# AN ANALYSIS OF VALUE-ADDED AGRICULTURAL EXPORTS TO THE MIDDLE-INCOME DEVELOPING COUNTRIES: THE CASE OF WHEAT AND BEEF PRODUCTS

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# CHAPTER I

## INTRODUCTION

Historically, U.S. agricultural exports have shared a relatively high portion of total exports. Agricultural exports have exceeded agricultural imports every year since 1959, while non-agricultural imports have exceeded non-agricultural exports by increasing amounts in the 1980's. Hence, agricultural trade surpluses have contributed to U.S. trade balance (Table I and Figure 1).

During the 1970's, U.S. agricultural exports experienced unprecedented rapid growth, mostly resulting from growing foreign demand and a relative depreciation in the value of the U.S. dollar. In 1981, U.S. agricultural exports reached a record level at 43.3 billion dollars, increasing 497 percent from 7.26 billion dollars in 1970 (Table II and Figure 2).

However, since 1981 the trend in U.S. agricultural exports has changed because of a relative appreciation in the value of the U.S. dollar. In 1986, U.S. agricultural exports dropped to 26.2 billion dollars, the lowest value in 1980's, down to 39.5 percent of U.S. agricultural exports in 1981. However, Since 1986 U.S. agricultural exports have shown a slight recovery (Table II and Figure 2).

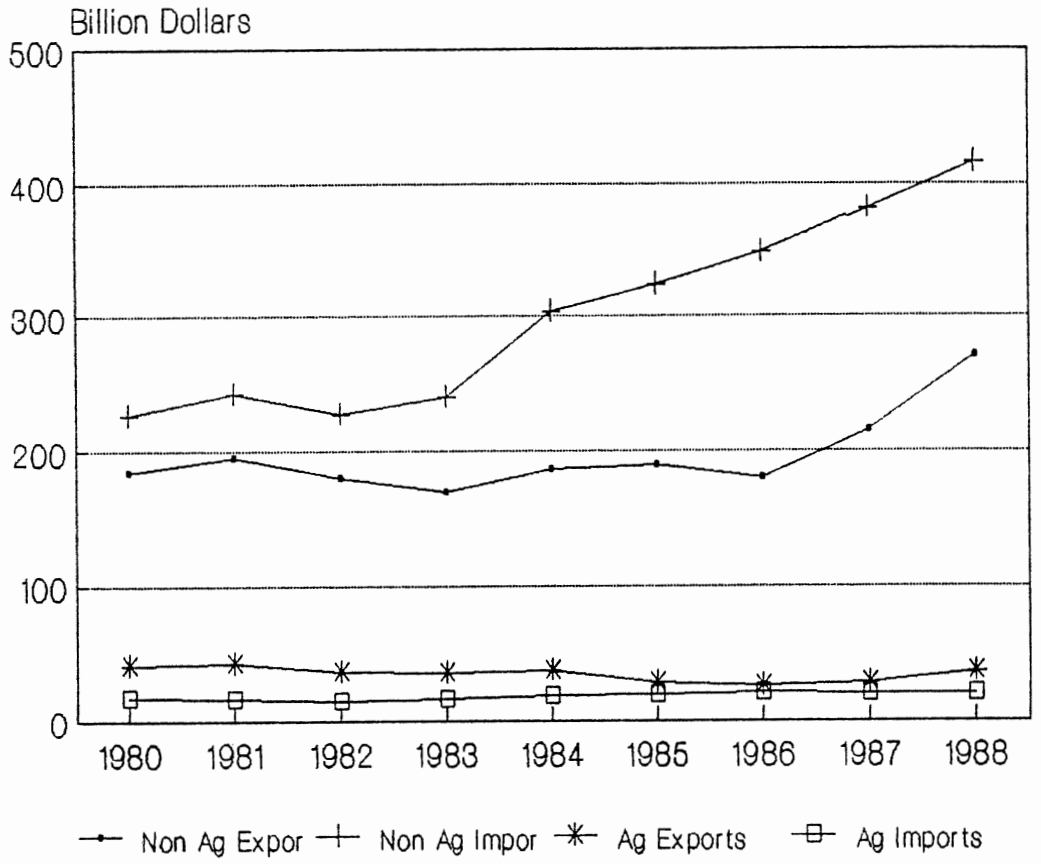
TABLE I

U.S. TRADE BALANCE

(Million Dollars)

| Year | Nonagricultural | | | Agricultural | | |
|---|---|---|---|---|---|---|
| | Exports | Imports | Balance | Exports | Imports | Balance |
| 1980 | 184333 | 226611 | -42278 | 41233 | 17366 | 23867 |
| 1981 | 195376 | 242240 | -46864 | 43339 | 16772 | 26567 |
| 1982 | 179815 | 226951 | -47136 | 36627 | 15389 | 21238 |
| 1983 | 169540 | 240053 | -70513 | 36099 | 16627 | 19472 |
| 1984 | 186172 | 303656 | -117484 | 37804 | 19334 | 18470 |
| 1985 | 189774 | 323585 | -133811 | 29041 | 19968 | 9073 |
| 1986 | 180154 | 347204 | -167050 | 26222 | 21453 | 4769 |
| 1987 | 215150 | 381664 | -166514 | 28709 | 20402 | 8307 |
| 1988 | 270921 | 416189 | -145268 | 37093 | 20951 | 16142 |

Source: U.S. Department of Agriculture (USDA), Foreign Agricultural Trade of The U.S. (FATUS), Calendar Year (CY), various issues




Source: USDA, FATUS, CY various issues.

Figure 1. U.S. Trade : Non-Agricultural vs Agricultural Trade

TABLE II

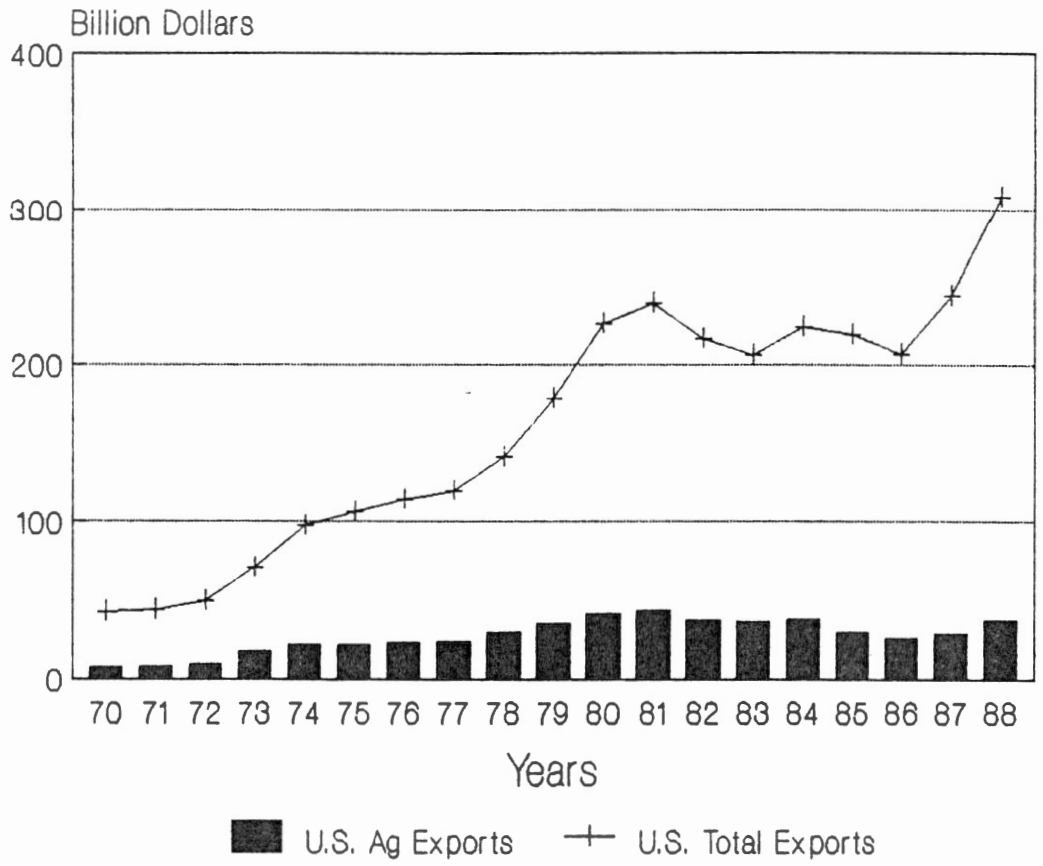
U.S. EXPORTS

(Million Dollars)

| Year | Ag exports | Total Exports | % 1\ |
|---|---|---|---|
| 1970 | 7259 | 42590 | 17.04 |
| 1971 | 7693 | 43492 | 17.69 |
| 1972 | 9401 | 48959 | 19.20 |
| 1973 | 17680 | 70246 | 25.17 |
| 1974 | 21945 | 97144 | 22.59 |
| 1975 | 21859 | 106561 | 20.51 |
| 1976 | 22978 | 113666 | 20.22 |
| 1977 | 23636 | 119006 | 19.86 |
| 1978 | 29382 | 141126 | 20.82 |
| 1979 | 34749 | 178591 | 19.46 |
| 1980 | 41233 | 225566 | 18.28 |
| 1981 | 43339 | 238715 | 18.16 |
| 1982 | 36627 | 216442 | 16.92 |
| 1983 | 36099 | 205639 | 17.55 |
| 1984 | 37804 | 223976 | 16.88 |
| 1985 | 29041 | 218815 | 13.27 |
| 1986 | 26222 | 206376 | 12.71 |
| 1987 | 28709 | 243859 | 11.77 |
| 1988 | 37093 | 308014 | 12.04 |

1\ Agricultural exports as percent of total.

Source: USDA, FATUS, Calendar Year, various issues.




Source: USDA, FATUS, CY various issues.

Figure 2. U.S. Exports : Ag Exports of Total Exports

Between 1981 and 1986, value-added agricultural exports were relatively stable. Over this period, they represented an increasing percentage of total agricultural exports (Table IV and Figure 3). Value-added exports consist of processed products and unprocessed high value products (Table III). Since processed products capture a larger scope of economic activity than bulk-type products, the promotion of value-added exports is thought by some to be beneficial to the economy. Schluter and Clayton (1981) argue that

> ... exporting processed commodities instead of their bulk agricultural components provides an export market for those domestic goods and services required to assemble, process and distribute the processed commodities. Three measures of the potential increase in economic activity associated with processed commodities are appropriate for consideration: (1) direct plus indirect plus induced output or business activity; (2) the employment associated with this increased business activity; and (3) the personal income generated by the increased business activity.

Schluter and Clayton (1981) estimated that if one million dollars of wheat exported as bulk form were exported as wheat flour, an additional $8.84 million of business activity, jobs for 192 workers, and $1.91 million of personal income would be generated.

The United States has recently become one of the largest exporters of value-added agricultural products. Historically, the United States has however exported low-value primary products because it has had a comparative advantage in producing bulk commodities such as wheat, cotton, corn and soybeans. Since 1981, the value of total

TABLE III

CLASSIFICATION OF AGRICULTURAL COMMODITIES

| Commodity Groups\ | Bulk | Value-Added 1\ |
|---|---|---|
| Grains and Feeds | Unmilled Wheat<br>Feed Grains<br>Rice-Paddy, milled | Wheat Flour<br>Bulgur Wheat<br><br>Feeds and Fodders<br>Other Grain Products<br>Other Wheat Products |
| Oilseeds and Products | Oilseeds | Oilcake and Meal<br>Vegetable Oils |
| Animals and Animal Products | Animals, Live (including Poultry live) | Meats<br>Dairy Products<br>Fats, Oils, Greases<br>Hides and Skins<br>Wool and Mohair<br>Sausage Casings<br>Bull Semen<br>Misc. Animal Products |
| Horticultural and Tropical Product | Hops, incl. Extract<br>Rubber-Crude Natural<br>Pulses<br>Fibers exc. Cotton | Fruits and Prep.<br>Fruit Juices<br>Wine<br><br>Nuts and Prep.<br>Vegetable and Prep. (excluding Pulses, Hops)<br>Sugar and Tropical Products |
| Cotton, Tobacco, Seeds & Others | Cotton<br>Tobacco-unmtg.<br>Seeds | Beverage (Excluding Juices)<br>Nursery and Greenhouse Products<br>Essential Oils |

1\ includes semi-processed and processed product (because it has added value through some processing) as well as some unprocessed high value product such as fresh fruit and vegetable, and nut.

Source: Foreign Agricultural Trade of the United States.

TABLE IV

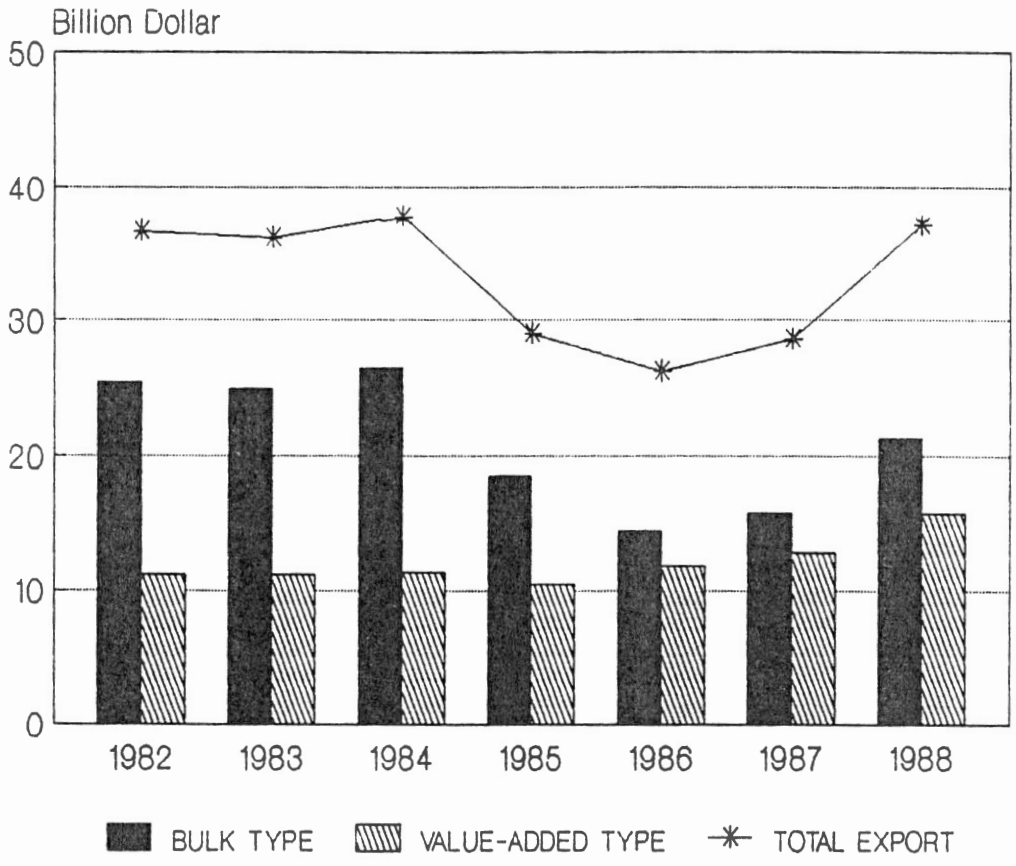
U.S. AGRICULTURAL EXPORTS

($1000)

| Year | Bulk | Value-Added | Total | % 1\ |
|---|---|---|---|---|
| 1982 | 25,424,768 | 11,197,829 | 36,622,597 | 30.6 |
| 1983 | 24,924,526 | 11,173,613 | 36,098,139 | 31.0 |
| 1984 | 26,357,353 | 11,447,045 | 37,804,398 | 30.3 |
| 1985 | 18,506,221 | 10,519,856 | 29,026,077 | 36.2 |
| 1986 | 14,435,926 | 11,781,028 | 26,216,954 | 44.9 |
| 1987 | 15,812,740 | 12,824,929 | 28,637,669 | 44.8 |
| 1988 | 21,340,772 | 15,752,309 | 37,093,081 | 42.5 |

1\ Value-Added as percent of total

Source: USDA, Foreign Agricultural Trade of the U.S. Calendar Year, various issues.




Source: USDA, FATUS, CY various issues

Figure 3. U.S. Agricultural Exports : Bulk vs Value-Added

U.S. agricultural exports had generally decreased until the slight recovery in 1987. The principal factor causing the sharp drop in exports of bulk commodities was a substantial production increase in both major exporting and importing countries. Other factors include the strong value of the U.S. dollar, the impact of global debt and increased food self-sufficiency in many developing country markets. However, value-added exports have shown relatively little decline despite these circumstances, and the value of value-added exports has increased over the past four years. In 1988, value-added exports as a percentage of total exports was 42.5 percent, up from 30.6 percent in 1982 (Table IV and Figure 3).

A significant proportion of the increase in both world and U.S. exports of value-added products since 1970 has resulted from sharp income growth in both developing and developed economies. Growth in U.S. value-added exports has occurred in spite of many trade barriers against them. Subsidized sales from competitors such as the European Community (EC) and Brazil have served to diminish U.S. exports (Rahe, Dewain H. and Wills G. 1985).

Most U.S. exports of grains and feeds have been in bulk-type form. Value-added exports accounted for 17 percent of the total feed grain exports in 1988. In contrast, animals and animal products have primarily been exported in value-added form. In 1988, 90.6 percent of all animals and animal product exports were in value-added form. Value-added

TABLE V

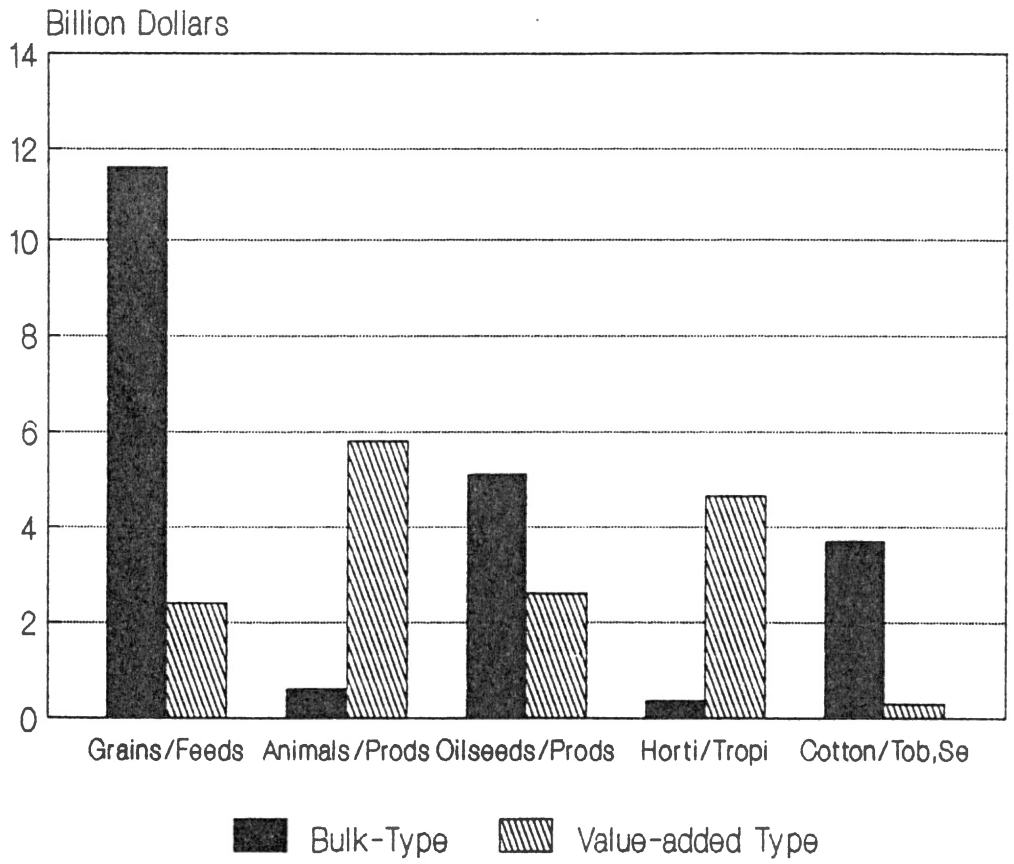
SELECTED U.S. AGRICULTURAL EXPORTS, 1988

($1000)

| Commodity | Bulk | Value-Added | Total | % 1\ |
|---|---|---|---|---|
| Grains & Feeds | 11,605,528 | 2,397,959 | 14,003,487 | 17.1 |
| Animals & Animal Products | 606,262 | 5,815,678 | 6,421,940 | 90.6 |
| Oilseeds & Products | 5,100,703 | 2,594,681 | 7,695,384 | 33.7 |
| Horticultural & Tropical Products | 354,238 | 4,648,318 | 5,002,556 | 92.9 |
| Cotton, Tobacco, Seeds & Others | 3,674,041 | 295,673 | 3,969,714 | 7.4 |
| Total | 21,340,772 | 15,752,309 | 37,093,081 | 42.5 |

1\ Value-Added as percent of total.

