ELSHEIKH, Abdelmoneim Mohamed, 1936-
AN ECONOMETRIC ANALYSIS OF THE IMPORT DEMAND FOR OILSEEDS AND OILSEED PRODUCTS IN THE EUROPEAN ECONOMIC COMMUNITY: IMPLICATIONS FOR SUDANESE AGRICULTURAL POLICY.

The University of Arizona, Ph.D., 1976
Economics, agricultural

AN ECONOMETRIC ANALYSIS OF THE IMPORT DEMAND FOR OILSEEDS AND OILSEED PRODUCTS IN THE EUROPEAN ECONOMIC COMMUNITY: IMPLICATIONS FOR SUDANESE AGRICULTURAL POLICY

by

Abdelmoneim Mohamed Elsheikh

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF ECONOMICS

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

1 9 7 6

THE UNIVERSITY OF ARIZONA

GRADUATE COLLEGE

I hereby recommend that this dissertation prepared under my direction by Abdelmoneim Mohamed Elsheikh

entitled An Econometric Analysis of the Import Demand for Oilseeds and Oilseed Products in the European Economic Community: Implications for Sudanese Agricultural Policy.

be accepted as fulfilling the dissertation requirement for the degree of Doctor of Philosophy

Roger Fox 8/11/76

Dissertation Director Date

As members of the Final Examination Committee, we certify that we have read this dissertation and agree that it may be presented for final defense.

Robert L. Finch 8/11/76

Foster D. Taylor 8-24-'76

Final approval and acceptance of this dissertation is contingent on the candidate's adequate performance and defense thereof at the final oral examination.

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Alu El sheikh

ACKNOWLEDGMENT

I wish to express my deep appreciation and gratitude to Dr. Roger W. Fox for the time he devoted and for his constructive guidance throughout the work on this research.

My thanks also go to Professors Robert S. Firch and Lester D. Taylor who, as members of the Committee, helped by their comments, suggestions and criticisms in the completion of this Dissertation.

My gratitude to Dr. Jimmye S. Hillman, Head of the Department of Agricultural Economics, for his encouragement and for the financial help he provided at various times.

Thanks are due to Mr. Paul Johnson of the Agricultural Experiment Station for his assistance in the programming and the analysis of the data.

The secretaries of the Department of Agricultural Economics deserve my appreciation for the typing services they provided.

The contribution of the government of Sudan, who financed my education, is gratefully acknowledged.

And, finally, to my wife, Nuwar, and my children: Souhair, Almoatassem and Sara, I express my appreciation and indebtedness for the patience and sacrifices they showed during my study.

TABLE OF CONTENTS

TABLE OF CONTENTS--Continued

LIST OF TABLES

LIST OF TABLES--Continued

LIST OF ILLUSTRATIONS

ABSTRACT

The primary purpose of this study was to investigate, with the assistance of an econometric model, the import demand for oilseeds and oilseed products in the European Economic Community (E.E.C.). At first, a simultaneous model consisting of eight equations was attempted. This model was estimated using two stage least squares regression analysis. The results were not satisfactory due mainly to the high intercorrelations between the exogenous variables. Because of this, the model was modified into two models. Model I contained four behavioral equations, (1) import demand for oilseed meals, (2) import price of soybean meal, (3) import demand for oilseeds, and (4) import price of soybeans, and four identity equations. Model II consisted of one equation for the import demand for vegetable oils. The data sets for the two models covered the period 1952-1973.

In Model I, the import demand for oilseeds and oilseed meal was related to the import price, the E.E.C. livestock population, the E.E.C. price of feed grains, net supply of fishmeal and the production of oilseeds in the E.E.C. Model I was estimated using two stage least squares and ordinary least squares. In the meal import equation, the import price of meal, the price of feed grains and the net supply of fishmeal were significant explanatory variables. In the oilseeds import equation, however, prices were not significant. Model I exhibited a complementary relationship between oilseeds and oilseed meals, on the one hand, and feed grains on the other. This type of relationship between the two groups

of feeds existed because both are essential ingredients in mixed feed industries. The results also indicated that fishmeal is a close substitute for oilseeds and oilseed meals as sources of protein in animal feeding.

In Model II, import price of oil and per capita private consumption expenditure were significant in explaining changes in total imports of vegetable oils. The other two variables included in the equation the E.E.C. retail price of butter and domestic production of olive oil plus the oil equivalent of E.E.C. production of oilseeds, were not significant.

