and population.

Conclusions

The application of cross section analysis to international data appears to offer a useful first approach to quantification of import demand in a group of reasonably homogeneous neighboring countries where more complete data are not available. Findings reported here confirm those of previous authors that level of per capita income is consistently the best variable for explaining agricultural imports. It was also possible to quantify the impact that certain special situations such as Bahrain's status as an entrepot port and Israel's special ties with the United States have on the level and source of agricultural imports. It was possible to identify the import elasticity of demand for products of U.S. origin versus those from other sources. This showed that Middle Eastern countries have a stronger income elasticity of demand for non-U.S. sources in the case of grain products, animal products and all agricultural imports combined.

The estimated models were used to illustrate the likely impact on imports to 1990 of an arbitrarily selected scenario. For fairly conservative estimates of economic growth, the projections suggested a more than tripling of Middle Eastern agricultural imports. In contrast, only modest growth was projected in demand for agricultural imports from the U.S. so that U.S. market share would be likely to decline.

As in all economic models, certain factors were omitted which could alter the forecasts reported here. While outside the scope of available data, it would have been desirable to include the interaction effects of domestic and other non-U.S. supplies on demand for imports. The absence of usable price data for the commodity groups studied made it impossible to determine whether price differences within the Middle East exist and affect import demand. It would also have been desirable to include the effect of exchange

rate changes, transportation costs, tariff rates and other factors which may have differential impacts on import demand in different countries. As better data series become available, future researchers may be able to incorporate these effects.

The observed mix of economic, social and political forces indicate a rapid response of Middle Eastern agricultural imports to continued economic growth, but a declining relative demand for imports from the U.S. Abou-Bakr has expressed similar concern-that the U.S. may be losing ground in one of the most rapidly growing agricultural markets in the world. To date, policymakers appear to be unaware of this decline and to have formulated no programs aimed at reversing it.

Given continued economic growth in the Middle East, the region has the potential to become an even more valuable outlet for U.S. agricultural products. However, U.S. exporters have to overcome cultural, religious and language barriers, long-established ties between the Middle East and rival exporters form Europe, and political animosity in certain countries.

A final consideration as a result of the oil price slump of 1982 may be that income per capita in these countries during the 1980s may be temporarily stalled or even decline, although still at a level far above the 1975-77 base period used in this study. Such income setbacks would have a strong direct effect on demand for imports of agricultural products. In addition, it could force extensive reappraisal of priorities in these countries' long-term economic plans and lead to selective discouragement of those imports considered least vital to national interests. The model presented here can be a useful guide to U.S. exporters in assessing the impact of alternative income scenarios.

References

Abou-Bakr, Ahmed, "U.S. Farm Sales to Arab Nations Soaring But Market Share Lags." *Foreign Agriculture*. USDA, August 1977.

Ball, R. J. and K. Mavwah, "The U.S. Demand for Imports, 1948-58," *The Review of Economics and Statistics*, 44(1962):395-401.

Glejser, H. "A new test for heteroscedasticity," *Journal of American Statistical Association*, 64(1969):316-23.

Goreux, L. M., "Income and Food Consumption," *Monthly Bulletin of Agricultural Economics and Statistics*, 9(1960):1-13.

Houthakker, H. S., "An International Comparison of Household Expenditure Patterns, Commemorating the Centenary of Engle's Law," *Econometrica*, 25(1957):532-51.

Houthakker, H. S. and Stephen P. Magee. "Income and Price Elasticities in World Trade." *The Review of Economics and Statistics*, 51(1969):111-25.

International Monetary Fund. *International Financial Statistics*, 32(1979).

Intriligator, Michael D. *Econometric Models, Techniques and Applications* Prentice-Hall Inc. Englewood Cliffs, N.J., 1978.

Johnson, D. Gale. "Postwar Policies Relating to Trade in Agricultural Products", in *A Survey of Agricultural Economics Literature*, Vol. 1, Lee R. Martin ed., University of Minnesota Press, 1977.

Johnston, J. *Econometric Methods*. McGraw-Hill Inc. 2nd ed., 1972.

Jureen, L., "Long-Term Trends in Food Consumption: A Multi-Country Study," *Econometrica*, 24(1956):1-21.

Kirkland, Jack J. and A. Desmond O'Rourke, *Market Potential of the Middle East*, College of Agricultural Research, Washington State University, Circular 0622, 1980.

Mackie, A. B., *Foreign Economic Growth and Market Potentials for U.S. Agricultural Products*, Development and Trade Division, ERS, USDA. Foreign Economic Report No. 24, April 1965.

United Nations. Dept. of Economics and Social Affairs. *World Population Trends and Policies 1977 Monitoring Report*. Population Studies No. 62, Vol. 1, Population Trends 1979.

———. Food and Agricultural Organization. *Trade Yearbook*. Various issues.

U.S. Dept. of Agriculture. *Alternative Futures for World Food in 1985*. Volume 1, World GOL Model

Analytical Report, Foreign Agricultural Economic Report No. 146, Economics, Statistics and Cooperatives Service, Washington, April 1978.

———. *Indices of Agricultural Production in Africa and the Near East*. Stat. Bull. No. 637, June 1980.

———. *U.S. Foreign Agricultural Trade and Statistical Report*, Calendar Years 1976 and 1977.

U.S. Dept. of Commerce. *Foreign Economic Trends and Their Implications for the U.S.: Iraq*. No. 78-143, December 1978.

———. *Foreign Economic Trends and Their Implications for the U.S.: Israel*. No. 78-077, July 1978.