Source: FATUS, USDA, calendar year 1988.




Source: USDA, FATUS, CY 1988

Figure 4. U.S. Agricultural Exports : Selected Products, 1988
Bulk vs Value-Added

agricultural exports accounted for 42.5 percent of total agricultural exports in 1988 (Table V and Figure 4).

## Objectives

The overall objective of this study was to analyze U.S. exports of value-added wheat and beef products to middle-income developing countries.

Specific objectives were to:

I. Develop empirical models of import demand which are generally sufficient to render valuable conclusions regarding factors affecting demand for value-added products, but which are sufficiently parsimonious to be estimated within the narrow limits of data availability,

II. Estimate the above models for the middle-income developing countries using optimal statistical techniques,

III. Analyze the estimated models to determine what factors have contributed to variation in value-added exports over the period of the data,

IV. Determine probable future directions in value-added exports to middle-income developing countries under the assumption of continued income growth,

V. Critically analyze the limitations of the empirical models, particularly with regard to inabilities to incorporate unmeasurable variables such as sociological and political factors.

TABLE VI

SELECTED AGRICULTURAL COMMODITIES

| Classes \ Products : | Beef | Wheat |
|---|---|---|
| Bulk-Type | : Live Cattle | Unmilled Wheat |
| Semi-Processed | : Fresh or Frozen Beef | Wheat Flour |
| High-Processed | : Preserved, Prepared Beef | Wheat Products |

Source : USDA, Foreign Agricultural Trade of the U.S.

## Middle-Income Developing Countries

A variety of studies have been done in estimating agricultural import demands of developed countries. For developing countries, however, only a few studies have been made, especially for middle-income countries. As middle-income developing countries have emerged as large agricultural importers in world markets, the importance of further studies of these countries has increased.

Middle-income developing countries (MIDCs) are usually classified on the basis of income levels. In this study, however, MIDCs are defined by the following criteria:

1) GNP per capita in 1985 (U.S. dollar) ranges from $1500 to $8000,

2) The country shows positive annual average growth rate of GNP per capita during 1980-1985,

3) Population is more than 2.5 million in the mid-1988.

On the basis of the above criteria, MIDCs include Singapore, Hong Kong, Korea, Taiwan, Algeria, Malaysia, Israel, Jordan, and Mexico (Table VII).

Table VIII and Figure 5 show U.S. total agricultural exports and U.S. agricultural exports to middle-income developing countries. As shown in the table, the U.S. agricultural export share to these countries has generally increased in the 1980's. U.S. agricultural exports to these countries were 14.1 percent of total agricultural exports in 1982, but have increased to 21.3 percent in 1988. Hence, these markets have become more important for U.S.

TABLE VII

MACROECONOMIC INDICATORS OF MIDCs 1\

| Country \ | Population (Million) Mid-1988 | GNP Per Capita (U.S. Dollar) 1985 | 1984 | 1983 | 1982 | 1981 | 1980 | % 2\ 1980-85 |
|---|---|---|---|---|---|---|---|---|
| Singapore | 2.65 | 7420 | 7260 | 6620 | 5910 | 5240 | 4430 | 11.0 |
| Hong Kong | 5.65 | 6230 | 6330 | 6000 | 5340 | 5100 | 4240 | 8.3 |
| Korea | 42.77 | 2150 | 2110 | 2010 | 1910 | 1700 | 1520 | 7.3 |
| Taiwan | 20 | 3144 | 3067 | 2744 | 2554 | 2570 | 2269 | 6.9 |
| Malaysia | 16.4 | 2000 | 1980 | 1860 | 1860 | 1840 | 1620 | 4.4 |
| Israel | 4.3 | 4990 | 5060 | 5370 | 5090 | 5160 | 4500 | 2.3 |
| Jordan | 2.85 | 1560 | 1570 | 1640 | 1690 | 1620 | 1420 | 2.1 |
| Mexico | 83.53 | 2080 | 2040 | 2240 | 2270 | 2250 | 2090 | 0.1 |
| Argentina | 31.53 | 2130 | 2230 | 2070 | 2520 | 2560 | 2390 | -1.8 |
| S. Africa | 35.09 | 2010 | 2340 | 2490 | 2670 | 2770 | 2300 | -2.0 |
| Venezuela | 18.78 | 3080 | 3410 | 3840 | 4140 | 4220 | 3630 | -2.8 |
| Portugal | 10.39 | 1970 | 1970 | 2230 | 2450 | 2520 | 2370 | -3.4 |
| Brazil | 150.69 | 1640 | 1720 | 1880 | 2240 | 2220 | 2050 | -4.0 |
| Greece | 10.02 | 3550 | 3770 | 3920 | 4290 | 4420 | 4380 | -4.1 |
| Yugoslavia | 23.58 | 2070 | 2120 | 2570 | 2800 | 2790 | 2620 | -4.2 |
| Spain | 39.21 | 4290 | 4440 | 4780 | 5430 | 5640 | NA | -5.2 |
| Chile | 12.64 | 1430 | 1700 | 1870 | 2210 | 2560 | 2150 | -7.0 |
| Uruguay | 2.98 | 1650 | 1980 | 2490 | 2650 | 2820 | 2810 | -9.8 |
| Hungary | 10.59 | 1950 | 2100 | 2150 | 2270 | 2100 | 4180 | -11.3 |
| Poland | 37.96 | 2050 | 2100 | NA | 4960 | NA | 3900 | ERR |

NA: Not available
1\ The Middle-Income Developing Countries
2\ Annual average growth rate of GNP per capita

Source: 1)FAO Trade Yearbook 1985
2)World Bank, World Development Report 1982-87
3)CIA, The World Factbook 1988.
4)USDA, FATUS, CY 1988
5)U.S. Dept. Of Commerce, FET (Foreign Economic Trends), various issues (for GNP per capita of Taiwan).

TABLE VIII

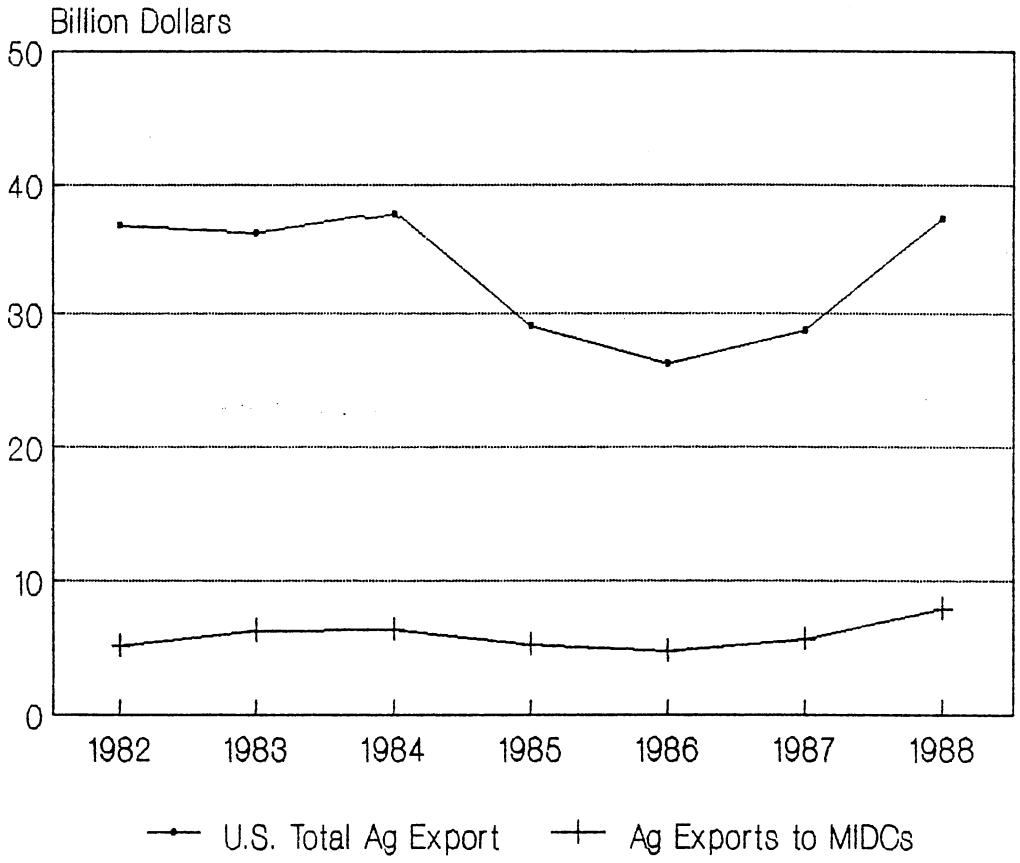
U.S. AGRICULTURAL EXPORTS TO MIDCs

($100,000)

| Countries | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|
| Singapore | 1567 | 1526 | 1446 | 1131 | 1185 | 1268 | 1467 |
| Hong Kong | 3917 | 3571 | 4122 | 3887 | 3997 | 4660 | 4886 |
| Korea | 15812 | 18397 | 16502 | 14128 | 13057 | 18334 | 22740 |
| Taiwan | 11549 | 13079 | 14579 | 12309 | 11706 | 12851 | 16611 |
| Algeria | 1666 | 2111 | 1992 | 2271 | 2871 | 3105 | 5958 |
| Malaysia | 1440 | 1311 | 1228 | 937 | 784 | 903 | 991 |
| Israel | 3529 | 3062 | 3335 | 2774 | 2553 | 2714 | 3287 |
| Jordan | 729 | 791 | 980 | 484 | 454 | 436 | 833 |
| Mexico | 11563 | 19424 | 19926 | 14393 | 10799 | 12018 | 22337 |
| Sub Total | 51771 | 63270 | 64110 | 52313 | 47406 | 56289 | 79110 |
| U.S. Ag Exports (Million Dollars) | | | | | | | |
| Total | 36627 | 36099 | 37804 | 29041 | 26222 | 28709 | 37093 |
| % 1\ | 14.13 | 17.53 | 16.96 | 18.01 | 18.08 | 19.61 | 21.33 |

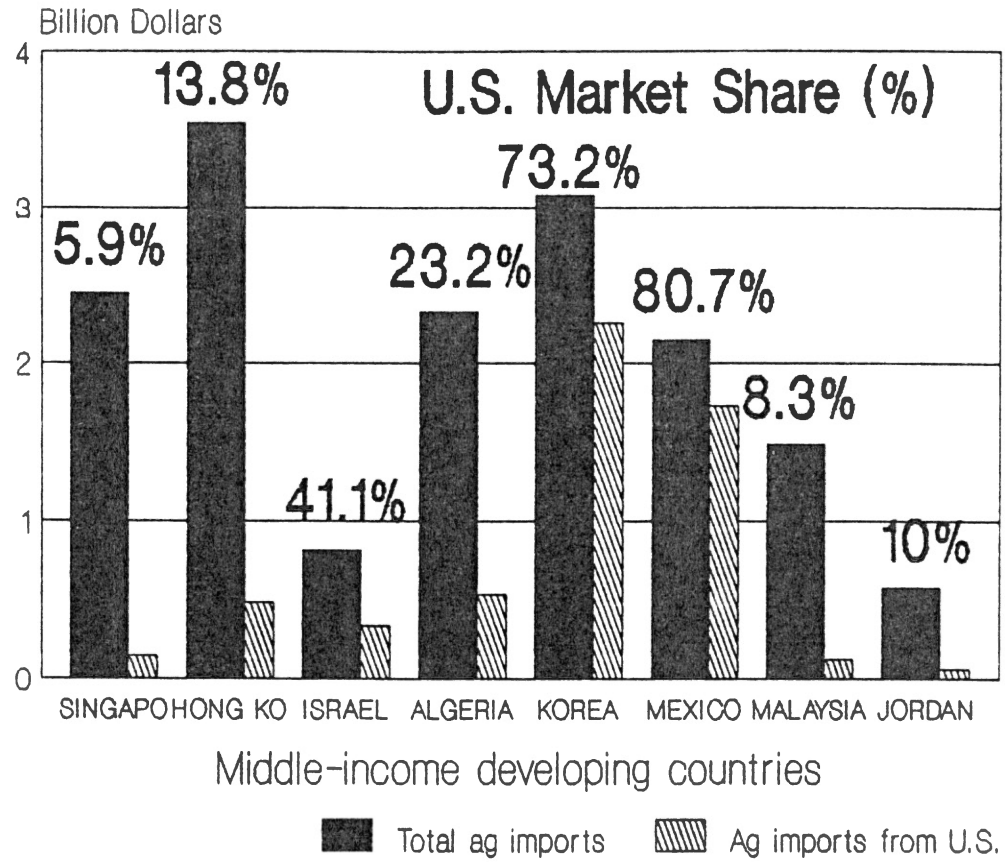
1\ U.S. ag. exports to MIDCs as percent of U.S. total ag. exports.

Source: USDA, FATUS, Calendar Year, various issues.




Source: USDA, FATUS, CY various issues.

Figure 5. U.S. Agricultural Exports To MIDCs, 1982 - 1988




Source: USDA, FATUS & FAO Trade Yearbook

Figure 6. Agricultural Imports Of MIDCs, 1985

agricultural exports.

## Organization of The Study

This study is divided into six chapters. Chapter two reviews the literature related to the import demand in international trade, mostly focusing on agricultural import demand.

Chapter three deals with the theory of the simple import demand under the assumption of free trade. This will include the derivations of domestic demand and supply and traditional import demand. This chapter also discusses sociological and political variables which cannot be incorporated into a quantitative analysis of international agricultural trade. These variables include quality restrictions, trade agreements, export embargos, political events, cultural practices and religious beliefs.

Chapter four presents data and methodology. In this chapter, import share models for each of the MIDCs will be developed for live cattle, fresh or frozen beef and, preserved or prepared beef, and for bulk wheat, wheat flour, and other wheat products.

In chapter five, the import share equations for each type of commodity in each selected country will be estimated. Using ordinary least square (OLS) estimates, relationships between import shares and their determinants will be analyzed.

The final chapter presents summary and conclusions.

Limitations and suggestions for further research will be discussed in this chapter six.

# CHAPTER II

# LITERATURE REVIEW

## Introduction

There have been a variety of economic studies of import demand in agricultural trade. However, few of these studies have dealt with estimation of import demand for U.S. agricultural products in MIDCs. This chapter presents a review of the literature relevant to import demand models and value-added agricultural exports.

This chapter consists of three sections. Section one reviews general studies of import demand in agricultural trade. Section two reviews agricultural import demands for developing countries. Section three deals with Armington's import demand model for products differentiated by source of supply. The fourth section presents a summary of import demand models in agricultural trade.

## General Import Demand Analyses in Agricultural Trade

The traditional explanatory variables of the import demand functions have been the ratio of the price of imported goods to the price of domestic competing goods and one or more domestic economic activity variables (usually income). Most of the estimations have used time series data.

In addition to the ratio of foreign supply price to price of domestic substitute, Armington (1969) added another price variable, the ratio of price of imports from a particular country to an average of prices of imports from all other foreign suppliers. His model was based on the recognition that a commodity's supplies from different exporting nations are rarely treated by importing nations as perfect substitutes. This model might be appropriate when estimating import demand for the product of individual foreign suppliers.

Coffin (1970) estimated the import demands for wheat and flour in world markets. He combined time series and cross section data to increase degrees of freedom in estimation. Data were collected for 30 net importing countries in Western Europe, South America and Asia, for the period 1959-1966. The models were estimated on each of several alternative hypotheses concerning the nature of differences in import demand among countries, regions and time periods. To capture the influence of real variables for which no observations were available, dummy variables were utilized.

Abbott (1979) argued that, in international grain trade, the incorporation of government as an exogenous factor was not appropriate. He estimated an alternative model in which government control was endogenous The model was compared with previous models of net import demand. It was argued that the effect of international prices and production on trade often would be smaller than what was derived from

traditional models.

It has been common to relate the quantity of a country's imports to two independent variables: real GNP and an index of import prices divided by an index of domestic wholesale prices. The expected signs were positive and negative, respectively. But Warner and Kreinin (1983) showed that use of aggregate relative price variables is invalid; use of component prices yielded more accurate results in their study which estimated import demands for 19 industrial countries.

Babula (1988) estimated a multicrop model of Canadian import demand for U.S. crops using both Zellner's seemingly unrelated regression (SUR) technique and ordinary least square (OLS). Comparisons were made between inference statistics, trade elasticity estimates, and out-of-sample forecasts for the two estimation techniques. He concluded that contemporaneous correlation in disturbances should be considered in the estimation, and hence the SUR technique is superior to OLS.

### Import Demand Analyses for Developing Countries

Gallagher, Bredahl, and Lancaster (1979) conducted a time series analysis 1960/61 through 1974/75 to estimate the import demand of less developed countries (LDC) for U.S. wheat. Ordinary least squares was applied to their model. They found that LDC commercial wheat imports from the United States respond to feed grain prices much more than to rice

prices. It was also found that LDC commercial imports of wheat from the United States are strongly related to their own level of supplies while less related to competitors' wheat supplies. Incomes in the LDC's were also found to be significant factors.

Wheat import demands among MIDCs were estimated by Jabara (1982). He used pooled cross-section and time-series annual data to compare import behavior across twenty middle-income developing countries from 1976 to 1979. The results indicated that the level of consumer price and foreign exchange availability are important variables affecting wheat import demand among non-wheat producing countries. On the other hand, wheat production, foreign exchange earnings, and income were found to important determinants of wheat import demand among wheat-producing countries. His estimation also indicated that wheat imports of wheat-producing countries were not responsive to world price movements, in contrast to the non-wheat producing countries.

Wilde, Cornell, Sorenson, and Black (1986) examined the structure of net import demand for wheat in various industrial and less developed countries. Their model was intended to identify characteristics of net import demand. It included net imports, a border price estimate of world price, GDP, annual level of production, annual beginning stocks, and foreign exchange availability and exchange rate as independent variables. Using annual data from 1960 to 1981, they found that many grain importing nations had

relatively low direct price elasticity estimates for net imports, For most countries, income was important in explaining changes in net imports. Middle-income countries (Korea, Israel, Malaysia, Brazil, Chile, and Venezuela) had relatively low elasticities (less than 0.5). As expected, the relationship between domestic production and net imports of wheat was negative for middle-income countries except Venezuela. The beginning stocks elasticity estimates were generally negative, although positive estimates were obtained for Korea and Chile. Foreign exchange availability and exchange rate elasticity estimates were not generally significant in middle-income countries.

According to Myers, Blaylock, and White (May, 1987), economic factors contributing to foreign demand growth for agricultural commodities included rates of real per capita income growth, especially in the middle income developing countries, growth in foreign exchange earnings, and the availability of credit at low real interest rates. They also argued that future demand growth (especially for food grains, feed grains and oilseeds) would depend on population growth and real income growth and distribution. On both counts, they predicted that the developing countries of the world offer the greatest potential for rapid growth in demand. They claimed this conclusion to be further supported by the fact that developing countries have per capita income levels at which the income elasticity of demand for food is relatively high. Consequently, income growth in developing

countries is more likely to result in food demand growing more rapidly than domestic supply, thus generating demand for imports.

Kim, Bolling, and Wainio (1987) examined the effects of Venezuela's price policies and financial constraints on the import demand for feed grains. They presented a feed grain import demand model in which government prices vary over time and are affected by government expenditures for subsidies.

## An Import Demand Model: for products differentiated by source of supply

Armington (1969) developed a world trade model which differentiated products imported in a country by kind and origin. His justification for the model came from the fact that the perfect substitutability assumption frequently used in world trade models was unrealistic (i.e., consumers identify products not only by their kind, but also by their origin). Since the advent of the model, Armington-type models, have been frequently applied in empirical analyses. Armington-type models are based on three assumptions: weakly separable importer preferences, constant importer's elasticities of substitution, and a common elasticity of substitution for all product pairs in a particular market. These assumptions are in fact strong restrictions on the demand side of the model.

Johnson, Grennes, and Thursby (1978) applied an

Armington-type model to analyze multilateral trade flows and prices of wheat. They studied the impacts that trade distortions in the world wheat market have on domestic prices.

An Armington-type model was applied by Sarris (1983) to analyze the effect of EC enlargement with Spain, Greece, and Portugal on world trade of fruits and vegetables. For the analysis, the world was divided into nine regions that were considered to well represent the trade patterns of fruit and vegetable products. He estimated the elasticity of substitution for the EC in imports for each of the categories of fresh, dried, and processed fruits, as well as fresh and processed vegetables. Income and price elasticities of imports for the EC were also estimated. Enlargement was simulated in the trade model by changes in the parameters used. It was concluded that EC enlargement would result in increased prices of fruits and vegetables in Spain, Greece, and Portugal, and a very slight decrease in prices in other markets.