Model I was used to make projections for the import demand for oilseeds and oilseed meals. The projections indicated that by 1985 total imports of oilseeds and oilseed meal will reach 60.1 million metric tons, an increase of 313 percent over average total imports during 1971-73. Imports of soybeans and soybean meal will account for a considerable share of this increase. Furthermore, the model showed that total imports of the traditional oilseeds--peanuts, cottonseeds, copra, and palm kernels--will be declining during the projection period. This result, in particular, has important implications for Sudan. It suggests that Sudan should undertake market promotional activities in the E.E.C., should start concentrating on other markets--particularly in the developing countries, and give more attention to the domestic market. The results also suggest that changes be made to the structure of Sudan's oilseeds sector with the purpose to introduce new oilseed crops with potentially good markets. Production of soybeans, in particular, is recommended to receive major attention.

Suggestions for improvement in E.E.C.-wide data and further studies based on dynamic models were made. With respect to Sudan, it was recommended that studies on demand for oilseeds and oilseed products in different regions and in the domestic market be undertaken. This should go together with studies on the supply side and with improvements in the availability of data at the various levels.

CHAPTER 1

INTRODUCTION

Sudan is mainly an agricultural country. Approximately 80 percent of its labor force is employed in agriculture and related activities (United Nations, Food and Agricultural Organization [UN, FAO], Production Yearbook, 1974, p. 18). In 1970, about 35 percent of the country's gross national product (GNP) was contributed by agriculture (United Nations, Department of Economics and Social Affairs [UN, DESA], Statistical Yearbook, 1974, p. 629). Recent plans to develop the national economy have emphasized the promotion of the agricultural sector by bringing new lands into production, introducing new crops into the rotation, and through improving the productivity of the currently employed factors of production. At the same time, cotton, traditionally the leading Sudanese cash export, is being deemphasized in favor of sugarcane, oilseeds, wheat, and livestock. Major development schemes for mixed farming and specialized crop production are under way.

Within this framework of developing the agricultural sector, the goal of increasing total output of oilseed crops has received considerable attention in the recent years.[1] The average annual area devoted

1. These include the traditional crops: peanut, sesame, cottonseeds (a byproduct of the cotton industry) and castor beans. Other oilseeds--safflower, sunflower and soybeans--are still in the experimental stage and are intended to be introduced to commercial production so that the country can cope with the changing nature of the world market for oilseeds.

to peanuts, sesame, and castor beans has increased from 526,000 hectares during 1957/58-1959/60 to 860,000 hectares during 1968/69-1970/71. Meanwhile, total oilseed output, including cotton seeds, increased from 517,000 metric tons (m.t.) to 960,000 m.t. per annum, giving an increase of 86 percent between the two periods (Bulletin of Agricultural Statistics of the Sudan, Ministry of Agriculture, Department of Agricultural Economics, Statistics Section, 1964/65--1969/70, inclusive). In 1973 and 1974, total production was estimated at 956,100 and 1,346,300 m.t., respectively, (UN, FAO, Production Yearbook, 1974, pp. 90-122).

In the foreign trade sector of the economy, exports of oilseeds and oilseed products[2] amounted to 66.5 million dollars per annum during 1969-1971 as compared to 39.3 million dollars per annum during 1959-1961. In relative terms, oilseeds and their products maintained their share in the total value of Sudan's exports during the last 10 to 15 years. This share amounts to 23 percent of the total value of all exports from the country (Foreign Trade Statistics, Ministry of Planning, Department of Statistics, Khartoum, Sudan, 1960-1971, inclusive).

On the other hand, a good proportion of the oilseed crop is devoted to the export market. For example, exports of cake and cake-equivalent of oilseeds amounted to 60 percent of the total production of oilseeds in 1970/72 (expressed in cake-equivalent) as compared to

---

2. Vegetable oils and oilseed meal and cake are the two by-products of the oilseed crushing industry. The term oilseed meal refers to extracted meals which are obtained from solvent extraction of seeds and generally contain less than one percent oil by weight. The term oilseed cake, on the other hand, refers to expeller cake and is obtained from pressing seeds and generally contains 3-7 percent oil by weight. In this study, no distinction is made between oilseed meal and cake.

75 percent in 1964/66. At the same time, exports of oil and oil-equivalent of oilseeds amounted to 32 percent in the first period as compared to 53 percent in the second period (see Table A-19).