Honma and Heady (1984) also applied an Armington-type model to estimation of an import demand model of wheat. Using the "seeming unrelated regression (SUR)" technique, they estimated the import demand and the trade flow equation for wheat in newly industrializing countries (NICs) (e.q. Brazil, Hong kong, Mexico, Singapore, South Korea, and Taiwan) using annual data 1962-78. They also simulated several changes in exogenous variables to determine changes

in trade flows and prices. Total import demand for all wheat was assumed to be determined in the framework of the traditional excess import demand theory. Consumption, production, and inventories were incorporated in deriving the total import demand equation. Trade flow equations were here derived from Armington's model and specified in a system of linear equations according to Hickman and Lau, who modified Armington's approach to the estimation of the elasticities of substitution.

The estimated coefficients of per capita real income and PL 480 imports, were 44 and -0.629, respectively. These mean that wheat is not an inferior good and that PL 480 imports, which have declined substantially, are not completely substituted by commercial imports. In contrast to the import demand equation, the trade flow equations showed no price effect on market share determination. The coefficients of the trade flow equations in NICs indicated that time trend favored the United States against Argentina, and that a shift in preference favoring the U.S. over Australia occurred in 1973.

Babula (1987) has applied an Armington-type model to U.S. cotton exports during 1960-81. The import demands of EC10, Japan, Korea, and the rest of world were estimated. The model was estimated with ordinary least square (OLS) estimator and Zellner's seemingly unrelated regression (SUR) estimator for comparison of the two techniques. He concluded that a multiregional Armington model of U.S. cotton exports

was estimated inappropriately with OLS estimator and appropriately with SUR estimator.

The Japanese import demands of U.S. corn and wheat were econometrically estimated, based on an Armington-type model, by Penson (1988). To estimate Japanese total wheat imports using annual data (1960-83), he used the real world average price of wheat as a proxy exogenous variable for import price of wheat. He included a crude petroleum price index as a proxy for transportation costs. He also used lagged relative U.S. wheat price to world average price of wheat as an explanatory variable. Petroleum price and the relative price were not found to be significant. He examined the effect of selected monetary polices on Japanese imports of U.S. wheat and corn.

Recently, an Armington's model was used by Haniotis and Ames (Dec. 1988) in the analysis of the trade impact of EC enlargement on U.S. corn and Soybean exports. They analyzed U.S.and EC agricultural trade relationships under different policy scenarios. Empirically estimated elasticities were used in model simulations under alternative assumption of policy changes after the enlargement.

Although Armington-type models have been popular in applications to distinguish commodity by country of origin, there have been some criticisms against the applications of Armington-type models. Alston, Carter, Green, and Pick (1989) tested the Armington assumption of homotheticity and separability with data from international cotton and wheat

markets. To test the assumptions that import demands are homothetic and separable among import sources, they used three approaches in their empirical work; namely, nonparametric methods, the double-log model, and the Almost Ideal Demand System (AIDS). Their study showed that the Armington model was comprehensively rejected with annual data from the five leading importing countries (China, Brazil, Egypt, USSR, and Japan) for wheat and the five leading importing countries (France, Italy, Japan, Taiwan, and Hong Kong) for cotton. Thus they argued that Armington restrictions should not be applied as a matter of course in the analysis of import demand for these goods. They further argued that similar conclusions might apply to other trade models in the literature which used Armington restrictions.

**Summary of Relevant Import Demand Studies**

This section presents the summary of relevant import demand studies. Import demand models reviewed in the previous sections are summarized in terms of time period, commodity in question, functional form or model used, and dependent variable as well as independent variables (Table IX).

TABLE IX

SUMMARY OF RELEVANT IMPORT DEMAND STUDIES

| Authors | Time Period | Commodity | Functional Form or Model | Dependent Variable |
|---|---|---|---|---|
| Coffin | 1959-66 | Wheat & Flour | Linear Form | Net Total Imports |
| Gallagher | 1960/61 - 74/75 | U.S. Wheat | Linear-log Form | LDC import of U.S. Wheat |
| Jabara 1\ | 1976-79 | Wheat | Linear Form | MIDCs' total imports |
| Abbott | 1951-73 | Wheat & Feed grains | | Net Total Imports |
| Warner | 1957-80 | Aggregate Commodities | Linear-log Form | Total Import |
| Wilde | 1960-81 | Wheat & Coarse grain | Linear Form | Net total Imports |
| Kim | 1970-82 | Sorghum | Linear Form | Total Import |
| Babula | 1965-82 | Cotton, Rice, & Soybean | | Imports from U.S. |
| Honma | 1962-78 | Wheat | Armington's Model | Disaggregate Imports |
| Babula | 1960-81 | Cotton | Arminrton's Model | Disaggregate Imports |
| Penson | 1956-83 | Corn & Wheat | Armington's Model | Disaggregate Imports |
| Haniotis | 1966-85 | Corn & Soybean | Armington's Model | Total Import |

TABLE IX (Continued)

| Authors | Independent Variables 3\ | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 |
| Coffin | x | | x | | | | | x | | x | | | | | | |
| Gallagher | x | | x | | | | x | x | | | | | x | | | x |
| Jabara 1\ | x | | | x | x | | | x | x | x | | | x | | | |
| Abbott | x | | | x | x | | | x | x | x | | x | x | x | | |
| Warner | x | | x | x | | | | | | | x | x | | | | |
| Wilde | x | | | | x | | | x | x | | x | x | | | | |
| Kim | x | | | x | x | | x | | | | x | x | | | | |
| Babula | | | | | x | | x | | | | | | | x | x | |
| Honma | x | | x | | | | x | | x | | | | x | x | | |
| Babula | x | | | | x | x | x | | | | | | | x | x | |
| Penson | x | | | | x | x | | | | | | | | | x | |
| Haniotis | x | | x | | | | | x | | | | | | x | | |

1\ Using time series and cross sectional data for MIDCs

2\ Independent Variables:

- X1 = income
- X2 = relative price (import price / domestic price)
- X3 = own import prices (for products from all suppliers or U.S. products
- X4 = domestic price
- X5 = world price
- X6 = Armington's price ratio (a particular country's export price / world average price)
- X7 = prices of substitutes
- X8 = domestic production
- X9 = stocks
- X10 = population
- X11 = exchange rate
- X12 = foreign exchange availability
- X13 = noncommercial imports
- X14 = time trend
- X15 = price of crude petroleum (as a proxy of transportation cost)
- X16 = competing exports supply.

# CHAPTER III

## THEORETICAL SPECIFICATION OF IMPORT DEMAND

Under free trade, there might be a gap between domestic demand and domestic supply at equilibrium world price. This gap will be filled by imports or exports, depending on which is greater, domestic demand or domestic supply. In the presence of excess demand, the gap will be filled by imports.

In the derivation of import demand, it is needful to consider the case where domestic products are perfect substitutes for imported products and the case where imported products are differentiated from domestic products. In the case of perfect substitutbility, import demand is derived as the difference between total domestic demand and total domestic supply of the commodity concerned. Therefore, the theoretical basis for the import demand function is contained entirely in the theories of domestic demand and supply.

### Demand Functions

#### Consumer's Demand

In Marshallian demand theory, the individual consumer is assumed to choose commodity bundles so as to maximize

utility subject to budget constraints. Thus demand functions can be derived in a constrained utility maximization problem. The demand functions are found by solving the first-order conditions for quantity of good demanded (q) in terms of prices (P) and income (y). Let the consumer's for ith good and jth consumer be denoted as:

$$q_{ij} = D_{ij}(P_1, P_2, \ldots, P_n, y_j), \quad i,j = 1, \ldots, n$$

Demand functions derived from the utility maximization problem are typically homogeneous of degree zero in prices and income; that is, changing all prices and income by the same proportion does not affect the quantities demanded.

Aggregate Demand

The aggregate demand function for the ith good is the sum of individual consumers' demands for that good. Let the aggregate demand be denoted by $Q_i$, then

$$Q_i = \sum_j D_{ij} = D_i(P_1, P_2, \ldots, P_n, y_j)$$

where n is the number of consumers.

If there exists a representative consumer, then aggregate demand can be written in terms of average per capita income and population. Hence, the form of the aggregate demand becomes:

$$Q_i = D_i(P_1, P_2, \ldots, P_n, POP, y)$$

If a representative consumer does not exist, then aggregate demand will be affected by changes in the distribution of income among consumers. If one consumer's income is reduced and another's increased by exactly the same amount, aggregate demand could change, even though average per

capita income has remained constant. However, it is generally assumed that aggregation bias does not pose serious problems to expressing aggregate demand as a function of average per capita income and population.

## Supply Functions

The supply function of a firm states the quantity that it will produce as a function of market prices. It can be derived from the first order conditions for the profit maximization problem. It can be shown that a firm in perfectly competitive markets maximizes profits by setting marginal cost equal to output prices, provided that price is sufficient to cover average variable costs. Failure to recover the average variable cost (AVC) will result in zero supply.

The ith firm's MC is a function of its output:

$$MC_i = g(q_i)$$

the supply function of the ith firm is obtained by setting P = MC and solving $q_i$ in terms of $MC_i$. This renders:

$$q_i = MC_i^{-1}(P) = S_i(P) \quad \text{for } P >= \text{min AVC}$$

$$q_i = 0 \quad \text{for } P < \text{min AVC}$$

The aggregate supply function for Q is obtained by summing the n individual supply functions. The aggregate supply is

$$S = \sum_i S_i(P) = S(P)$$

Geometrically the aggregate supply curve is the horizontal sum of the individual supply curves.

## Import Demand

Under the assumption of free trade, a country's import demand may be regarded as the excess demand between domestic demand and domestic supply. This import demand is derived through consumer utility maximization and producer profit maximization processes. Mathematically, this may be expressed as follows:

$$M = D(P, y) - S(P)$$

where M = net imports,

D = quantity of total demand,

S = quantity of supply,

Y = real income,

P = real prices.

The above derivation assumes that one price prevails in both the domestic and import markets. Under this condition, the import demand should be homogeneous of degree zero since both demand and supply are homogeneous of degree zero.

## Qualitative Variables: In International Trade

Though the theory of import demand focuses upon the impacts of prices and income, there are several sociological and political factors which can greatly affect the form of the import demand function. Moreover, if trade is not free but subject to regulation, then political factors will also play an important role in the determination of imports, possibly more important than prices and income.

In quantitative analyses of import demand, it has been common to use prices, income, and financial variables as explanatory factors. However, because of insufficient data and difficulties in quantification, sociological and political factors are not incorporated into these analyses. Unfortunately, these factors can have particularly strong affects upon the import demand of agricultural products.

Since these unmeasurable variables can affect international trade more than variables such as prices, income, population, exchange rate, and foreign exchange availability. They must be carefully considered, even though a quantitative analysis of their influence may not be possible.

Import demands in foreign countries frequently face barriers such as import tariffs, import quotas, quality restrictions, trade agreements, etc. These barriers distort free market mechanism and hence also the theoretical base for many quantitative models of import demand.

**Quality restrictions** often have large effects on agricultural import demand. These restrictions include sanitary regulations and grades which must be met before products are allowed to enter the importing countries. Such protectionism is often motivated by legitimate health and safety concerns but also serves as very effective barriers to trade (Peterson, 1987).

A recent case from the U.S. shows an example of quality restriction against imported fruits from Chile. For reasons

of food safety, fruit imports from Chile were banned by the U.S. A similar case comes from the European Community (EC) against U.S. cattle and beef. The EC imposed restrictions on cattle and beef imports from the U.S. because of a growth hormone used in feeding the cattle. The U.S. argues that the growth hormone is not harmful for human health while the EC contends that it is. Scientific evidence on whether certain substances are harmful to human health is not always conclusive. For this reason, the standards on food safety vary from country to country.

**Trade agreements** and **export embargos** have had large influences upon trade. Grain trade agreements and embargos between the U.S. and the Soviet Union have had particularly large influence upon wheat trade. These agreements and embargos were primarily motivated by political factors rather than by prices, income, exchange rates, etc.

A case of **domestic political events** which had considerable impacts on import demand comes from Korean live cattle imports from the U.S. Since 1970, Korea has typically imported around 10 thousand or less head of U.S. live cattle. But, it imported 25.4 thousand head of U.S. live cattle in 1983. This surge in imports was later revealed to be due to corrupt dealings of Korean officials.

These examples on quality restrictions, trade agreements, export embargos, and domestic political events, remind us that empirical models of trade need to be interpreted within the context of the qualitative telling in which trade takes

place.

A country may have several ethnic groups, each with its own culture, language, and religious preferences. In this study group, Mexico, Israel, Malaysia, and Singapore consist of different ethnic groups which have different cultures and religious affiliations (Table X). An import demand composes demands of a variety of groups in a society. In international trade, it is important to realize major components of a society. Among these variables, religious variables especially play important roles in international trade.

In our study group, Muslims are the majority in Jordan, Malaysia, and Algeria (Table X). The Islamic practices impact trade involving livestock and meat products. Pork is never consumed. All imports of meat products must come from animals slaughtered by the Islamic practice called **Halal**. Meat slaughtering via injection, hanging, stunning, and chemical methods are prohibited. The Halal certificates for all imports of meat must be approved by government. Islamic practices also impact on alcoholic beverages since such beverages are prohibited in many Islamic countries.

TABLE X

SOCIOLOGICAL INDICATORS OF MIDCs

| Country | Population 1\ total | % in Ag. | Ethnic Divisions | 2\ % | Religion | 2\ % |
|---|---|---|---|---|---|---|
| Mexico | 82860 (50710) | 31.87 (46.61) | Mestizo 3\ Amerindian White | 60 30 9 | Roman Catholic | 97 |
| Israel | 4359 (2904) | 4.77 (10.50) | Jewish Arab | 83 17 | Judaism Islam | 83 13.1 |
| Jordan | 3807 (2317) | 7.04 (38.71) | Arab | 98 | Muslim Christian | 92 8 |
| Malaysia | 16231 (10786) | 32.92 (56.51) | Malay Chinese Indian | 59 32 9 | Muslim M 4\ Buddhist | |
| Singapore | 2613 (2105) | 1.15 (8.17) | Chinese Malay Indian | 74.6 14.9 6.4 | Buddhist Muslim | M |
| Hong kong | 5738 (4168) | 1.41 (4.65) | Chinese | 98 | Buddhist Christian | M |
| Korea | 42651 (32107) | 25.30 (53.36) | Korean | 99.9 | Buddhist Christian Roman Catholic | M |
| Taiwan | 19800 (14600) | NA NA | Chinese | 98 | Buddhist Local religion | |
| Algeria | 23156 (14012) | 24.73 (55.70) | Arab | 99 | Muslim | 99 |

1\ percent of agricultural population in total population
2\ percent in total population
3\ Indian + Spanish
4\ M = majority
Population in million, 1987
1970 data in parenthesis

Source : FAO, Production Yearbook, 1970 and 1987
CIA, The World Factbook, 1989
USDA/ERS, World Agricultural Trends and Indicators, 1970-1980.

# CHAPTER IV

# DATA AND METHODOLOGY

This chapter presents models of import share equations for U.S. beef and wheat products in middle-income developing countries. Variables used in the models are defined and sources of their data are given.

## Model Formulation

Data limitations prohibit estimation of import demand functions for MIDCs. However, data for U.S. export to these countries is available. Unfortunately, proper estimation of an import demand function for U.S. products would require all the data that would be necessary for traditional import demand function. However, if we choose to estimate share equations instead, then we can dismiss all factors which affect the general level of beef and wheat product imports but which do not affect the allocation of imports among product classes.

The import share equation is based on the traditional import demand equation which can be derived from consumer's utility maximization process presented in the Chapter 3. Estimation of the import share equation allows for analysis of relations of the import share of U.S. bulk commodity and

value-added products to personal disposal income and each of the product import prices.

The general forms of import share equations are as follow:

$$S_{ih} = f_{ih}(RP_{1h}, RP_{2h}, .., RP_{nh}, IY_h); \text{ (functional form),}$$

$$S_{ih} = \frac{p_{ih}q_{ih}}{\sum_i p_{ih}q_{ih}}; \text{ (definitional form),}$$

$$\sum_i S_{ih} = 1$$

where $S_{ih}$ = the import share of the ith U.S. product (e.q. bulk wheat, flour, and other wheat products) of total U.S. products (e.q. total bulk wheat and wheat products) in country h,

$P_{ih}$ = price of the ith U.S. product to country h in U.S. dollar,

$RP_{ih}$ = price of the ith U.S. product to country h in real national currency,

$q_{ih}$ = quantity of the ith U.S. product to country h,

$IY_h$ = per capita gross domestic product (GDP) of country h in real terms,

$p_{ih}q_{ih}$ = import expenditure for the ith U.S. product in country h,

$\sum_i p_{ih}q_{ih}$ = aggregate import expenditure for total U.S products in country h.

## Variable Specifications

### Import Shares

Live Cattle and Beef Products: For each country, U.S. beef imports were divided into three categories corresponding to various degrees of processing. These categories were live cattle, fresh or frozen beef, and prepared beef.

Wheat and Wheat Products: For each country, imports of U.S. wheat were divided into three categories corresponding to various degrees of processing. These categories were bulk wheat, wheat flour, and other wheat products.

Income

Per capita gross domestic product (GDP) for each country can be used as a proxy for consumer's personal disposable income which could represent a country's economic growth. This proxy is expressed in domestic currency and deflated by the domestic consumer price index (1985=100).

$$IY_h = \frac{GDP_h \ / \ POP_h}{CPI_h \ / \ 100}$$

where $IY_h$ = real per capita income in deflated domestic currency (1985=100) in country h,

$GDP_h$ = gross domestic product (GDP) in domestic currency of country h,

$POP_h$ = population in country h,

$CPI_h$ = consumer price index (1985=100) in country h.

Unit Values

U.S. export unit values of wheat and beef products to MIDCs were used as proxy of import prices in MIDCs. These unit values were computed by dividing U.S. export value by

export quantity as following:

$$P_{ih} = \frac{XUSV_{ih}}{XUSQ_{ih}}$$

where $P_{ih}$ = U.S. export unit value of product i to country h,

$XUSV_{ih}$ = U.S. export values of product i to country h,

$XUSQ_{ih}$ = U.S. export quantities of product i to country h.

Real Prices

The unit values of the imported products are used as proxies for prices of imported products. These proxy prices are transformed into a particular country's domestic currency and then deflated by the domestic consumer price index (1985=100) of the country as following:

$$RP_{ih} = \frac{P_{ih} * EXR_h}{CPI_h / 100}$$

where $RP_{ih}$ = real import unit value for U.S. product i in deflated domestic currency (1985=100) in country h,

$P_{ih}$ = unit value of import for U.S. product i in U.S. dollars to country h,

$EXR_h$ = nominal exchange rate of country h's currency per U.S. dollar,

$CPI_h$ = domestic consumer price index of country h (1985=100).

Variables Notation by Product Category

Wheat Category:

$SWV_h$ = Wheat imports as a share of total wheat and wheat products imports from U.S. in country h,

$SWFV_h$ = Wheat flour imports as a share of total wheat and wheat products imports from U.S. in country h,

$SWPV_h$ = Wheat products imports as a share of total wheat and wheat products imports from U.S. in country h,

$PW_h$ = Unit value of U.S. wheat export per metric ton in U.S. dollar to country h,

$PWF_h$ = Unit value of U.S. wheat flour export per metric ton in U.S. dollar to country h,

$PWP_h$ = Unit value of U.S. wheat products export per metric ton in U.S. dollar to country h,

$RPW_h$ = Real import price of wheat in country h's currency, (PW*EXR)/(CPI/100),

$RPWF_h$ = Real import price of wheat flour in country h's currency, (PWF*EXR)/(CPI/100),

$RPWP_h$ = Real import price of wheat products in country h's currency, (PWP*EXR)/(CPI/100),

Beef Category:

$SCV_h$ = Live cattle imports as a share of total cattle, beef and beef products imports from U.S. in country h,

$SBFV_h$ = Fresh or frozen beef imports as a share of total cattle, beef and beef products imports from U.S. in country h,

$SBPV_h$ = Prepared or preserved beef imports as a share

of total cattle, beef and beef products imports from U.S. in country h,

$PC_h$ = Unit value of U.S. live cattle export per head to country h,

$PBF_h$ = Unit value of U.S. fresh or frozen beef export per metric ton to country h,

$PBP_h$ = Unit value of U.S. prepared or preserved beef export per MT to country h,

$RPC_h$ = Real import price of live cattle in country h's currency, (PC*EXR)/(CPI/100),

$RPBF_h$ = Real import price of fresh or frozen beef in country h's currency, (PBF*EXR)/(CPI/100),

$RPBP_h$ = Real import price of preserved or prepared beef in country h's currency, (PBP*EXR)/(CPI/100).

**Estimated Models**

Live cattle and Beef Products: Each import share of U.S. live cattle, fresh or frozen beef, and preserved or prepared beef of U.S. total beef exports to a particular country is regressed on real per capita income and real import prices of the three beef products. In some countries, live cattle import is left out because they have imported no live cattle from the U.S. in certain years; consequently, unit values for these years cannot be calculated.