One of the major export markets for Sudan's oilseeds is the European Economic Community, hereafter referred to as E.E.C.[3] Exports to this region amounted to 60 percent of the total value of Sudan's annual exports of oilseeds and oilseed products during 1958-1960 and declined slightly to 51 percent during 1968-1970 (Foreign Trade Statistics, 1960-71, inclusive).

The E.E.C. is considered to be the world's leading importing region for oilseeds and oilseed products. During 1959-1961, the nine countries that are now members of the Community imported 5.1 million m.t. of oilseeds, 1.2 million m.t. of vegetable oils and 4.0 million m.t. of oilseed meals with a total annual value of 1.3 billion dollars. By 1960-1971 annual imports of oilseeds averaged 8.0 million m.t. while imports of vegetable oils and oilseed meals averaged 2.0 million m.t. and 7.3 million m.t., respectively, with an annual total value of 2.3 billion dollars. The significance of the E.E.C. share in world imports of oilseeds and oilseed products is illustrated in Table 1.

Underlying the increased volume of E.E.C. trade of oilseeds and oilseed products is the rise in per capita consumption of vegetable oils on the one hand and of meat, eggs, and dairy products on the other hand (Table 2).

---

3. The Enlarged Community comprises Belgium-Luxembourg, Denmark, France, Germany, Ireland, Italy, Netherlands, and the United Kingdom.

Table 1. The E.E.C. share of world imports of oilseeds and oilseed products.[a]

Period	Vegetable Oils and Oil-Equivalent of Oilseeds	Oilseed Meals and Meal-Equivalent of Oilseeds
1952-1961	67.0%	76.0%
1962-1971	46.1%	60.4%
1972-1973	44.0%	55.5%

a. Computed by author using data from UN, FAO Trade Yearbook, 1952-1974, inclusive.

Table 2. Per capita consumption of vegetable oils, meat, eggs, and dairy products in the E.E.C., 1955-1959 and 1971.[a]

Period	Vegetable-Oils (Fat Content)	Total Meat	Eggs	Dairy Products (Excluding Butter)
1955-1959	9.7	55.7	12.0	151.3
1971	12.2	76.2	13.1	148.6

a. Organization for Economic Cooperation and Development (OECD), Food Consumption Statistics: 1955-1971, Paris: 1973. Figures are kilograms per capita.

The increased per capita consumption of meat, eggs and dairy products can be taken as an indicator for increased number and/or increased productivity of the animal resources in the Community which reflects, in turn, an increasing demand for animal feeds, particularly those with high-protein content such as oilseed meals.

The Research Problem

It can be concluded from Table 2 that consumption of oilseeds and their products in the E.E.C. during the last 15 to 17 years has been increasing. At the same time only about 16-20 percent of the Community's requirements are being satisfied by domestic production. Self-sufficiency in these products is far from being realized and the member countries will continue to be heavily dependent on imports from non-member countries.

Several factors contribute to the expanding demand for oilseeds and oilseed products in the E.E.C. Since the level of consumption of fats and oils is largely determined by the level of income ("General Agreement on Tariff and Trade," International Trade, 1965, 1966, p. 41), the shift in the demand for vegetable-oils could be explained partly by the rising level of per capita income in the member countries of the Community. In the case of oilseed meals, the increased number of animal units, due to increased demand for animal products and the long-term movement toward concentrated protein-rich animal feeds ("General Agreement on Tariff and Trade," International Trade 1973-74, 1974, p. 30), are among the main factors contributing to the increased demand for oilseed meals. It is the goal of this study to define, investigate, and analyze these and other factors with the purpose of estimating the import demand for oilseeds and oilseed products in the Community, and to make projection of this demand. Such knowledge will be of interest to policy makers both within the E.E.C., in planning for the Community's future needs, and in the exporting countries in their effort to increase their relative share of the market. As far as Sudan is concerned, it has been shown above that the European Economic Community is a major outlet for a good part of the country's total output of oilseeds and oilseed products. Hence, quantitative estimates of the level of demand for oilseeds in the E.E.C. and the future trend of this demand will be of great value to the Sudan in evaluating its policies to cope with the changes that might occur in the E.E.C. market for oilseeds. For example, given alternative assumptions about Sudan's share of the E.E.C. oilseed market, estimates of the level of import demand could be used as a basis for estimating production as well as resources committed to oilseed production.

Objectives of the Study

The over-all objective of this study is to investigate the economic forces that influence the import demand for oilseeds and oilseed products[4] by the European Economic Community, and to analyze the future trend of this demand in the light of the behavior of these forces. More specifically, the objectives of the study are the following.

1. To construct an econometric model of the structure of the oilseeds market in the E.E.C. based on the period 1952-1973.

---

4. For the purpose of this study and unless otherwise indicated, oilseeds, vegetable oils and oilseed meals considered in this research include the following: oilseeds--soybean, peanut, cotton seeds, sunflower seeds, rape seeds, copra, palm nut and kernel, and linseeds; vegetable-oils--soybean oil, peanut oil, cotton seed oil, sunflower seed oil, rape seed oil, coconut oil, palm kernel oil, palm oil and olive oil; oilseed cake and meal--meal and cake from soybean, peanut, cotton seeds, sunflower seeds, rape seeds, copra, palm kernel and linseed.

2. To estimate the structural parameters of the model and to determine the relevant elasticities.

3. To make projections of the import demand for oilseeds, vegetable oils and oilseed meals for the period 1980-1985.

4. To derive policy implications for Sudan's development strategy in the field of production and export of oilseed crops.

Review of Literature

There are a large number of recent studies on import demand that contain quantitative estimates of the influence which certain factors have in determining the volume and origin of imports. Some of these studies focus on the analysis of total imports (Ball and Marwah 1962) whereas others focus on import demand for certain categories of goods (Kreinin 1973; Kwack 1972; Price and Thornblade 1972). The disaggregated approach has the advantage that more attention can be given to the specific needs of the economy under consideration and that a wider and more appropriate choice of the independent variables is possible. Furthermore, disaggregation enables utilization of high quality data on income and price to obtain more reliable estimates of income and price elasticities for particular commodity categories (Kwack 1972, p. 302). On the other hand, some studies found that the forecast of total imports yielded by an aggregate equation are not statistically inferior to those yielded by disaggregated equation (Norton, Jackson and Sweeny 1969, p. 589). Others argue that the price coefficients in aggregate models are likely to have smaller standard errors (Price and Thornblade 1972, p. 51).

In most of these studies, quantities of imports are regressed on import prices and income. Two different prices, both relative, are usually used. The first, is the unit value index of import prices divided by the domestic wholesale price index for the same commodity or group of commodities under consideration (Kreinin 1973; Kwack 1972). The second is the unit value index of import prices divided by the composite unit value index for imports from other foreign countries that supply the same commodity (Price and Thornblade 1972; Reimer 1964). In both cases the estimate of price elasticities derived indicate the degree of substitution that occurs among alternative sources of supply. As for the income variable, the purpose is to introduce an appropriate measure of the shift in domestic demand and/or domestic economic activity in the equation. The exact variable used may be real disposable income in the case of manufactured or consumption goods and domestic production (total output excluding services) in the case of raw materials. Some studies take account of other variables such as changes in stocks (Kwack 1972) while others introduce dummy variables to reflect seasonal movements in imports or structural changes or disturbances that occur during the period under consideration and which are not accounted for by the variables used in the analysis (Kreinin 1973; Price and Thornblade 1972; and Reimer 1964).

There are a number of studies focusing on the analysis of import demand for agricultural products in general (Abaelu and Manderscheid 1968; Ayob and Prato 1973; and Junghaus 1971), and on the demand for oil seeds in particular (Dahl 1965; Elz 1967; Houck 1965; Houck and Mann

1968; Moe and Mohtadi 1971; and Vandenborre 1966). The study by Moe and Mohtadi (1971) focuses upon the expected long run world demand for oilseeds and their products. Its main conclusion is that world trade in these commodities is expected to be competitive, i.e., with declining prices for vegetable oils and stable prices for oil cakes, import demand for vegetable oils in the less developed countries and for oilseed meals in the developed countries is expected to experience the greatest expansion. Houck and Mann (1968) and Vandenborre (1966) used different versions of the least square method to obtain estimates of the coefficients of U. S. domestic demand and foreign demand for U. S. soybeans and soybeans products. As far as foreign demand is concerned, these studies focus on the effect on the volume of U. S. exports of soybean and soybean products of changes in prices of the commodities in question, the number and prices of foreign livestock, and foreign availability of competing feeds. A trend variable is used by Vandenborre to reflect, in the case of oils, changes in population and shifts in taste and preferences away from animal fats and towards vegetable oils, and, in the case of meals, improvements in feeding technology. In the Houck and Mann (1968) study, price and income were good explanatory variables in the regional soybean export demand equations. Similarly, livestock numbers and their prices, and feed grain production were significant in the regional meal export equations. Vandenborre found that a one percent increase in European and Canadian livestock prices increases meal export from the U. S. by 1.47 percent while a one percent increase in the price of soybean meal decreases exports by 0.45 percent.