The regression form of each beef product equation is as follows:

live cattle:

$$SCV_h = a_0 + a_1 RPC_h + a_2 RPBF_h + a_3 RPBP_h + a_4 IY_h + E,$$

fresh or frozen beef:

$$SBFV_h = b_0 + b_1 RPC_h + b_2 RPBF_h + b_3 RPBP_h + b_4 IY_h + E,$$

prepared beef:

$$SBPV_h = c_0 + c_1 RPC_h + c_2 RPBF_h + c_3 RPBP_h + c_4 IY_h + E,$$

where E = disturbance term.

Wheat and Wheat Products: Each import share of U.S. unmilled wheat as bulk-type product, wheat flour, and other wheat products of total U.S. wheat and wheat products exported to a certain country is regressed on per capita income and import prices of these products, in real terms. For some countries, import data of U.S. wheat flour or other wheat products are equal to zero. Hence, unit values of wheat flour or other wheat products can not be obtained in certain years. For this reason, wheat flour and other products are aggregated to processed wheat products for such countries.

The regression form of each wheat product equation is as follows:

bulk wheat:

$$SWV_h = a_0 + a_1 RPW_h + a_2 RPWF_h + a_3 RPWP_h + a_4 IY_h + E,$$

wheat flour:

$$SWFV_h = b_0 + b_1 RPW_h + b_2 RPWF_h + b_3 RPWP_h + b_4 IY_h + E,$$

other wheat products:

$$SWPV_h = c_0 + c_1 RPW_h + c_2 RPWF_h + c_3 RPWP_h + c_4 IY_h + E,$$

where E = disturbance term.

## Data Sources

Annual time series data from 1970 to 1988 were used. But the analysis for live cattle and beef products covers the period 1978 to 1988 because data for preserved or prepared beef have not been compatible over the period 1970 to 1988.

U.S. export data for live cattle, fresh or frozen beef and preserved or prepared beef by destinations were obtained from USDA/FAS's U.S. Trade Data Collection in quantity and value. The data for wheat, wheat flour and other wheat products were provided from the Foreign Agricultural Trade of the U.S. by U.S. Department of Agriculture. Composition of other wheat products included bulgur wheat, rolled wheat, and other wheat products (Table X). These unit values were computed by dividing export value by export quantity. All data above were based on calendar years.

Gross domestic product (GDP), population, consumer price index (CPI), and exchange rate were reported from the International Financial Statistics of the International Monetary Fund (IMF) in various issues. However, these macroeconomic indicators for Hong Kong and Taiwan could not be obtained from IMF since these countries are not official members of IMF. Therefore, data needed for Taiwan were obtained from the Economic Research Service of the U.S. Department of Agriculture. For Taiwan, the original source for the GDP, population, and CPI data is the Council for Economic Planning and Development of the Republic of China. The exchange rates originally came from the Financial

Statistics of the Central Bank of China. Data for Hong Kong were not available.

TABLE XI

COMPOSITIONS OF COMMODITIES

| Composition | Codes of Commodities / Period 1970 - 77 | 1978 - 81 | 1982 -88 |
|---|---|---|---|
| Live Cattle | 0011010 | 1004120 | 1004120 |
| | 0011020 | 1004140 | 1004140 |
| | 0011030 | 1004160 | 1004160 |
| | 0011040 | 1004180 | 1004180 |
| | | 1004190 | 1004190 |
| Fresh or frz. Beef | 0111010 | 1061025 | 1061025 |
| | 0111020 | 1061060 | 1061060 |
| | | 1061080 | 1061080 |
| Pres., prep. Beef | 0129010 | 1073820 | 1073820 |
| | | 1073840 | 1073840 |
| | | 1074200 1\ | 1074200 1\ |
| | | 1074600 1\ | 1074600 1\ |
| Wheat - Unmilled | 0410010 | 1306520 | 1306520 |
| | 0410020 | 1306540 | 1306540 |
| Wheat Flour | 0460110 | 1314010 | 1314010 |
| | 0460120 | 1314020 | 1314020 |
| | 0460130 | 1314030 | 1314030 |
| | 0460140 | 1314040 | 1314040 |
| | 0460150 | | |
| | 0460210 | 1314090 | |
| | 0460220 | | |
| | (Grain equivalent) | (Grain equivalent) | |
| | High value | Low value | |
| | 0460110 - 140 > 0460150 | > 0460210 -220 | |
| Bulgur Wheat | 0481110 | 1314050 | 1314050 |
| | 0481140 | 1314060 | 1314060 |
| Rolled Wheat | 0481120 | NA | NA |
| | 0481150 | | |
| Other Wheat Products | 0483000 | 1823800 | 1314090 |
| | | | 1823800 |
| | High value | Low value | |
| | 0483000 > 0481150 | > 0481120 > 0481140 | |

NA : Not available
1\ Newly added products

Source: USDA, Foreign Agricultural Trade of the U.S.

# CHAPTER V

# EMPIRICAL RESULTS

The import share equations were estimated using ordinary least square (OLS) technique. The equations were estimated for each country and product. The empirical results are reported here.

## Wheat Category

This import category includes unmilled wheat, wheat flour and other wheat products. These correspond to bulk-type, semi-processed, and high-processed products, respectively.

### Wheat - unmilled

In most of our selected countries, the import share of U.S. bulk wheat has been high compared with shares from other major wheat exporters. The import share of U.S. wheat of total U.S. wheat category in these countries has generally been over 90 percent.

The impact of own-price upon import share will be largely, though not entirely, determined by the elasticity of import demand. There will be a tendency for inelastic goods to have import shares that are positively related to own-price, and for elastic goods to have import shares that are negatively related to own-price.

For Mexico and Taiwan, the regression coefficient for own price of wheat has a negative sign. This negative sign suggests that in Mexico and Taiwan, import demands for U.S. bulk wheat are elastic to U.S. wheat prices. However, for the other countries, the own prices have positive signs, that is, increases in the own price of U.S. wheat have positive effects on the import share of U.S. wheat.

For all countries except Taiwan, the regression coefficients for per capita income have positive signs. As the countries' per capita incomes increase, the import share for U.S. bulk wheat will increase, while decreasing for processed U.S. wheat products.

In Taiwan, the import share of U.S. bulk wheat showed a negative relation with its per capita income over the studied period. However, in terms of quantity imported from the U.S., since 1980, imports have generally showed steady increases. Taiwan imported about 550 thousand MT from the U.S. in 1980 but in 1988, about 829 thousand MT. Therefore, since income in Taiwan increased over this period, it is likely that total imports of bulk wheat are positively related to income, even though their share of imports of all wheat products has decreased.

TABLE XII

WHEAT - UNMILLED: OLS ESTIMATES

| Country | Independent Variables | | | | | |
|---|---|---|---|---|---|---|
| | C 1\ | RPW | RPWF | RPWP | IY | R^2 |
| Mexico | 1.0831 | -8.688D-6 | -5.380D-6 | 1.113D-7 | 5.465D-7 | 0.76 |
| | (4.155) | (-4.502) | (-3.183) | (3.516) | (1.184) | |
| Israel | 0.8645 | 0.022953 | -0.034541 | 0.000222 | 0.004482 | 0.30 |
| | (5.176) | (0.454) | (-0.936) | (0.032) | (0.848) | |
| Jordan | -0.8675 | 0.000205 | 0.000517 | 2.333D-5 | 0.002919 | 0.71 |
| | (-2.429) | (0.901) | (1.935) | (0.352) | (3.97) | |
| Malay-sia 2\ | 0.3668 | 0.000459 | NA | 9.082D-6 | 9.126D-5 | 0.67 |
| | (2.933) | (2.734) | | (0.958) | (4.498) | |
| Singa-pore | 0.6503 | 0.000310 | 1.347D-5 | 1.114D-5 | 1.244D-5 | 0.37 |
| | (4.273) | (1.541) | (0.262) | (1.63) | (1.899) | |
| Korea | 0.9059 | 5.659D-8 | 4.840D-8 | 1.456D-8 | 4.054D-8 | 0.67 |
| | (40.015) | (0.576) | (0.44) | (0.597) | (2.972) | |
| Taiwan 2\ | 1.0035 | -2.647D-7 | NA | -5.088D-9 | -1.573D-8 | 0.62 |
| | (916.9) | (-3.869) | | (-1.306) | (-2.972) | |

The t-values are in parentheses.
NA: not available; the variable was not included in the regression model.
1\ intercept
2\ wheat products including wheat flour.

Wheat Flour

Because of lack of data, wheat flour and other wheat products were aggregated to one category for Taiwan and Malaysia. An analysis of this product category is placed in the next section.

Per capita incomes in all of the selected countries show a negative relationship with the import share for wheat flour. These results suggest that as MIDCs' personal disposal incomes grow, they tend to develop their own flour milling industries. This is not a surprising result since these industries do not generally require high-technology. Hence, the results are not encouraging for U.S. firms wishing to promote wheat flour exports to the selected middle-income developing countries.

For Mexico and Israel, the regression coefficient for own price of wheat flour has a positive sign but a negative sign is obtained for Jordan, Singapore, and Korea. These results suggest that import demands for U.S. wheat flour are elastic to U.S. flour prices in Jordan, Singapore, and Korea, but are inelastic in Mexico and Israel.

TABLE XIII

WHEAT FLOUR: OLS ESTIMATES

| Country | Independent Variables | | | | | R^2 |
|---|---|---|---|---|---|---|
| | C 1\ | RPW | RPWF | RPWP | IY | |
| Mexico | -0.1283 | 8.587D-6 | 4.978D-6 | -1.082D-6 | -4.547D-7 | 0.77 |
| | (-0.522) | (4.72) | (3.125) | (-3.627) | (-1.045) | |
| Israel | 0.1843 | -0.034364 | 0.044051 | -0.002799 | -0.006114 | 0.32 |
| | (1.114) | (-0.686) | (1.206) | (-0.41) | (-1.169) | |
| Jordan | 1.8502 | -0.000208 | -0.000518 | -2.411D-5 | -0.002876 | 0.71 |
| | (5.256) | (-0.927) | (-1.969) | (-0.37) | (-3.968) | |
| Malay-sia | NA | NA | NA | NA | NA | NA |
| Singa-pore | 0.1147 | -0.000120 | -1.139D-8 | -3.839D-6 | -3.275D-6 | 0.22 |
| | (1.724) | (-1.359) | (-0.001) | (-1.285) | (-1.143) | |
| Korea | 0.0932 | -5.343D-8 | -5.189D-8 | -1.373D-8 | -4.023D-8 | 0.67 |
| | (4.141) | (-0.548) | (-0.475) | (-0.566) | (-2.969) | |
| Taiwan | NA | NA | NA | NA | NA | NA |

The t-values are in parentheses.
NA: not available; the variable was not included in the regression model.
1\ intercept

Other Wheat Products

For all countries but Taiwan and Malaysia, other wheat products includes high processed wheat products. This group includes various kinds of wheat products which have relatively high unit value and a high degree of processing.

For 5 out of 7 countries, the regression coefficients for per capita income have negative signs in our import share equations. As per capita incomes in Mexico, Jordan, Malaysia, Singapore, and Korea increase, the import share of other wheat products falls while increasing for Israel and Taiwan. This suggests that U.S. high processed wheat products tend to lose advantage to bulk wheat for five of the countries as income increases.

In contrast, for Taiwan and Israel, high processed wheat products have shares that increase with income. With the exception of these two countries, the results are generally discouraging for the promotion of highly processed wheat products.

For Mexico, Malaysia, Singapore, and Korea, there is a negative relation between own price of wheat products and the import share. The import demands for U.S. high-processed wheat products appear to be elastic to U.S. prices in these countries, but inelastic in the others.

TABLE XIV

OTHER WHEAT PRODUCTS: OLS ESTIMATES

| Country | Independent Variables | | | | | |
|---|---|---|---|---|---|---|
| | C 1\ | RPW | RPWF | RPWP | IY | R^2 |
| Mexico | 0.0452 | 1.010D-7 | 4.013D-7 | -3.068D-8 | -9.180D-8 | 0.36 |
| | (1.387) | (0.418) | (1.899) | (-0.775) | (-1.59) | |
| Israel | -0.0488 | 0.011412 | -0.009510 | 0.002576 | 0.001632 | 0.91 |
| | (-5.519) | (4.259) | (-4.867) | (7.049) | (5.834) | |
| Jordan | 0.0173 | 2.921D-6 | 1.494D-6 | 7.860D-7 | -4.298D-5 | 0.67 |
| | (2.577) | (0.681) | (0.297) | (0.631) | (-3.105) | |
| Malay-sia 2\ | 0.6332 | -0.000459 | NA | -9.082D-6 | -9.126D-5 | 0.67 |
| | (5.064) | (-2.734) | | (-0.958) | (-4.498) | |
| Singa-pore | 0.2349 | -0.000191 | -1.346D-5 | -7.300D-6 | -9.168D-6 | 0.44 |
| | (2.388) | (-1.464) | (-0.404) | (-1.652) | (-2.164) | |
| Korea | 0.0009 | -3.165D-9 | 3.484D-9 | -8.317D-10 | -3.017D-10 | 0.68 |
| | (3.898) | (-3.117) | (3.066) | (-3.298) | (-2.139) | |
| Taiwan 2\ | -0.0035 | 2.647D-7 | NA | 5.090D-9 | 1.573D-8 | 0.62 |
| | (-3.197) | (3.868) | | (1.306) | (2.973) | |

The t-values are in parentheses.
NA: not available; the variable was not included in the regression model.
1\ intercept
2\ wheat products including wheat flour.

## Beef Category

This import category consists of Live cattle, fresh or frozen beef, and preserved or prepared beef. These correspond to bulk form, semi-processed, and high processed products, respectively.

The selected countries have imported few live cattle from the U.S. except for Mexico, Korea, and Taiwan. Therefore, data for U.S. live cattle exports to Algeria, Israel, Jordan, Malaysia, and Singapore were mostly equal to zero. For this reason, unit values of live cattle for these countries could not be calculated. Consequently, the import share of U.S. live cattle of total U.S. beef category was estimated only for Mexico, Korea, and Taiwan. Import shares for the other countries represent percentage of the sum of fresh or frozen beef and preserved or prepared beef.

### Live Cattle

Per capita incomes of Mexico and Korea have negative relationship with the import share of U.S. live cattle. Mexico has historically been a major importer of U.S. live cattle with its import share of total U.S. beef category being over 90 percent in the 1970's.

In the 1980's the share for Mexico has kept around 80 percent. Our econometric results indicate that decreases in import share of U.S. live cattle are likely to occur with increasing personal disposal income in Mexico. For Korea, the import share also seems to decrease with growing personal disposal income. In contrast, for Taiwan, import

share is positively related to income.

For all countries above, own prices of live cattle were positively related to the import share. This suggests that the import demands for U.S. live cattle are inelastic to U.S. cattle prices.

TABLE XV

LIVE CATTLE: OLS ESTIMATES

| Country | Independent Variables | | | | | |
|---|---|---|---|---|---|---|
| | C 1\ | RPC | RPBF | RPBP | IY | R^2 |
| Mexico | 1.3599 | 5.803D-7 | -1.269D-7 | -3.552D-8 | -7.510D-7 | 0.62 |
| | (4.399) | (1.274) | (-1.08) | (-0.212) | (-1.835) | |
| Israel | NA | NA | NA | NA | NA | NA |
| Jordan | NA | NA | NA | NA | NA | NA |
| Malay-sia | NA | NA | NA | NA | NA | NA |
| Singa-pore | NA | NA | NA | NA | NA | NA |
| Korea | 2.4800 | 1.594D-7 | -1.499D-7 | 4.285D-8 | -9.739D-7 | 0.81 |
| | (4.544) | (1.7050 | (-1.685) | (0.979) | (-3.975) | |
| Taiwan | -1.5248 | 2.625D-6 | 3.488D-6 | 1.041D-6 | 6.418D-6 | 0.72 |
| | (-2.048) | (0.544) | (2.193) | (0.941) | (1.846) | |

The t-values are in parentheses.
NA: not available
1\ intercept

Fresh or Frozen Beef

For fresh or frozen beef, the regression coefficients for per capita income have positive signs for Mexico, Malaysia, Singapore, and Korea while having negative signs for Israel, Jordan, and Taiwan. These results are encouraging for the prospects of promoting fresh or frozen beef to all countries but Israel, Jordan, and Taiwan.

The denominators in the shares for all countries but Mexico, Korea, and Taiwan do not include live cattle. Therefore, the signs on the income coefficients for all countries but these show the relative affect that income should have upon fresh or frozen beef and preserved or prepared beef. A negative sign indicates that the share of fresh or frozen beef will be lost to preserved or prepared beef as income increases. A negative sign is in fact found for Israel and Jordan.

Taiwan's imports of U.S. fresh or frozen beef have not much changed since 1979. Although our empirical results revealed a negative relation between import share of U.S. fresh beef and personal disposal income, the quantity of fresh beef import from the U.S. has showed a moderate increase since 1985.

The import share of U.S. semi-processed beef products in Jordan and Taiwan was negatively related to own price but was positively related in the other countries. This suggests that the import demands for U.S. fresh or frozen beef are elastic to the own prices in Jordan and Taiwan.

TABLE XVI

FRESH OR FROZEN BEEF: OLS ESTIMATES

| Country | Independent Variables | | | | | |
|---|---|---|---|---|---|---|
| | C 1\ | RPC | RPBF | RPBP | IY | R^2 |
| Mexico | -0.1910 | -1.881D-7 | 4.539D-8 | 9.572D-9 | 4.054D-7 | 0.59 |
| | (-1.246) | (-0.833) | (0.779) | (0.115) | (1.998) | |
| Israel | 7.3695 | NA | 0.000641 | -0.016188 | -0.214538 | 0.68 |
| | (2.18) | | (0.114) | (-1.411) | (-2.083) | |
| Jordan | 5.5791 | NA | -3.344D-7 | -1.041D-5 | -0.010286 | 0.59 |
| | (1.936) | | (-0.028) | (-1.782) | (-1.602) | |
| Malay-sia | -0.5120 | NA | 1.115D-5 | 6.730D-6 | 0.000199 | 0.25 |
| | (-0.548) | | (0.730) | (0.670) | (1.185) | |
| Singa-pore | -0.3517 | NA | 2.296D-5 | -1.224D-6 | 4.770D-5 | 0.23 |
| | (-0.332) | | (1.329) | (-0.102) | (1.041) | |
| Korea | -1.3958 | -1.431D-7 | 1.044D-7 | -3.179D-8 | 9.464D-7 | 0.84 |
| | (-3.109) | (-1.86) | (1.427) | (-0.883) | (4.695) | |
| Taiwan | 2.1706 | -7.529D-7 | -3.764D-6 | -6.781D-7 | -5.073D-6 | 0.82 |
| | (3.853) | (-0.206) | (-3.127) | (-0.81) | (-1.928) | |

The t-values are in parentheses.
NA: not available; the variable was not included in the regression model.
1\ intercept

Preserved or Prepared Beef

In Mexico and Korea, like the results for fresh or frozen beef, per capita income has a positive relationship with the import share of U.S. preserved or prepared beef. On the other hand, the results for Taiwan showed a negative relation between per capita income and import share of U.S. prepared beef.

The import share of U.S. prepared beef of total U.S. beef category has shown a positive relation with its own price for Mexico, but a negative relation for Korea and Taiwan. This suggests that the import demands for U.S. prepared beef are elastic to the own prices in Korea and Taiwan. For Mexico, the import demand for prepared beef appears to be inelastic to its own price.

The rest of the countries import only fresh or frozen beef and preserved or prepared beef in significant quantities. For these countries, the empirical results for high-processed beef products are simply the negative of those found for semi-processed beef products.

TABLE XVII

PREPARED BEEF: OLS ESTIMATES

| Country | Independent Variables | | | | | |
|---|---|---|---|---|---|---|
| | C 1\ | RPC | RPBF | RPBP | IY | R^2 |
| Mexico | -0.1689 | -3.922D-7 | 8.153D-8 | 2.595D-8 | 3.456D-7 | 0.66 |
| | (-1.078) | (-1.699) | (1.368) | (0.306) | (1.666) | |
| Israel | -0.6395 | NA | -0.000641 | 0.016188 | 0.214537 | 0.68 |
| | (-1.884) | | (-0.114) | (1.411) | (2.083) | |
| Jordan | -4.5791 | NA | 3.344D-7 | 1.041D-5 | 0.010286 | 0.59 |
| | (-1.589) | | (0.028) | (1.782) | (1.602) | |
| Malay-sia | 1.5120 | NA | -1.115D-5 | -6.730D-6 | -0.000199 | 0.25 |
| | (1.657) | | (-0.731) | (-0.682) | (-1.222) | |
| Singa-pore | 1.3517 | NA | -2.296D-5 | 1.224D-6 | -4.770D-5 | 0.23 |
| | (1.274) | | (-1.329) | (0.102) | (-1.041) | |
| Korea | -0.0843 | -1.640D-8 | 4.551D-8 | -1.106D-8 | 2.754D-8 | 0.63 |
| | (-0.678) | (-0.77) | (2.249) | (-1.109) | (0.494) | |
| Taiwan | 0.3542 | -1.873D-6 | 2.767D-7 | -3.624D-7 | -1.345D-6 | 0.45 |
| | (1.498) | (-1.222) | (0.548) | (-1.032) | (-1.219) | |

The t-values are in parentheses.
NA: not available; the variable was not included in the regression model.
1\ intercept

## Summary

The empirical results from the estimated import share of bulk wheat and wheat products indicate that in all selected MIDCs except Taiwan, U.S. bulk wheat exports have better prospects than U.S. processed wheat product exports. The results showed that increases in real income growth have negative impacts on U.S. processed wheat products in all MIDCs except Taiwan.