Except for the fact that the latter two studies included exports to western Europe as one equation in their models, specific studies of E.E.C. import demand for oilseeds and oilseed products are very scarce. Dahl (1965) projected increased demand for soybeans and soybean products by the E.E.C. based on rising number of livestock, better feeding practices, and favorable prices for soybeans relative to feed-grains. Elz (1967) used multiple regression analysis to estimate the requirements of the individual member countries of the E.E.C. (the Six), for vegetable oils and oilseed meals; these estimates were aggregated to obtain an estimate of total E.E.C. demand. The main purpose of Elz's study was to analyze the potential 1970 import demand of the Community for oilseeds and their products and the implications for the export of the United States.

Neither of the last two studies is specifically formulated in terms of structural relations. In both studies, the analyses and projections are made from time series data. Their analyses do not reflect the fact that in the real world economic relations are determined simultaneously; consequently, this fact may invalidate the single equation approach followed in the two studies. Furthermore, both studies are concerned with the demand in the original Six. This study, on the other hand, treats the Enlarged Community (the Nine) rather than the six member Community that existed prior to 1973. The study attempts to develop a model which reflects the joint product relationship between meal and oil and which contains the economic forces that determine simultaneously the import demand for both products. By use of a system of the simultaneous equations, the research problem will be to estimate all the parameters and to make predictions from the complete model. These predictions will be used to draw implications for Sudanese agricultural policy with respect to the production of oilseed crops.

CHAPTER 2

AGRICULTURAL POLICY OF THE EUROPEAN ECONOMIC COMMUNITY

This chapter briefly reviews the development of the E.E.C. and its agricultural policy. Special attention is given to the provision of the regulations for vegetable oils and oilseeds.

Development of the E.E.C.

The European Economic Community originated in 1957 when Belgium-Luxembourg, France, Germany, Italy and the Netherlands signed the Treaty of Rome on March 25 of that year. The core of the treaty was the formation of a custom union with these purposes: (1) removal of custom duties and import and export quotas between each of the six, (2) establishment of a common tariff and a common commercial policy with non-member countries, and (3) abolishment of obstacles to free movement of persons, services and capital between them. In effect, these were provisions to establish a large common market over a period of 12-15 years beginning January 1, 1958. The industrial sector was first to come under the regulations of the E.E.C. when in 1958 tariffs on industrial goods between the six countries were reduced by 50 percent and a large number of products were removed from the quotas list. The agricultural sector, which maintained a central role in the formation of the E.E.C. and at the same time proved to be the most difficult to bring to some sort of integration, was given until December 31, 1961, to develop a common agricultural policy to eliminate barriers on agricultural products and to work toward a common tariff and trade policy with countries outside the six. These were the broad goals around which the common agricultural policy was established (Andrews 1973).

Enlargement of the E.E.C.

The establishment of the E.E.C. was a long-sought goal of the European countries who considered it as a forceful instrument of European integration. Since the signing of the Treaty of Rome, other countries approached the original six for some kind of economic relationship. During 1961-63, negotiations started between Britain, Denmark and Ireland to join the E.E.C., provided each could obtain satisfactory terms for entry. The negotiations were difficult since acceptance to the Community meant that the marketing organizations in the new countries should be incorporated into the E.E.C. marketing system. In the case of Britain, in particular, the biggest problem was that of agriculture and what to do with the preferential treatment provided to the Commonwealth countries. Gradually these problems were settled and on February 1, 1973, Britain, Denmark and Ireland accepted the Common Agricultural Policy subject to transitional arrangements until 1977 (Butterwick and Neville-Rolfe 1968, pp. 249-267; Commission of the European Communities, Office for Official Publications of the European Communities [CEC, OOPEC], The Common Agricultural Policy, July 1974, p. 29).

The Assoicate Members

The E.E.C. has developed economic relationshps with outside areas to provide other non-member countries an access to the common market. These arrangements range from full association membership that grants all the preferences and privileges of the member countries in turn for free and unrestricted trade for the nine in the associate countries to bilateral agreements that give the non-member country the most-favored nation provisions for certain items of its exports to the E.E.C.

One of the most significant forms of association is the one between the E.E.C. and 46 of the African, Caribbean and Pacific states (ACP), which is based on Lome Convention of February 28, 1975. The agreement which came out of this Convention provided for (1) duty-free entry to the Community market for almost all imports from the ACP, (2) export-earnings stabilization machinery, and (3) financial assistance. In turn, the ACP states agreed not to discriminate between the member states and to accord treatment to the Community which is no less favorable than the most-favored nation treatment. Their relations with other developing countries, however, are excepted from this (C.E.C., Information Memo, P. 13, February 1975).

The Common Agricultural Policy (CAP)

Support for the agricultural sector by the member countries of the E.E.C. existed long before the initial steps for a common agricultural market were taken in early 1962. The national policies developed in an ad hoc fashion with varying stress being pursued in different countries and at different times. The long run objective of these policies was to improve the farm and marketing structure, and their short run objective was to support farm prices. The ultimate goal of these policies was to increase farm productivity and farm income. The mechanism used to achieve these objectives varied from one country to another. In Germany, for example, the approach was to set a system of import taxes and quotas together with direct farm subsidies designed to adjust the prices of imports to the level of the guaranteed producer prices for certain commodities. In France, the essential features of the agricultural policy prior to the enactment of the CAP included complete control of cereal marketing and target prices for most other products. In the Netherlands, farmers received considerable government support in the form of guaranteed prices for cereals, sugar beets, potatoes, and milk. Besides, the Dutch agricultural policy included graduated pension schemes for farmers voluntarily giving up their holdings for amalgamation with other units into larger farms. Support and reform policies in other member countries developed along similar lines (Butterwick and Neville-Rolfe 1968, pp. 10-53).

As experience showed, the individual countries were not successful in achieving their objectives, and progress was very slow in realizing higher income for the farm sector. This situation motivated the signatory members of the Treaty of Rome to study the agricultural sector of the community and to develop what later became the foundation of the Common Agricultural Policy. The objectives of this common policy as stated in Article 39 of the Treaty were the following (OECD, "Agricultural Policy of the European Economic Community," 1974, p. 375):

1. to increase agricultural productivity by promoting technical programs and by ensuring the rational development of agricultural production and the optimum utilization of the factors of production, in particular, labor;
2. to ensure a fair standard of living for the Agricultural Community, in particular, by increasing the individual earnings of persons engaged in agriculture;
3. to stabilize markets;
4. to assure the availability of supplies;
5. to assure that supplies reach consumers at reasonable prices.

The initial steps to achieve these objectives started early in 1962 with a view to gradually establish a common market for certain agricultural products. In the interim between 1962 and December 1969, basic regulations for various products were adopted and the transition to the final stage came on January 1, 1970. By this date all tariffs and quotas as well as all other restrictions on intra-Community trade were removed and the individual national tariffs on imports from non-member countries were replaced by a uniform system of variable levies for the Community.[1]

There are two important features of the support for the agricultural sector under the CAP; the first relates to the Guarantee System and the second to the Guidance System.

The Guarantee System

This is the largest of the two systems and accounted for 92 percent of the total European Agricultural Guidance and Guarantee Fund

---

1. This is true for every product covered by a common market organization. At present almost 90 percent of the Community agricultural production is covered by such regulations. Common regulations of the market for other products are still in preparation. For a summary of these regulations see Organization for Economic Cooperation and Development, Agricultural Policy of the European Economic Community.

(EAGGF or FEOGA, as it is generally referred to) in 1973. The Guarantee System is used to finance the Community's marketing and price policy. It deals with official intervention to support the market through purchases at minimum prices and with payments of export subsidies to enable the Community exporters to sell their products at low, world market prices.

The Guidance System

This system is established to finance all types of aid offered for the purpose of structural improvements of farms and marketing systems, retraining of farmers, retirement pensions for marginal farmers, financing special expenditures such as aids for the establishment of producer groups, and aids on censuses and statistical activities.

Both the Guarantee System and the Guidance System are financed through FEOGA which is a part of the E.E.C. budget.

The CAP with Respect to Oilseeds and Oilseed Products

The scale of oilseed production in the E.E.C. is very small and the Community produces only a very small part of its own needs of oils and oilcake. Historically the degree of self-sufficiency has not exceeded 22-26 percent of oil requirements (and only 11 percent if we exclude olive oil) and 4-5 percent of oilcake (see Table 6, p. 30 and Table 8, p. 35). This means that the Community depends heavily on imports from non-member countries to satisfy its needs. This situation has been a matter of concern to the Community policy-makers. From the beginning of common market organization for agriculture, it was one of their goals to lessen this dependency by promoting the Community's production of oilseeds. To achieve this goal, and at the same time to ensure a fair price to producers, production and marketing of olive oil, rapeseeds and sunflower seeds were regulated by Regulation No. 136 of September 22, 1966 (CEC, OOPEC, Official Journal of the European Communities, No. 172, Sept. 30, 1966, pp. 3025-3025).