Indeed, international wheat flour trade has declined since 1980. In 1980/81, world total of wheat flour trade was 9.48 million tons, but it decreased to 5.72 million tons in 1985/86 (Table XVIII). In the world wheat flour market, major exporters have been developed countries, while major importers have been developing countries in Asia and Africa (Table XVIII and XIX). In 1985/86, world market shares of wheat flour of developed countries were above 94 percent and the world import share of developing countries in Asia and Africa took account of 90.6 percent (Table XVIII). In the Asian countries, wheat flour imports have mostly decreased since 1979/80. Indeed, Japan, which has been a large bulk wheat importer, turned out to be a large net exporter of wheat flour in 1985/86 (Table XX). This indicates that the Asian countries tend to develop their milling industries as their economies grow. However, there has been a tendency for African countries to increase wheat flour imports (Table XVIII).

Unlike processed wheat products, the empirical results

from the estimated import shares of U.S. live cattle and processed beef products indicate that U.S. processed beef products mostly have better prospects than U.S. cattle exports. The results showed that U.S. processed beef products tend to increase with income growth in Mexico and Korea, while decreasing in Taiwan.

In Malaysia and Singapore, the share of fresh or frozen beef tends to increase with income growth, but the share of prepared beef decreases. However, in Israel and Jordan, the opposite tendency occurs.

TABLE XVIII

TRADE IN WHEAT FLOUR: IMPORTS

(1000 MT)

| Year 1\ | Asia | % | 2\ | Africa | % | World Total |
|---|---|---|---|---|---|---|
| 1970/71 | 2830 | 50.9 | | 1360 | 24.5 | 5559 |
| 1971/72 | 2300 | 41.6 | | 1590 | 28.8 | 5530 |
| 1972/73 | 2472 | 44.1 | | 1633 | 29.2 | 5602 |
| 1973/74 | 2325 | 47.0 | | 1344 | 27.2 | 4948 |
| 1974/75 | 2178 | 45.9 | | 1615 | 34.1 | 4743 |
| 1975/76 | 2325 | 44.0 | | 2024 | 38.3 | 5285 |
| 1976/77 | 2933 | 46.3 | | 1870 | 29.6 | 6328 |
| 1977/78 | 3003 | 42.2 | | 2295 | 32.3 | 7108 |
| 1978/79 | 2518 | 34.6 | | 2537 | 34.9 | 7279 |
| 1979/80 | 3197 | 38.9 | | 2650 | 32.3 | 8209 |
| 1980/81 | 1914 | 20.2 | | 4175 | 44.0 | 9480 |
| 1981/82 | 1530 | 17.9 | | 3541 | 41.5 | 8532 |
| 1982/83 | 1887 | 26.7 | | 3950 | 55.9 | 7065 |
| 1983/84 | 2141 | 26.7 | | 4334 | 54.1 | 8006 |
| 1984/85 | 1317 | 20.7 | | 4293 | 67.6 | 6348 |
| 1985/86 | 1264 | 22.1 | | 3914 | 68.5 | 5718 |

1\ the crop year, July/June
2\ Asia as percent of world total

Source: International Wheat Council,
World Wheat Statistics, various issues.

TABLE XIX

WORLD MAJOR WHEAT FLOUR EXPORTERS

(1000 MT)

| 1\ Year\ | EEC | U.S. | Canada | Japan | USSR | Austral | World Total |
|---|---|---|---|---|---|---|---|
| 1980/81 | 4331 | 1705 | 638 | NA | 200 | 137 | 9480 |
| RMS 2\ | 0.46 | 0.18 | 0.07 | | 0.02 | 0.01 | 1 |
| 1981/82 | 4381 | 1320 | 536 | NA | 200 | 130 | 8532 |
| | 0.51 | 0.15 | 0.06 | | 0.02 | 0.02 | 1 |
| 1982/83 | 3690 | 1825 | 401 | 149 | 200 | 124 | 7065 |
| | 0.52 | 0.26 | 0.06 | 0.02 | 0.03 | 0.02 | 1 |
| 1983/84 | 4190 | 2166 | 730 | 319 | 300 | 78 | 8006 |
| | 0.52 | 0.27 | 0.09 | 0.04 | 0.04 | 0.01 | 1 |
| 1984/85 | 4088 | 1087 | 428 | 210 | 200 | 81 | 6348 |
| | 0.64 | 0.17 | 0.07 | 0.03 | 0.03 | 0.01 | 1 |
| 1985/86 | 3609 | 1103 | 355 | 308 | 100 | 50 | 5718 |
| | 0.63 | 0.19 | 0.06 | 0.05 | 0.02 | 0.01 | 1 |

NA : Not available
1\ the crop year, July/June
2\ market share

Source : International Wheat Council,
World Wheat Statistics, various issues.

TABLE XX

WORLD MAJOR EXPORTERS OF WHEAT FLOUR TO ASIA:
EXPORTS TO ASIA

(1000 MT)

| 1\ Year\ | EEC | U.S. | Canada | Japan | USSR | Austral | World Total |
|---|---|---|---|---|---|---|---|
| 1980/81 | 732 | 606 | 38 | NA | 110 | 29 | 1914 |
| RMS 2\ | 0.38 | 0.32 | 0.02 | | 0.06 | 0.02 | 1 |
| 1981/82 | 889 | 328 | 27 | NA | 90 | 27 | 1530 |
| | 0.58 | 0.21 | 0.02 | | 0.06 | 0.02 | 1 |
| 1982/83 | 954 | 325 | 76 | 149 | 200 | 35 | 1887 |
| | 0.51 | 0.17 | 0.04 | 0.08 | 0.11 | 0.02 | 1 |
| 1983/84 | 1001 | 341 | 93 | 305 | 300 | 21 | 2141 |
| | 0.47 | 0.16 | 0.04 | 0.14 | 0.14 | 0.01 | 1 |
| 1984/85 | 832 | 88 | 80 | 202 | 80 | 8 | 1317 |
| | 0.63 | 0.07 | 0.06 | 0.15 | 0.06 | 0.01 | 1 |
| 1985/86 | 514 | 199 | 97 | 306 | 100 | 12 | 1264 |
| | 0.41 | 0.16 | 0.08 | 0.24 | 0.08 | 0.01 | 1 |

NA : Not available
1\ the crop year, July/June
2\ market share

Source : International Wheat Council,
World Wheat Statistics, various issues.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

This study has analyzed the import shares of U.S. value-added wheat and beef products in MIDCs. Singapore, Hong Kong, Korea, Taiwan, Algeria, Malaysia, Israel, Jordan, and Mexico were the countries classified as MIDCs. However, Hong Kong and Algeria were excluded from the empirical estimations because of data limitations.

In estimating the import share equations for U.S. wheat, wheat flour and other wheat products, and for live cattle, fresh or frozen beef and preserved or prepared beef, the ordinary least square (OLS) technique was applied to annual data from 1970 to 1988. A linear functional form of the import share equation was chosen.

The empirical results from the estimated import share of wheat and wheat products indicate that in most of our selected countries, increasing exports of U.S. bulk wheat has better prospects than increasing exports of processed wheat products. Increases in real per capita income have negative effects on the import share of wheat flour and other wheat products while having positive effects on the import share of unmilled wheat. This indicates that MIDCs in general tend to develop their milling industries as their

economies grow.

Unlike wheat products, the import shares of U.S. processed beef products including fresh or frozen beef and preserved or prepared beef tend to increase with income growth in Mexico and Korea. In contrast, for Taiwan, the import share of processed beef tends to decrease with personal disposal income growth.

The import share of U.S. live cattle could not be estimated for Israel, Jordan, Malaysia, and Singapore because there have been little or no imports of U.S. cattle in these countries. Hence, import shares for these countries represent percentage of the sum of fresh or frozen beef and preserved or prepared beef. In terms of semi-processed and high-processed beef products, the share of fresh or frozen beef tends to increase in Malaysia and Singapore with income growth, but not in Israel and Jordan. These indicate that U.S. high-processed beef products have better prospects in Israel and Jordan than the semi-processed beef products. However, in Singapore and Malaysia, the prospects for semi-processed beef products are better.

## Limitations and Suggestions For Further Research

In this study, analysis of import demand for value-added agricultural exports was conducted using share equations. This approach was taken because extreme limitations in data availability and quality prevented estimation of ordinary

import demand functions. Unfortunately, share equations cannot be used to explain or predict absolute movements in exported quantities or revenues. Absolute measures would of course be more valuable in assessing the potentialities of markets for value-added products. Were data to become of adequate quality and availability, significant improvements could be made to this study by estimating and analyzing the ordinary import demands.

Although the importances of unmeasurable variables such political and sociological factors have been recognized in this paper, the empirical models do not include such variables for several reasons. Therefore, improvements could probably be made to this study by the quantification of the impacts of institutional variables.

Another limitation of the study is that the samples upon which the share equations are based are effectively truncated since the manner in which the price regressors were calculated requires positive exported quantities. Therefore the estimates of the share equations could possibly be improved by using truncated - sample estimation techniques (e.q. Tobit analysis) rather than OLS.

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# APPENDIX

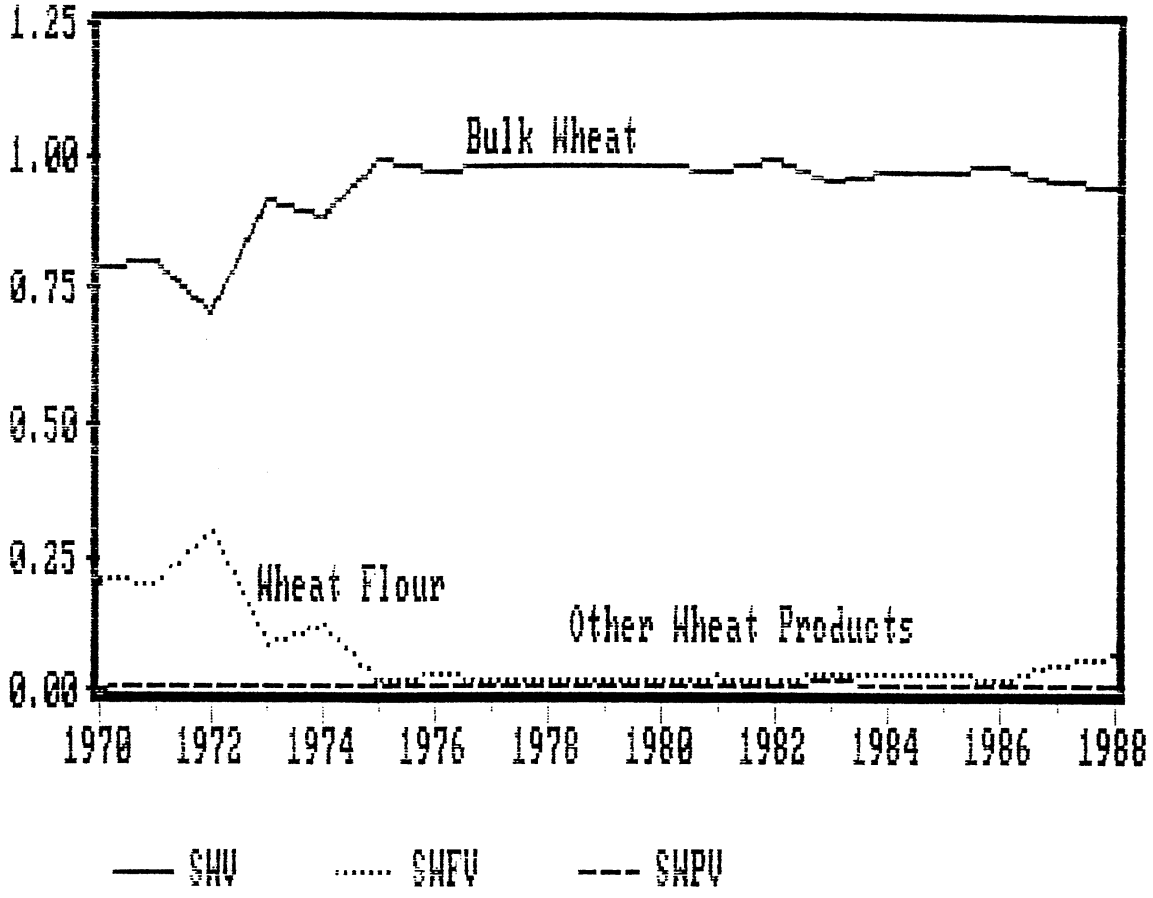
# THE IMPORT SHARES AND PRICES OF U.S. WHEAT AND BEEF PRODUCTS, AND THE TRENDS OF THE IMPORT SHARES IN MIDDLE-INCOME DEVELOPING COUNTRIES

IMPORT SHARES AND REAL PRICES OF
U.S. WHEAT PRODUCTS IN ISRAEL

| Year | SWV | SWFV | SWPV | RPW | RPWF | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 0.79566 | 0.20340 | 0.00094 | NA | NA | NA |
| 1971 | 0.80059 | 0.19825 | 0.00117 | NA | NA | NA |
| 1972 | 0.70550 | 0.29395 | 0.00055 | NA | NA | NA |
| 1973 | 0.91930 | 0.08070 | 0.00000 | NA | NA | NA |
| 1974 | 0.88401 | 0.11486 | 0.00114 | 2.24119 | 2.70206 | 3.19895 |
| 1975 | 0.99054 | 0.00926 | 0.00020 | 1.75730 | 1.71309 | 1.89125 |
| 1976 | 0.97622 | 0.02291 | 0.00087 | 1.17686 | 1.12128 | 1.63043 |
| 1977 | 0.98431 | 0.01486 | 0.00082 | 1.40964 | 1.46074 | 2.16049 |
| 1978 | 0.98246 | 0.01615 | 0.00139 | 1.04282 | 1.10417 | 1.43832 |
| 1979 | 0.97991 | 0.01521 | 0.00487 | 1.28585 | 1.33790 | 1.88820 |
| 1980 | 0.97848 | 0.01486 | 0.00666 | 1.33592 | 1.38298 | 1.70633 |
| 1981 | 0.97159 | 0.01930 | 0.00910 | 1.32620 | 1.32676 | 1.65763 |
| 1982 | 0.98853 | 0.00906 | 0.00241 | 1.16194 | 1.73605 | 1.74965 |
| 1983 | 0.95724 | 0.02850 | 0.01426 | 1.45172 | 2.47425 | 7.11392 |
| 1984 | 0.97474 | 0.02160 | 0.00366 | 1.73154 | 2.84615 | 2.59911 |
| 1985 | 0.96890 | 0.02756 | 0.00354 | 0.92870 | 1.36863 | 1.43643 |
| 1986 | 0.98656 | 0.01180 | 0.00164 | 0.53647 | 0.88646 | 1.21738 |
| 1987 | 0.95530 | 0.04340 | 0.00130 | 0.43703 | 0.71508 | 0.58672 |
| 1988 | 0.94109 | 0.05848 | 0.00043 | NA | NA | NA |

NA : Not available

IMPORT SHARES OF U.S. WHEAT PRODUCTS IN ISRAEL

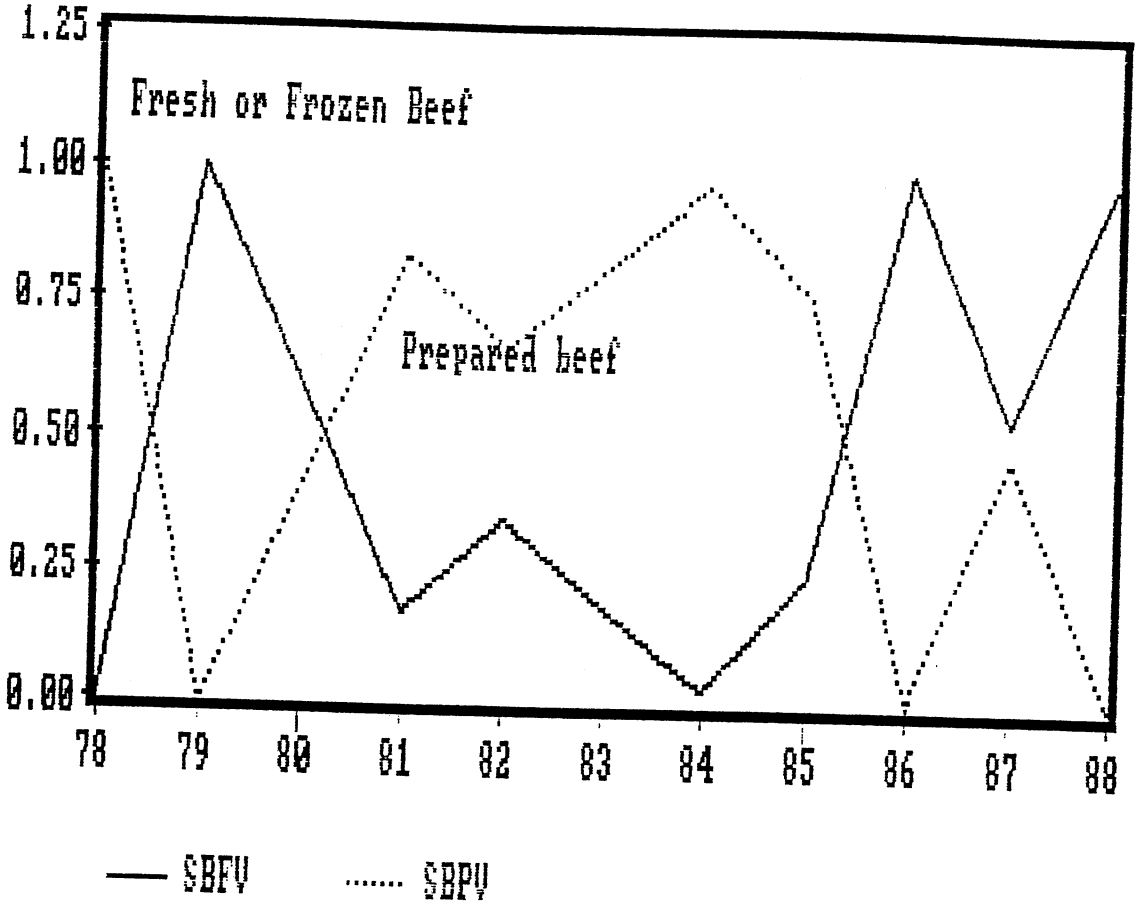


IMPORT SHARES AND PRICES OF
U.S. BEEF PRODUCTS IN ISRAEL

| Year | SBFV | SBPV | PBF | RPBF | PBP | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.00000 | 1.00000 | NA | NA | 5042.18 | 42.0182 |
| 1979 | 1.00000 | 0.00000 | 6000.00 | 48.8372 | NA | NA |
| 1980 | 0.59160 | 0.40840 | 1848.14 | 13.8610 | 5790.23 | 43.4267 |
| 1981 | 0.16804 | 0.83196 | 1921.05 | 13.8103 | 3170.26 | 22.7908 |
| 1982 | 0.34340 | 0.65660 | 4647.40 | 32.6679 | 3915.86 | 27.5257 |
| 1983 | 0.18509 | 0.81491 | 1276.66 | 11.7227 | 2309.33 | 21.2050 |
| 1984 | 0.03227 | 0.96772 | 3521.67 | 40.4548 | 2017.87 | 23.1801 |
| 1985 | 0.23947 | 0.76053 | 8226.10 | 54.8273 | 7060.96 | 47.0616 |
| 1986 | 1.00000 | 0.00000 | 8928.57 | 39.8210 | NA | NA |
| 1987 | 0.53278 | 0.46722 | 4532.85 | 17.4631 | 1987.51 | 7.6570 |
| 1988 | 0.97869 | 0.02131 | 8224.67 | NA | NA | NA |