More recently, cottonseed production has been covered by Regulation No. 1516 of July 12, 1971. According to this regulation, cotton producers are entitled to a subsidy which is determined annually at a uniform amount throughout the Community; the amount of the subsidy is fixed on a per hectare sown and harvested basis (CEC, OOPEC, Official Journal of European Communities No. L160, July 17, 1971, p. 122). As regards linseed and hempseed, payments per hectare were introduced in 1970/71 and effective November 1, 1974, a support system was applied to soybeans by Regulation No. 1900 of July 15, 1974 (CEC, OOPEC, Official Journal of European Communities No. L201, July 23, 1974, pp. pp. 5-6).

The main features of Regulation No. 136 are:[2]

1. <u>Regulations with respect to prices</u>. These are based on a system of prices that can be broken into the following types (Table 3):

   a. <u>Target or guide prices</u>. These are wholesale prices on Community-produced oilseeds and are set with reference to

---

2. With respect to the Enlarged Community, regulations covering oilseeds are supposed to be applied to Denmark, Ireland and the United Kingdom progressively between 1973-1978.

standard qualities. They are set each year in time to allow farmers to plan their production and at a level fair to producers with due regard to the need of maintaining the necessary volume of output in the Community.

In the case of olive oil, there are two types of target prices: a producer target price and a market target price. These prices are fixed so as to allow the normal marketing of olive oil taking into account prices of competing products. The market price is usually lower than the producer target price, reflecting the objective of stimulating output (Table 3).

b. Intervention prices. These exist to handle the situation when overproduction in the Community threatens to depress prices. They are designed to guarantee producers a price as close as possible to the target price, due account being taken of transportation costs to intervention agencies (centers). The basic intervention price is determined with respect to the most deficit area in the Community and derived prices for other areas are set throughout the Community to allow differences in supply and demand and to take account of transportation costs.

c. Threshold prices. These are entry prices and are fixed such that the selling price of imported oil at the frontier is the same as the market target price. Under Regulation No. 136, these prices apply only to olive oil and are used to calculate the import levy which is determined by the difference between these prices and the CIF import price.

Table 3. E.E.C. prices for olive oil and oilseeds.[a]

	Season[b]						
	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
				UA/Metric Ton			
Olive Oil:							
Producer target price	1150.0	1152.5	1152.2	1152.5	1152.5	1187.5	1247.0
Market target price	800	802.5	721	721	721	756	796
Intervention price	730	730	730	648.5	648.5	683.6	723.5
Threshold price	798	792.5	707	707	707	742	782
Rape Seed:							
Market target price	---	202.5	202.5	202.5	202.5	202.5	208.5
Intervention price	---	196.5	196.5	196.5	196.5	196.5	202.5
Sunflower:							
Market target price	---	202.5	202.5	202.5	202.5	202.5	210.5
Intervention price	---	196.5	196.5	196.5	196.5	196.5	204.5

a. Taken from Vegetable Oils and Oilseeds, A Review, Commonwealth Secretariat, London, 1973. UA (Unit of Account) is the monetary unit used in pricing in the Community budget.

b. November-October for olive oil; July-June for rapeseeds; and September-August for sunflower.

Market target prices, intervention prices and threshold prices are subject to identical monthly increments, account being taken of average storage costs and interest charges in the Community.

2. Aid to producers. The purpose of the regulations covering oilseeds is to encourage their production by ensuring domestic producers "fair" prices. Consequently, in most cases a subsidy is paid to the producers, and in the case of olive oil it is equal to the difference between the producer target price and the market target price.

In case of rape seeds and sunflower seeds, the subsidy is equal to the difference between the market target price and the lowest offer CIF price at E.E.C. ports (Table 4). In most cases, the payment is claimed by the crushers which means that the amount paid to producers when they deliver their crop to the crushing industry actually includes the amount of the subsidy due to them. The producers may be paid the market target price (thus getting the full amount of the subsidy) or they may be paid a lower price but higher than the intervention price. The actual outcome depends on the strength of the producer's bargaining power and that of the crusher.