NA : Not available

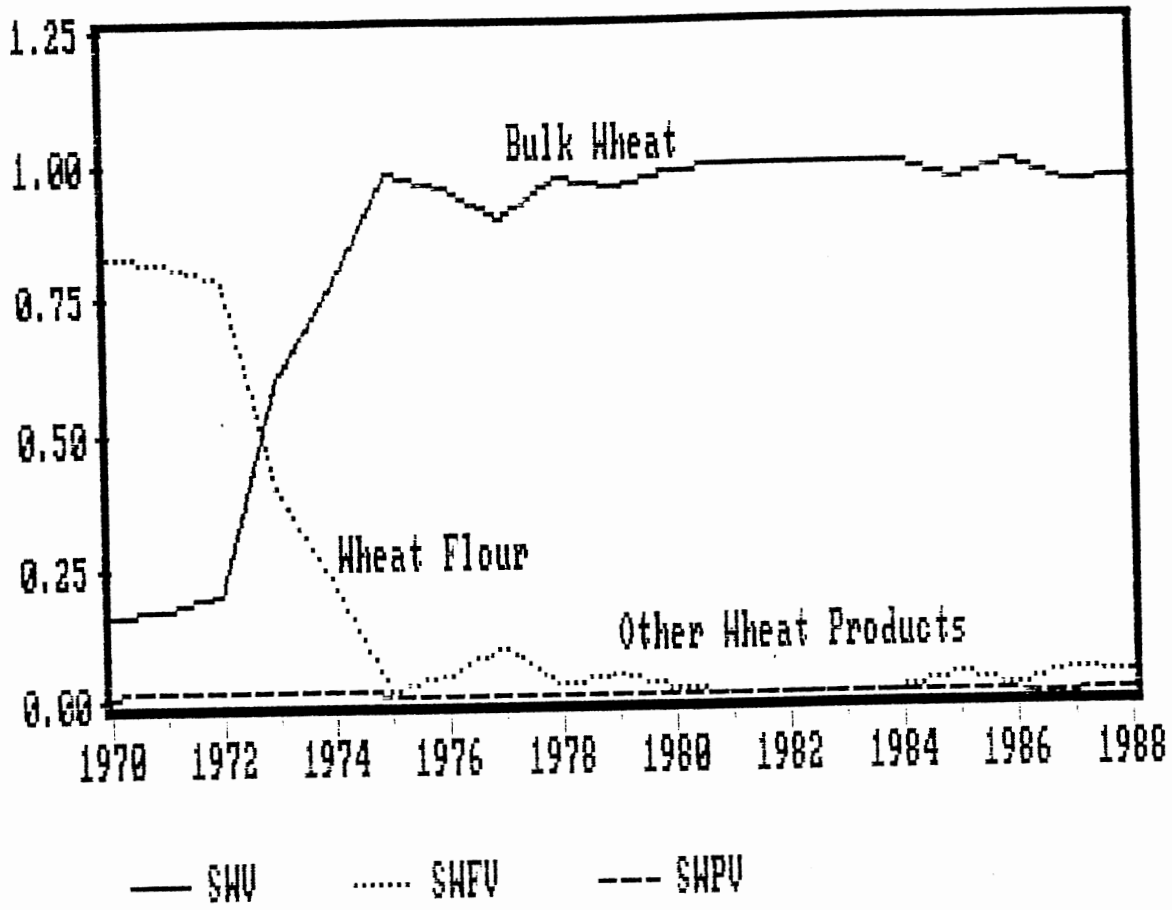
IMPORT SHARES OF U.S. BEEF PRODUCTS IN ISRAEL



IMPORT SHARES AND REAL PRICES OF
U.S. WHEAT PRODUCTS IN JORDAN

| Year | SWV | SWFV | SWPV | RPW | RPWF | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 0.16437 | 0.82776 | 0.00786 | 639.75 | 648.45 | 737.17 |
| 1971 | 0.16997 | 0.81404 | 0.01599 | 637.23 | 648.61 | 733.76 |
| 1972 | 0.20463 | 0.78347 | 0.01190 | 576.63 | 605.82 | 737.89 |
| 1973 | 0.60243 | 0.38310 | 0.01448 | 1630.98 | 866.82 | 1046.88 |
| 1974 | 0.77197 | 0.20902 | 0.01902 | 1308.99 | 1503.52 | 1684.44 |
| 1975 | 0.98229 | 0.01114 | 0.00657 | 1061.92 | 1272.57 | 1315.66 |
| 1976 | 0.95445 | 0.04305 | 0.00250 | 869.25 | 884.67 | 1111.52 |
| 1977 | 0.90170 | 0.09481 | 0.00350 | 568.97 | 669.99 | 879.83 |
| 1978 | 0.97720 | 0.01984 | 0.00295 | 685.13 | 779.00 | 1188.41 |
| 1979 | 0.95389 | 0.04239 | 0.00372 | 821.92 | 753.62 | 1213.99 |
| 1980 | 0.98328 | 0.01238 | 0.00433 | 853.69 | 762.93 | 1096.90 |
| 1981 | 0.99014 | 0.00787 | 0.00198 | 549.02 | 806.99 | 856.12 |
| 1982 | 0.98954 | 0.00567 | 0.00479 | 516.54 | 869.58 | 2018.92 |
| 1983 | 0.99501 | 0.00256 | 0.00244 | 461.69 | 969.91 | 1637.31 |
| 1984 | 0.98904 | 0.00957 | 0.00139 | 382.63 | 620.94 | 2985.08 |
| 1985 | 0.96246 | 0.03498 | 0.00255 | 372.05 | 642.53 | 4140.60 |
| 1986 | 0.98910 | 0.01091 | 0.00000 | 264.62 | 1368.68 | NA |
| 1987 | 0.95727 | 0.04273 | 0.00000 | 228.17 | 614.46 | NA |
| 1988 | 0.96764 | 0.03083 | 0.00153 | NA | NA | NA |

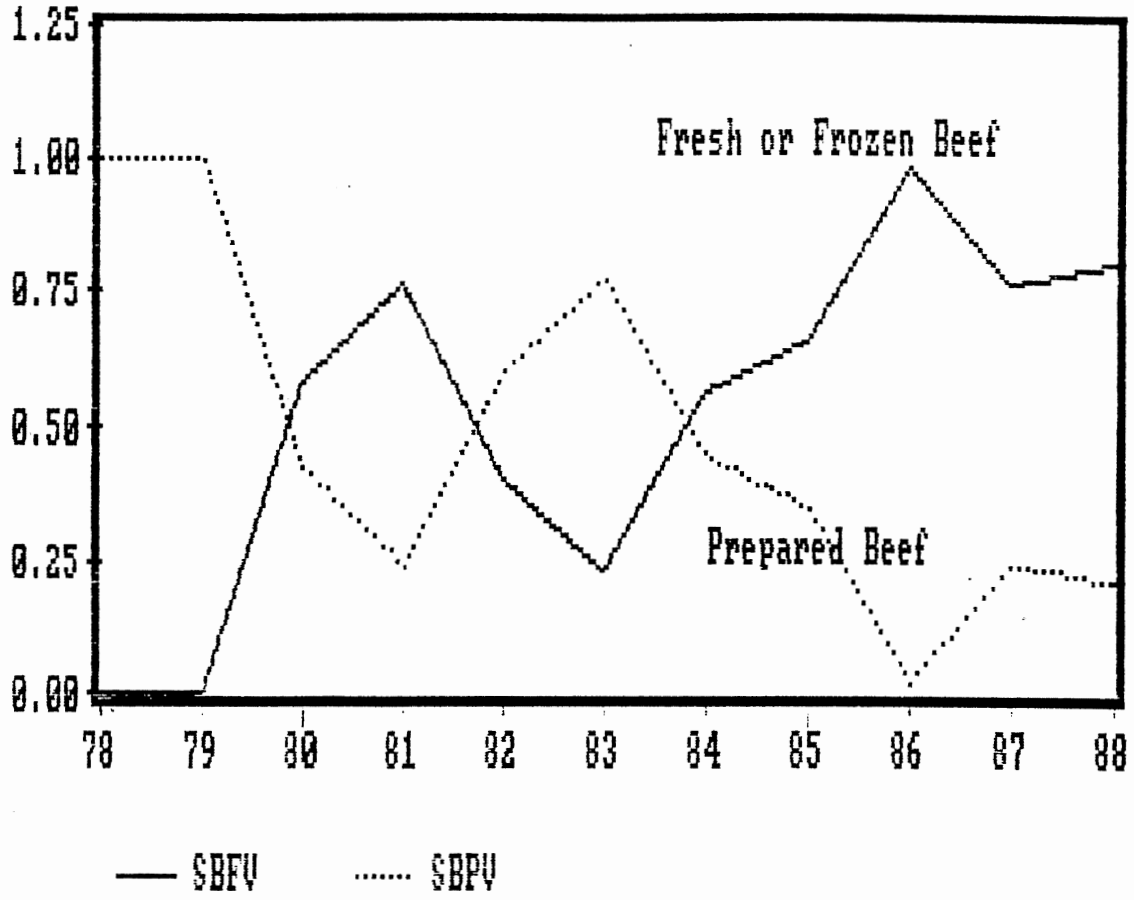
IMPORT SHARES OF U.S. WHEAT PRODUCTS IN JORDAN



IMPORT SHARES AND PRICES OF
U.S. BEEF PRODUCTS IN JORDAN

| Year | SBFV | SBPV | PBF | RPBF | PBP | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.00000 | 1.00000 | NA | NA | 1054.0 | 5936.1 |
| 1979 | 0.00000 | 1.00000 | NA | NA | 6051.0 | 29641.2 |
| 1980 | 0.58583 | 0.41417 | 5011.8 | 21125.7 | 10624.8 | 44785.9 |
| 1981 | 0.76365 | 0.23635 | 7998.5 | 28495.3 | 6188.8 | 22048.1 |
| 1982 | 0.40117 | 0.59883 | 7627.6 | 24382.6 | 11880.6 | 37977.9 |
| 1983 | 0.23140 | 0.76860 | 6988.3 | 20118.8 | 9027.0 | 25988.1 |
| 1984 | 0.56377 | 0.43623 | 13889.8 | 35319.7 | 6141.5 | 15616.9 |
| 1985 | 0.65691 | 0.34309 | 5843.2 | 15888.9 | 6103.6 | 16597.0 |
| 1986 | 0.98313 | 0.01687 | 6560.9 | 19066.6 | 1661.0 | 4827.0 |
| 1987 | 0.76594 | 0.23406 | 5999.0 | 18288.7 | 8031.3 | 24484.5 |
| 1988 | 0.79683 | 0.20317 | 9845.0 | 20057.4 | 10668.5 | 21735.1 |

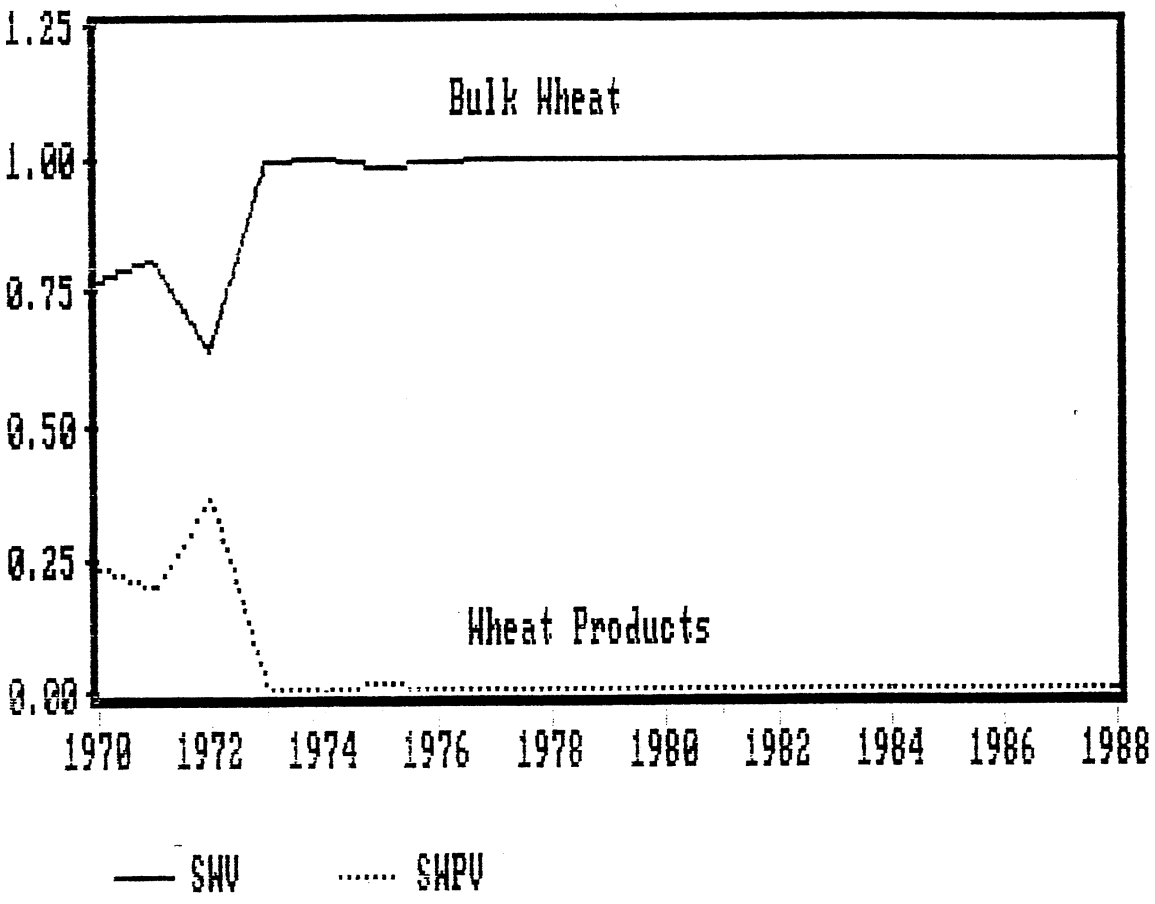
IMPORT SHARES OF U.S. BEEF PRODUCTS IN JORDAN



IMPORT SHARES AND PRICES OF
U.S. WHEAT PRODUCTS IN MALAYSIA

| Year | SWV | SWPV | PW | RPW | PWP | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 0.77424 | 0.22576 | 63.43 | 433.81 | 55.54 | 379.82 |
| 1971 | 0.81024 | 0.18976 | 62.56 | 395.06 | 58.71 | 370.74 |
| 1972 | 0.63810 | 0.36190 | 63.12 | 377.54 | 59.64 | 356.70 |
| 1973 | 0.98997 | 0.01003 | 101.08 | 475.69 | 84.49 | 397.63 |
| 1974 | 1.00000 | 0.00000 | 183.50 | 693.45 | 0.00 | 0.00 |
| 1975 | 0.98658 | 0.01342 | 195.28 | 791.00 | 212.50 | 860.74 |
| 1976 | 0.99500 | 0.00500 | 150.69 | 582.33 | 500.00 | 1932.17 |
| 1977 | 0.99764 | 0.00236 | 107.87 | 371.41 | 526.32 | 1812.23 |
| 1978 | 0.99960 | 0.00040 | 131.71 | 402.99 | 300.00 | 917.89 |
| 1979 | 0.99949 | 0.00051 | 160.85 | 471.36 | 125.00 | 366.30 |
| 1980 | 0.99967 | 0.00033 | 178.43 | 497.91 | 384.62 | 1073.26 |
| 1981 | 0.99991 | 0.00009 | 179.77 | 461.20 | 250.00 | 641.39 |
| 1982 | 0.99794 | 0.00206 | 162.87 | 408.73 | 16.45 | 41.28 |
| 1983 | 0.99928 | 0.00072 | 168.59 | 411.07 | 515.15 | 1256.08 |
| 1984 | 1.00000 | 0.00000 | 163.84 | 398.50 | 0.00 | 0.00 |
| 1985 | 0.99943 | 0.00057 | 154.40 | 374.66 | 1666.67 | 4044.17 |
| 1986 | 0.99978 | 0.00022 | 143.55 | 371.07 | 3000.00 | 7754.72 |
| 1987 | 0.99950 | 0.00050 | 135.13 | 331.56 | 1333.33 | 3271.39 |
| 1988 | 0.99921 | 0.00079 | 144.56 | 378.89 | 714.29 | 1872.10 |

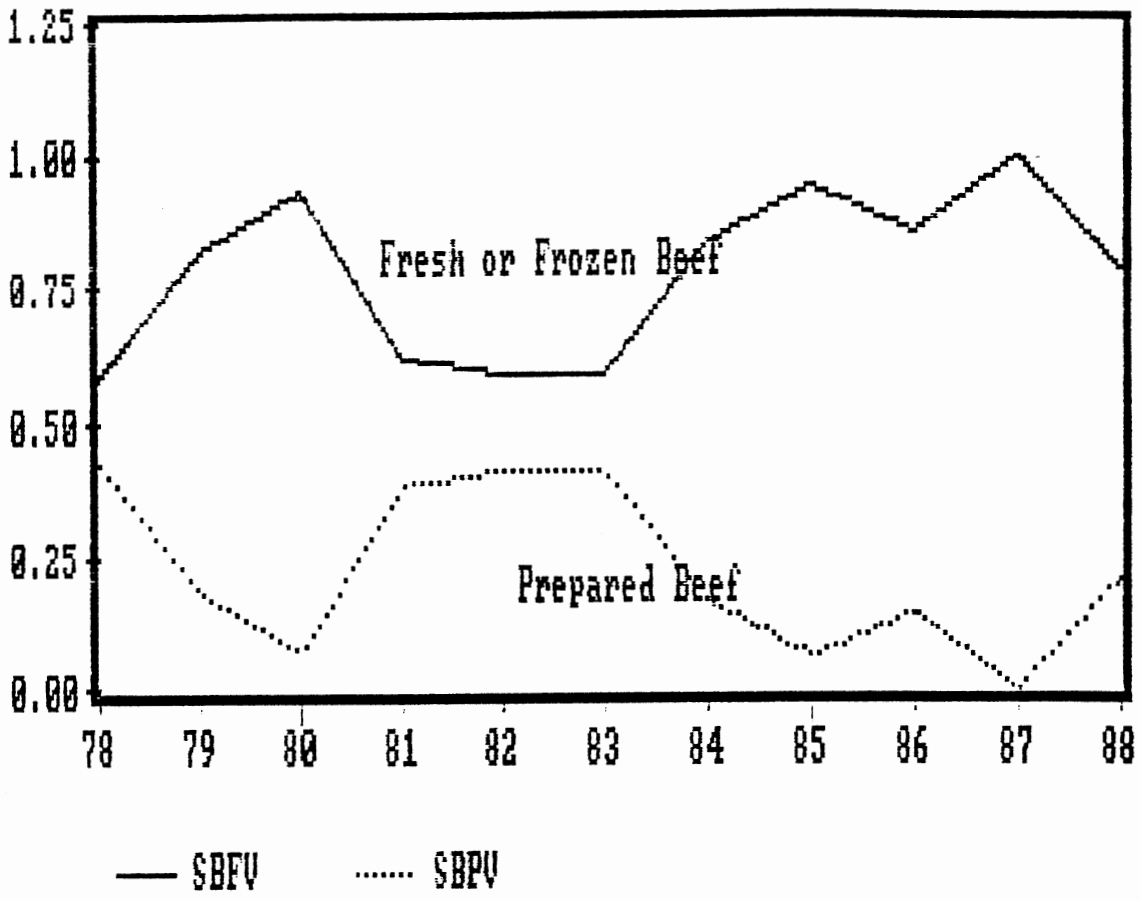
IMPORT SHARES OF U.S. WHEAT PRODUCTS IN MALAYSIA



IMPORT SHARES AND PRICES OF
U.S. BEEF PRODUCTS IN MALAYSIA

| Year | SBFV | SBPV | PBF | RPBF | PBP | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.58262 | 0.41738 | 5842.4 | 17875.6 | 6278.2 | 19208.9 |
| 1979 | 0.82007 | 0.17993 | 4448.8 | 13036.8 | 7028.2 | 20595.4 |
| 1980 | 0.93150 | 0.06850 | 7809.5 | 21792.2 | 2915.5 | 8135.5 |
| 1981 | 0.62038 | 0.37962 | 7761.5 | 19912.6 | 6530.4 | 16754.1 |
| 1982 | 0.59441 | 0.40559 | 8048.1 | 20196.9 | 3768.6 | 9457.5 |
| 1983 | 0.59440 | 0.40560 | 8287.8 | 20207.9 | 3644.6 | 8886.4 |
| 1984 | 0.83710 | 0.16290 | 9773.5 | 23772.0 | 5521.8 | 13430.8 |
| 1985 | 0.94169 | 0.05831 | 9193.0 | 22306.8 | 3180.8 | 7718.3 |
| 1986 | 0.85589 | 0.14411 | 9458.0 | 24448.0 | 9732.2 | 25156.9 |
| 1987 | 1.00000 | 0.00000 | 7414.7 | 18192.3 | NA | NA |
| 1988 | 0.79179 | 0.20821 | 6310.3 | 16539.1 | 6637.5 | 17396.6 |

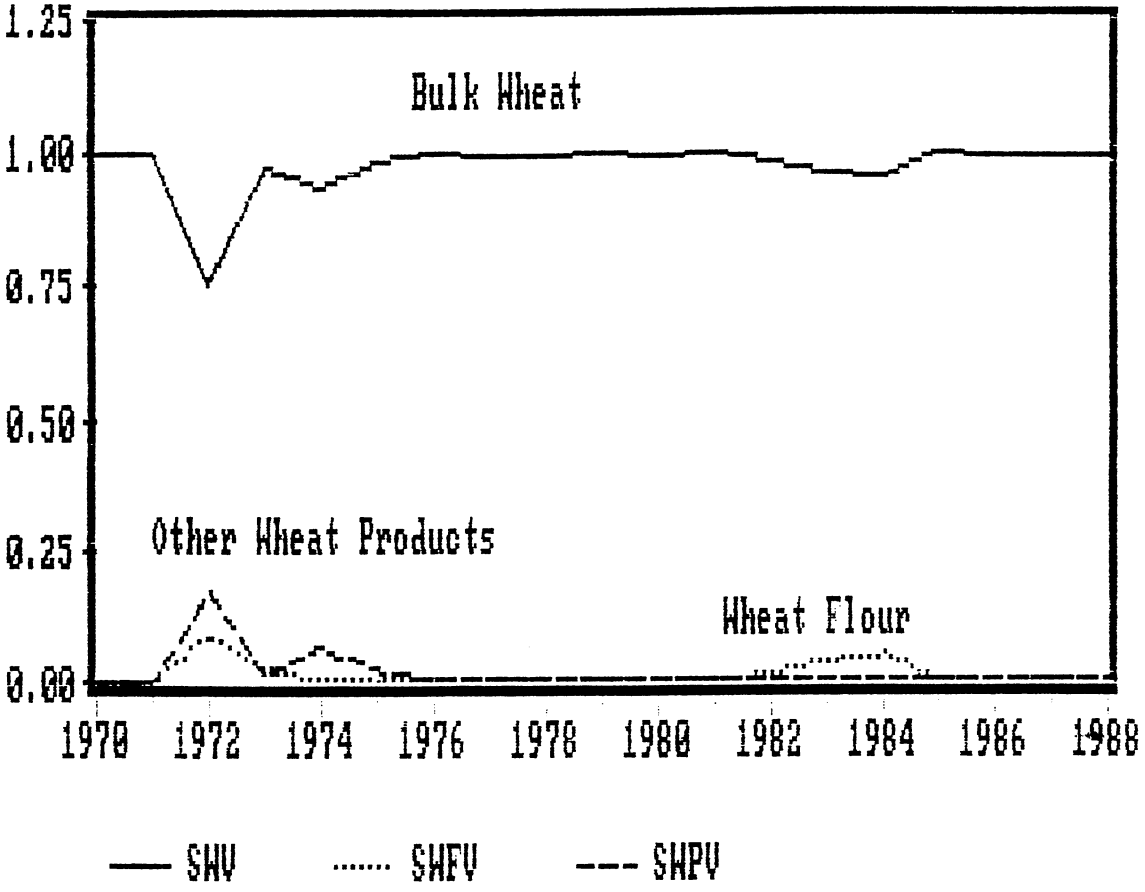
IMPORT SHARES OF U.S. BEEF PRODUCTS IN MALAYSIA



IMPORT SHARES AND REAL PRICES OF
U.S. WHEAT PRODUCTS IN SINGAPORE

| Year | SWV | SWFV | SWPV | RPW | RPWF | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 1.00000 | 0.00000 | 0.00000 | 411.69 | NA | NA |
| 1971 | 1.00000 | 0.00000 | 0.00000 | 400.30 | NA | NA |
| 1972 | 0.75000 | 0.08772 | 0.16228 | 367.60 | 386.32 | 517.34 |
| 1973 | 0.97203 | 0.02197 | 0.00601 | 555.79 | 440.05 | 658.56 |
| 1974 | 0.93921 | 0.00023 | 0.06056 | 666.05 | 289.69 | 731.08 |
| 1975 | 0.98044 | 0.00000 | 0.01956 | 667.47 | NA | 806.88 |
| 1976 | 0.99830 | 0.00057 | 0.00114 | 590.28 | 453.27 | 2810.30 |
| 1977 | 0.99059 | 0.00591 | 0.00351 | 367.53 | 382.99 | 3243.41 |
| 1978 | 0.99426 | 0.00512 | 0.00062 | 369.54 | 858.53 | 3815.70 |
| 1979 | 0.99762 | 0.00195 | 0.00043 | 329.09 | 677.30 | 10987.3 |
| 1980 | 0.98847 | 0.00248 | 0.00904 | 414.44 | 271.81 | 597.87 |
| 1981 | 0.99950 | 0.00009 | 0.00041 | 409.27 | 1479.09 | 2218.64 |
| 1982 | 0.98497 | 0.01396 | 0.00107 | 370.80 | 389.28 | 2200.94 |
| 1983 | 0.96160 | 0.03593 | 0.00247 | 395.37 | 878.45 | 2466.88 |
| 1984 | 0.95009 | 0.04834 | 0.00157 | 376.35 | 861.28 | 2814.36 |
| 1985 | 0.99823 | 0.00059 | 0.00118 | 360.40 | 1052.50 | 1403.33 |
| 1986 | 0.99630 | 0.00000 | 0.00370 | 338.86 | NA | 4963.24 |
| 1987 | 0.99297 | 0.00399 | 0.00304 | 261.38 | 516.46 | 1792.58 |
| 1988 | 0.99244 | 0.00498 | 0.00258 | 311.20 | 534.32 | 2901.89 |

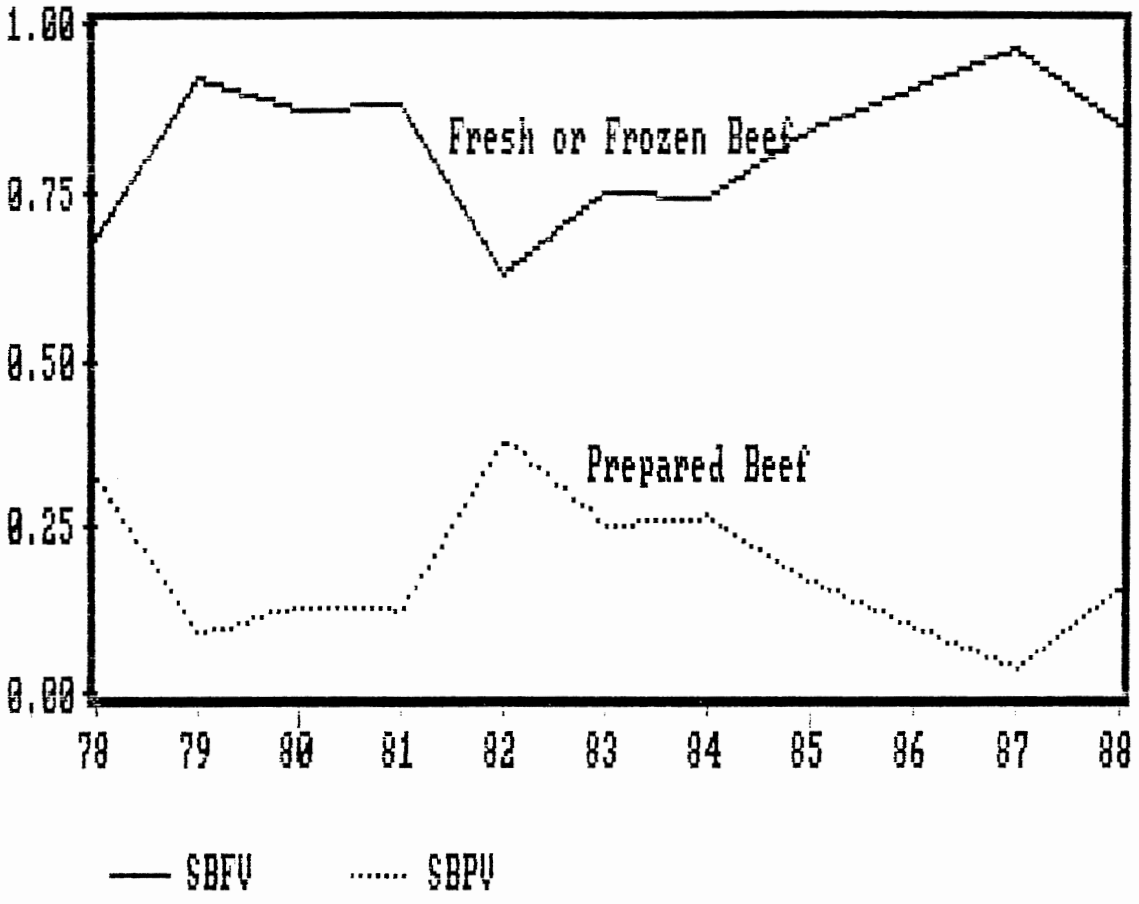
IMPORT SHARES OF U.S. WHEAT PRODUCTS IN SINGAPORE



IMPORT SHARES AND PRICES OF
U.S. BEEF PRODUCTS IN SINGAPORE

| Year | SBFV | SBPV | PBF | RPBF | PBP | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.68252 | 0.31748 | 5282.3 | 29750.1 | 3846.7 | 21664.5 |
| 1979 | 0.91393 | 0.08607 | 6255.9 | 30645.0 | 3971.0 | 19452.1 |
| 1980 | 0.87299 | 0.12701 | 6214.0 | 26193.3 | 6014.0 | 25350.2 |
| 1981 | 0.87828 | 0.12172 | 6147.9 | 21902.3 | 5294.7 | 18862.5 |
| 1982 | 0.62434 | 0.37566 | 6840.5 | 21866.7 | 5668.5 | 18119.9 |
| 1983 | 0.75141 | 0.24859 | 7097.5 | 20433.1 | 4306.4 | 12397.9 |
| 1984 | 0.74004 | 0.25996 | 7273.8 | 18496.2 | 3654.5 | 9292.9 |
| 1985 | 0.83629 | 0.16371 | 7481.2 | 20342.9 | 3630.7 | 9872.6 |
| 1986 | 0.90441 | 0.09560 | 6711.0 | 19502.9 | 2979.3 | 8658.1 |
| 1987 | 0.96492 | 0.03508 | 7673.8 | 23394.6 | 3400.8 | 10367.7 |
| 1988 | 0.84508 | 0.15492 | 6805.8 | 13865.6 | 3446.7 | 7022.0 |

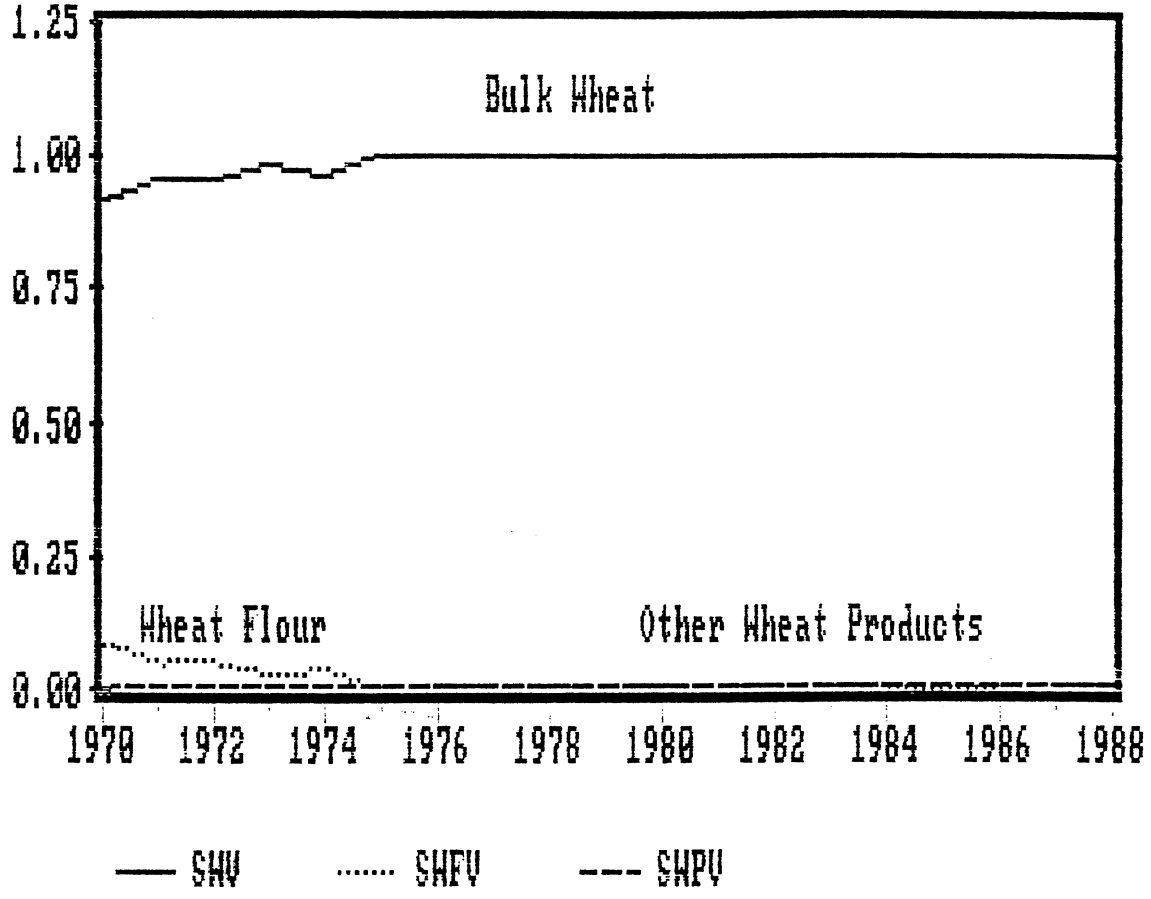
IMPORT SHARES OF U.S. BEEF PRODUCTS IN SINGAPORE



IMPORT SHARES AND REAL PRICES OF
U.S. WHEAT PRODUCTS IN KOREA

| Year | SWV | SWFV | SWPV | RPW | RPWF | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 0.91674 | 0.08225 | 0.00101 | 112464 | 121350 | 173201 |
| 1971 | 0.95277 | 0.04716 | 0.00007 | 127063 | 122204 | 698876 |
| 1972 | 0.94989 | 0.05010 | 0.00002 | 136552 | 132126 | 668174 |
| 1973 | 0.97921 | 0.02077 | 0.00002 | 267992 | 188350 | 742158 |
| 1974 | 0.96767 | 0.03231 | 0.00002 | 376827 | 359930 | 945313 |
| 1975 | 0.99909 | 0.00075 | 0.00016 | 256053 | 254392 | 488654 |
| 1976 | 0.99899 | 0.00098 | 0.00003 | 179506 | 272635 | 874435 |
| 1977 | 0.99984 | 0.00008 | 0.00008 | 133549 | 253694 | 1268468 |
| 1978 | 0.99942 | 0.00000 | 0.00057 | 133538 | 346209 | 863183 |
| 1979 | 0.99992 | 0.00005 | 0.00003 | 134989 | 159710 | 439202 |
| 1980 | 0.99982 | 0.00000 | 0.00018 | 154398 | NA | 434857 |
| 1981 | 0.99967 | 0.00007 | 0.00025 | 143388 | 201694 | 541041 |
| 1982 | 0.99984 | 0.00001 | 0.00015 | 129510 | 180477 | 664484 |
| 1983 | 0.99987 | 0.00003 | 0.00011 | 134814 | 202147 | 786208 |
| 1984 | 0.99998 | 0.00000 | 0.00002 | 126196 | NA | 1186844 |
| 1985 | 1.00000 | 0.00000 | 0.00000 | 127087 | NA | 890200 |
| 1986 | 0.99992 | 0.00000 | 0.00008 | 103969 | NA | 1061387 |
| 1987 | 0.99987 | 0.00006 | 0.00007 | 83828 | 206938 | 872851 |
| 1988 | 0.99990 | 0.00003 | 0.00007 | 84472 | 965220 | 1005438 |

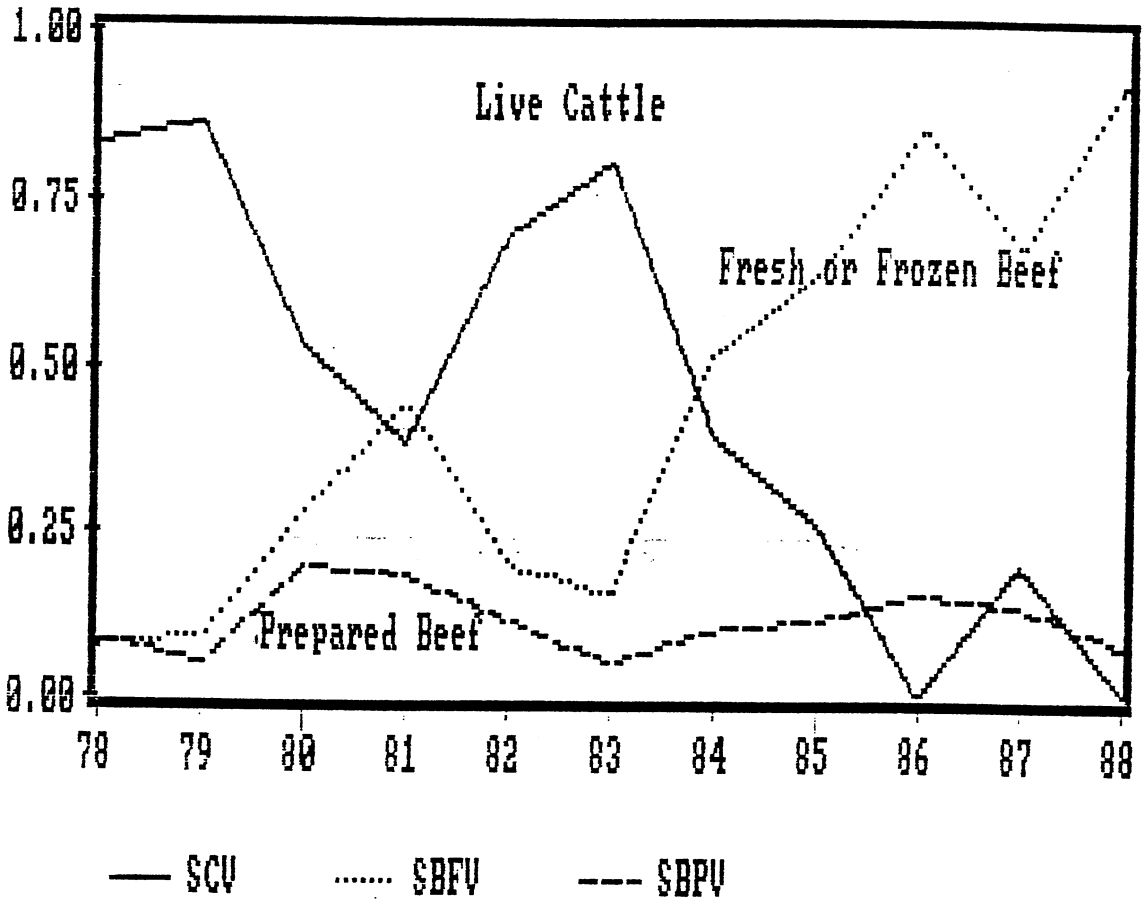
IMPORT SHARES OF U.S. WHEAT PRODUCTS IN KOREA



IMPORT SHARES AND REAL PRICES OF
U.S. BEEF PRODUCTS IN KOREA

| Year | SCV | SBFV | SBPV | RPC | RPBF | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.83519 | 0.07808 | 0.08672 | 1017189 | 3522995 | 1871344 |
| 1979 | 0.86480 | 0.08682 | 0.04837 | 1104368 | 4657188 | 2773605 |
| 1980 | 0.52889 | 0.27694 | 0.19417 | 1358251 | 6205845 | 1683867 |
| 1981 | 0.38021 | 0.43846 | 0.18133 | 696326 | 4643940 | 1740554 |
| 1982 | 0.69391 | 0.19500 | 0.11108 | 867991 | 4650671 | 5625538 |
| 1983 | 0.79821 | 0.15206 | 0.04973 | 649597 | 3616999 | 5134565 |
| 1984 | 0.38655 | 0.51498 | 0.09846 | 1252026 | 4574509 | 4881630 |
| 1985 | 0.25715 | 0.63047 | 0.11238 | 1629133 | 4676370 | 2953841 |
| 1986 | 0.00113 | 0.84852 | 0.15034 | 325818 | 4745762 | 2986574 |
| 1987 | 0.20015 | 0.66963 | 0.13021 | 3276147 | 5206313 | 3894007 |
| 1988 | 0.00471 | 0.92096 | 0.07432 | 831200 | 2791093 | 2780219 |

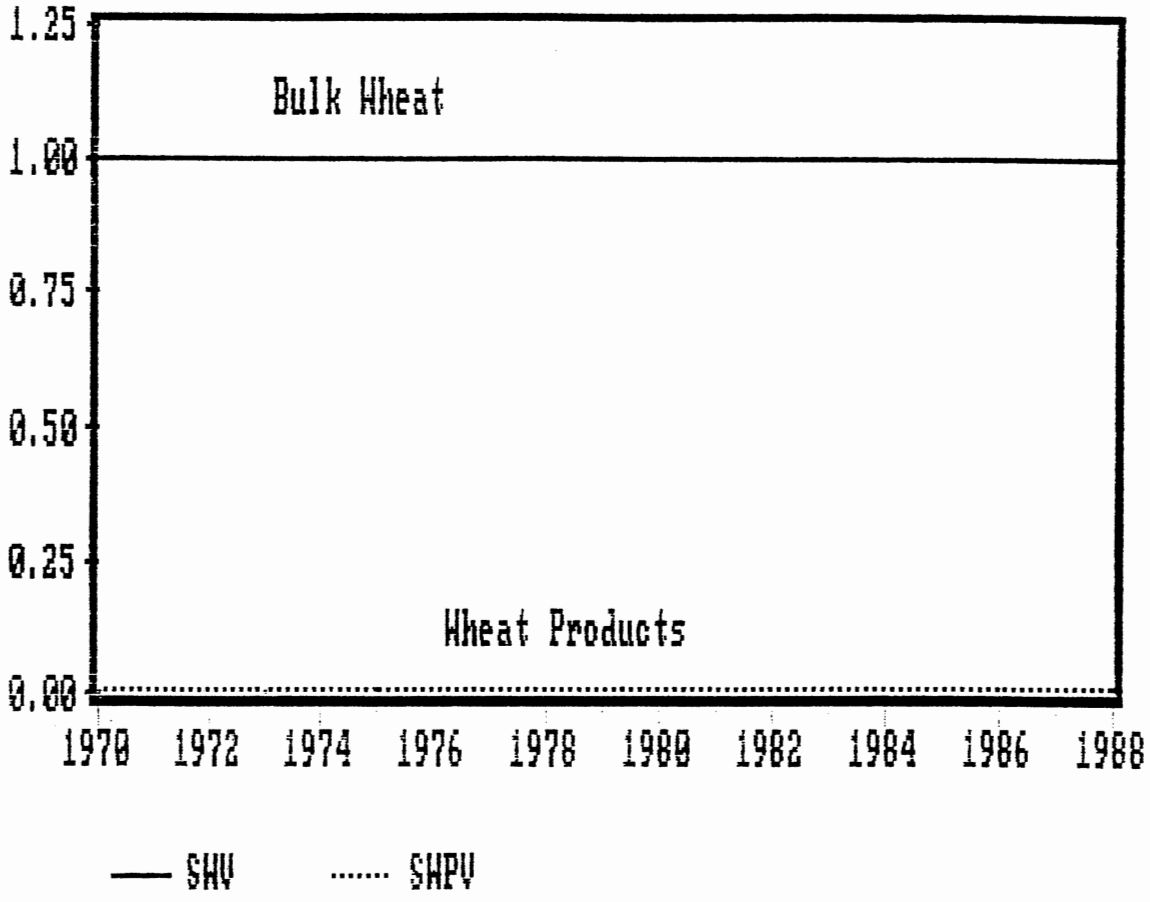
IMPORT SHARES OF U.S. BEEF PRODUCTS IN KOREA



IMPORT SHARES AND PRICES OF
U.S. WHEAT PRODUCTS IN TAIWAN

| Year | SWV | SWPV | PW | RPW | PWP | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 1.00000 | 0.00000 | 55.37 | 7282.8 | NA | NA |
| 1971 | 0.99996 | 0.00005 | 59.22 | 7575.5 | 1000.0 | 127918 |
| 1972 | 0.99997 | 0.00003 | 61.61 | 7650.6 | 333.3 | 41395.0 |
| 1973 | 1.00000 | 0.00000 | 148.66 | 16324.7 | NA | NA |
| 1974 | 0.99820 | 0.00180 | 189.09 | 13984.8 | 105.2 | 7783.2 |
| 1975 | 1.00000 | 0.00000 | 176.32 | 12391.4 | NA | NA |
| 1976 | 0.99988 | 0.00012 | 157.33 | 10787.6 | 360.0 | 24684.2 |
| 1977 | 0.99973 | 0.00027 | 116.21 | 7444.0 | 346.9 | 22224.7 |
| 1978 | 0.99988 | 0.00012 | 130.36 | 7698.9 | 360.0 | 21261.5 |
| 1979 | 0.99997 | 0.00003 | 149.77 | 7840.3 | 800.0 | 41879.8 |
| 1980 | 0.99998 | 0.00002 | 188.42 | 8280.5 | 100.0 | 4394.8 |
| 1981 | 0.99999 | 0.00001 | 191.71 | 7409.4 | 333.3 | 12883.4 |
| 1982 | 0.99999 | 0.00001 | 170.78 | 6806.9 | 1000.0 | 39857.4 |
| 1983 | 0.99986 | 0.00014 | 171.97 | 6925.4 | 245.9 | 9902.6 |
| 1984 | 0.99999 | 0.00001 | 166.97 | 6646.8 | NA | NA |
| 1985 | 0.99977 | 0.00023 | 153.58 | 6163.2 | 1045.5 | 41954.0 |
| 1986 | 1.00000 | 0.00000 | 144.92 | 5483.3 | NA | NA |
| 1987 | 0.99979 | 0.00021 | 124.18 | 3934.1 | 846.2 | 26806.4 |
| 1988 | 0.99925 | 0.00076 | 154.91 | 4350.0 | 1515.6 | 42559.9 |

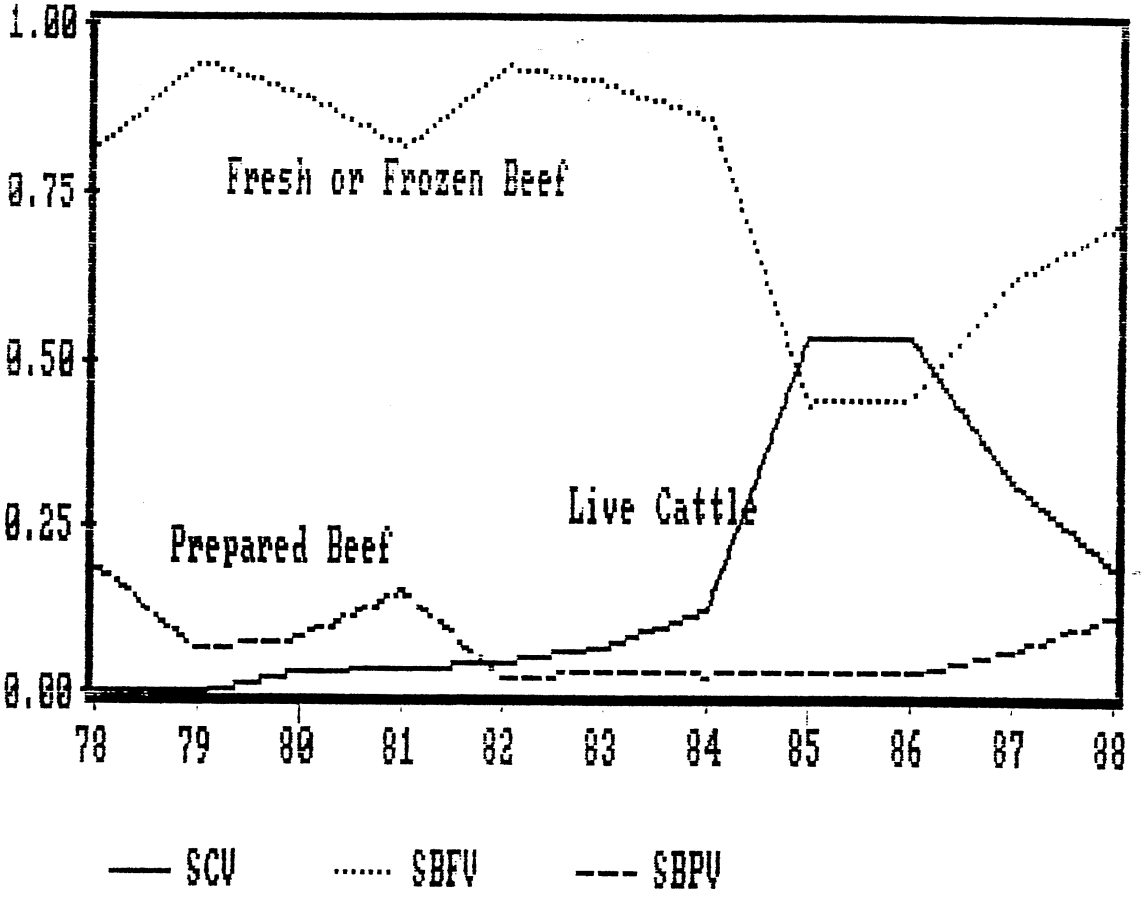
IMPORT SHARES OF U.S. WHEAT PRODUCTS IN TAIWAN



IMPORT SHARES AND REAL PRICES OF
U.S. BEEF PRODUCTS IN TAIWAN

| Year | SCV | SBFV | SBPV | RPC | RPBF | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.00000 | 0.81565 | 0.18435 | NA | 277066 | 306578 |
| 1979 | 0.00000 | 0.93765 | 0.06235 | NA | 116288 | 308737 |
| 1980 | 0.03341 | 0.88844 | 0.07815 | 61263 | 132435 | 223893 |
| 1981 | 0.04102 | 0.81112 | 0.14786 | 53917 | 207016 | 160614 |
| 1982 | 0.04745 | 0.93404 | 0.01851 | 58262 | 121639 | 253642 |
| 1983 | 0.06714 | 0.90648 | 0.02639 | 89759 | 145701 | 190736 |
| 1984 | 0.11928 | 0.85821 | 0.02251 | 56775 | 153839 | 208172 |
| 1985 | 0.53781 | 0.43497 | 0.02722 | 62286 | 222115 | 290463 |
| 1986 | 0.53147 | 0.44216 | 0.02637 | 51585 | 202372 | 105564 |
| 1987 | 0.32317 | 0.61837 | 0.05847 | 40672 | 158416 | 127792 |
| 1988 | 0.18950 | 0.69764 | 0.11286 | 36436 | 167771 | 128904 |

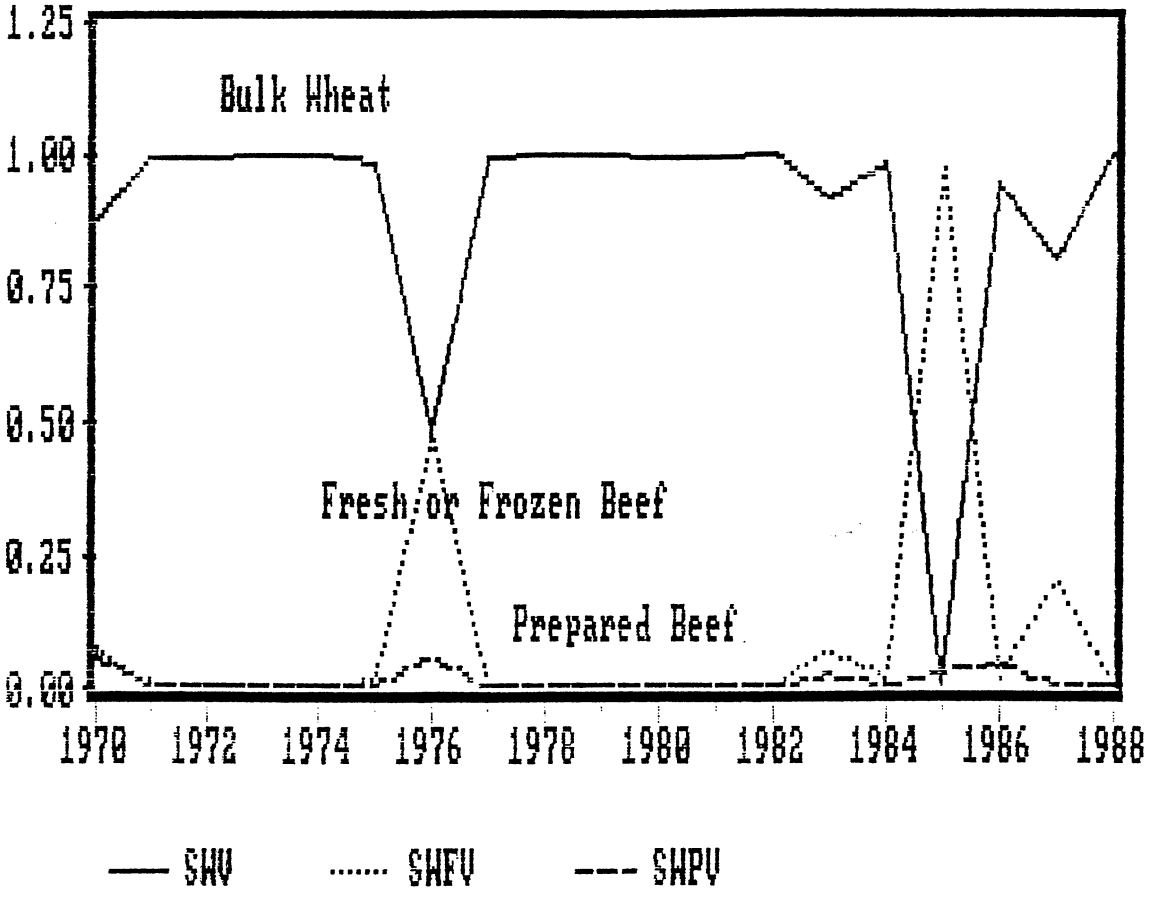
IMPORT SHARES OF U.S. BEEF PRODUCTS IN TAIWAN



IMPORT SHARES AND REAL PRICES OF
U.S. WHEAT PRODUCTS IN MEXICO

| Year | SWV | SWFV | SWPV | RPW | RPWF | RPWP |
|---|---|---|---|---|---|---|
| 1970 | 0.87427 | 0.06725 | 0.05848 | 38360 | 47131 | 93985 |
| 1971 | 0.99064 | 0.00735 | 0.00201 | 38189 | 31822 | 68177 |
| 1972 | 0.99694 | 0.00269 | 0.00037 | 37898 | 32189 | 236742 |
| 1973 | 0.99852 | 0.00119 | 0.00029 | 51895 | 21481 | 256098 |
| 1974 | 0.99935 | 0.00051 | 0.00015 | 72209 | 25270 | 201613 |
| 1975 | 0.98569 | 0.01232 | 0.00199 | 67402 | 46469 | 322421 |
| 1976 | 0.47756 | 0.46795 | 0.05449 | 88959 | 48196 | 318152 |
| 1977 | 0.99575 | 0.00384 | 0.00041 | 39077 | 40624 | 151931 |
| 1978 | 0.99837 | 0.00079 | 0.00084 | 48189 | 34730 | 51430 |
| 1979 | 0.99945 | 0.00035 | 0.00020 | 51548 | 42781 | 55027 |
| 1980 | 0.99254 | 0.00722 | 0.00023 | 45785 | 30204 | 168648 |
| 1981 | 0.99294 | 0.00676 | 0.00031 | 43756 | 14486 | 151681 |
| 1982 | 0.99758 | 0.00214 | 0.00027 | 93770 | 99642 | 634737 |
| 1983 | 0.91254 | 0.06601 | 0.02145 | 41772 | 100212 | 375796 |
| 1984 | 0.98408 | 0.01592 | 0.00000 | 45550 | 75931 | NA |
| 1985 | 0.00486 | 0.96921 | 0.02593 | 101373 | 87407 | 92925 |
| 1986 | 0.94118 | 0.01810 | 0.04072 | 35579 | 123993 | 557969 |
| 1987 | 0.79705 | 0.19929 | 0.00366 | 60347 | 104160 | 44733 |
| 1988 | 0.99782 | 0.00077 | 0.00141 | 28388 | 39705 | 141415 |

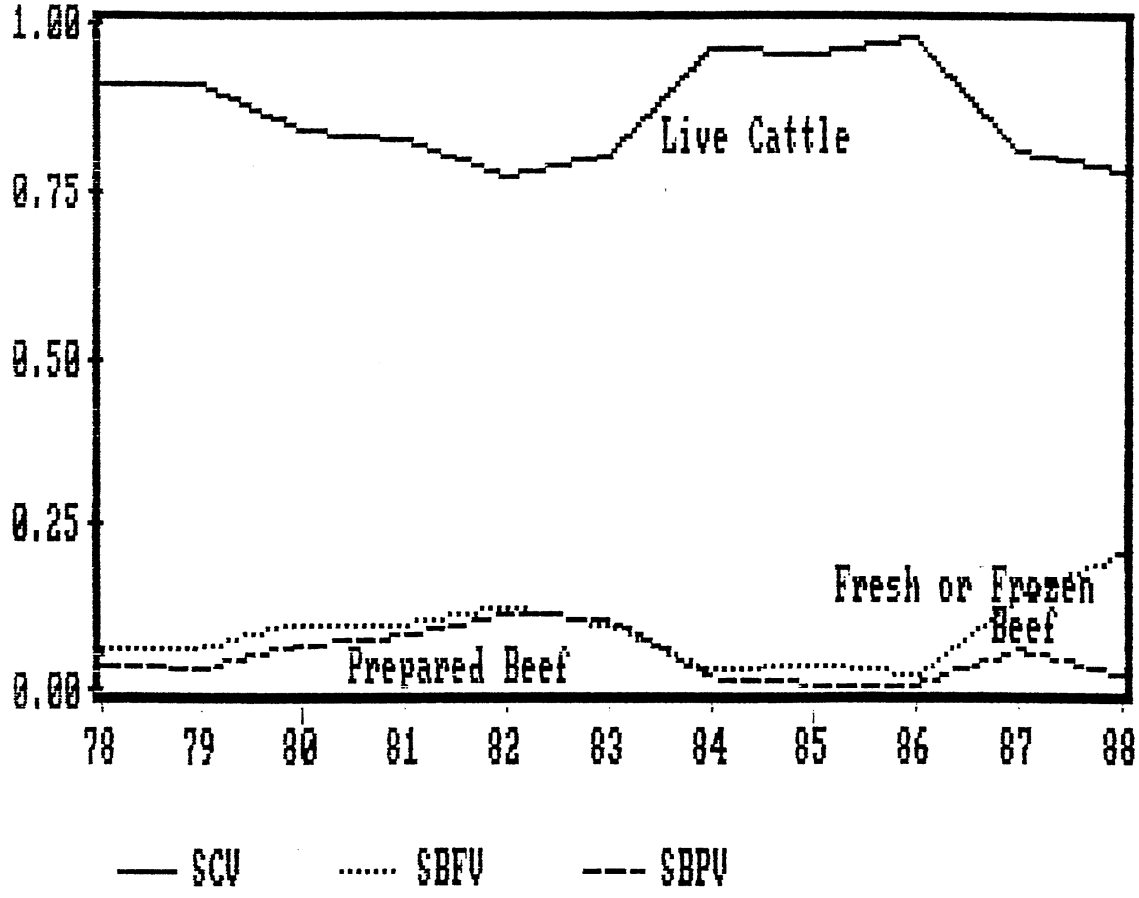
IMPORT SHARES OF U.S. WHEAT PRODUCTS IN MEXICO



IMPORT SHARES AND REAL PRICES OF
U.S. BEEF PRODUCTS IN MEXICO

| Year | SCV | SBFV | SBPV | RPC | RPBF | RPBP |
|---|---|---|---|---|---|---|
| 1978 | 0.91009 | 0.05428 | 0.03563 | 239126 | 817658 | 738491 |
| 1979 | 0.91171 | 0.06028 | 0.02801 | 239714 | 788495 | 619441 |
| 1980 | 0.83630 | 0.09865 | 0.06505 | 214532 | 650967 | 648701 |
| 1981 | 0.82559 | 0.09665 | 0.07776 | 171190 | 591381 | 658640 |
| 1982 | 0.76788 | 0.12143 | 0.11069 | 329409 | 1417659 | 1380563 |
| 1983 | 0.80296 | 0.09294 | 0.10410 | 211322 | 1419972 | 896486 |
| 1984 | 0.95935 | 0.02498 | 0.01567 | 194748 | 798148 | 974285 |
| 1985 | 0.95634 | 0.03740 | 0.00625 | 340009 | 885626 | 871031 |
| 1986 | 0.97733 | 0.01764 | 0.00502 | 415595 | 1712145 | 1373550 |
| 1987 | 0.81051 | 0.13492 | 0.05457 | 319981 | 958273 | 749827 |
| 1988 | 0.77911 | 0.20283 | 0.01806 | 134896 | 641845 | 705433 |

IMPORT SHARES OF U.S. BEEF PRODUCTS IN MEXICO



VITA

Jung-Hee Lee

Candidate for the Degree of

Master of Science

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