To give an example: ignoring monthly increments, the basic Community market target price for rape seeds for season 1972/73 was set at UA 208.50 per metric ton (m.t.), giving a subsidy (at a world price of say, UA 153.00) of UA 55.50.

Table 4. E.E.C. and world prices of oilseeds.[a]

Season	Olive Oil			Oil Seeds		
	E.E.C. Entry Price[c] UA/m.t.	World Market Price UA/m.t.	Percent[b]	E.E.C. Entry Price[c] UA/m.t.	World Market Price UA/m.t.	Percent[b]
1968-69	1152.5	666.4	173	209.7	103.4	203
1969-70	1152.5	719.4	160	209.7	135.1	155
1970-71	1152.5	743.0	155	209.7	160.4	131
1971-72	1187.5	775.1	153	210.1	143.2	147

a. Taken from Agricultural Policy of the European Economic Community, OECD, Paris, 1974.

b. E.E.C. entry price as percentage of world market price.

c. E.E.C. entry price is equal to world price plus direct aids to producers.

Assuming a basic intervention price of UA 202.50/m.t., the crusher buying at something above this price, say UA 205.00, would obtain his seeds at a price below that ruling on the world market: UA 205.00 minus the subsidy of UA 55.50 equals UA 149.50, while he would be paying UA 153.00 on the world market. However, if the crusher pays the target price of UA 208.50, producers will be getting the full amount of the subsidy and the crusher will be paying the same price for home grown as for imported seeds. Notice that the size of the subsidy depends on the world market price; higher world prices results in lower subsidies. An extreme example of this occurred during the 1973/74 marketing season when the target price of rapeseed was set at UA 210.60/m.t. while the average world market price was UA 262.00. As a result, beginning December 1973 subsidies for rapeseeds were fixed at zero for the entire marketing year. The greater part of the Community harvest was marketed at satisfactory prices, especially in France where price levels were on the average from 20 to 80 UA/m.t. above the intervention (CEC, OOPEC, The State of Agriculture in the Community, Part II, 1974 Report, November 27, 1974, p. 53).

3. Regulations with respect to imports of oilseeds and oilseed products.[3] Olive oil imported at CIF prices below the threshold

3. Duties on oilseeds, traded between the new members (Denmark, Ireland and United Kingdom) and the original six were reduced starting from July 1973 and are supposed to be completely eliminated by July 1977. The common custom tariff against third countries was introduced to the new members in 1974 and is supposed to be completed by 1977.

price pays a levy equal to the difference between the two prices. Except for vegetable oils from the associated countries which are imported duty free, custom duties are about 10 percent for crude vegetable oils, 15 percent for refined vegetable oils for nutritional purposes, and 25 percent for edible oils. Under certain conditions, compensatory import levies may be applied for fats and oils from third countries. These are import taxes over and above the existing ones and are levied when imports reach certain volumes which cause or threaten to cause serious loss to producers in the Community or when one or several third countries grant subsidies on exports to the Community. Imports of oilseeds and oilseed cakes enter the Community duty free.

4. Subsidies and levys on exports. Olive oil exported from the Community may qualify for a refund (a restitution payment) if the Community price exceeds the world market price, but pays an export levy if the latter is above the Community price. Exports of oilseed also receive a subsidy to bridge the gap between the high Community prices and the lower world prices. Because of the normal deficit position, exports of oil and oilseeds are not common. Further, the export subsidy is normally set below the producer subsidy thus tending to discourage exports.

CHAPTER 3

THE OILSEEDS SECTOR OF THE EUROPEAN ECONOMIC COMMUNITY

Although several regulations have been adopted by the E.E.C. Commission to encourage expansion in the production of oilseeds by the member countries, the oilseeds sector occupies only an insignificant part of their agricultural economy. This chapter provides a general review of the situation with respect to the production of oilseeds in the Community and examines the principal trends in the consumption of oilseed products.

Production of Oilseeds

The main oilseed crops produced in the E.E.C., besides olives, are rapeseeds and sunflower seeds; France, Germany, and Denmark produced 92 percent of the Community's total production of these crops in 1973/74. The production of rapeseeds and sunflower seeds in the original six countries rose steadily from the establishment of Regulation No. 136 in 1966 until the 1973/74 marketing year. Rapeseed production rose from 578,800 metric tons (m.t.) in 1967/68 to 1.1 million m.t. in 1972/73, an increase of 76 percent; for sunflower seeds, production rose in the same period from 25,400 to 89,200 m.t., an increase of 250 percent (CEC, OOPEC, The State of Agriculture in the Community, Part II, 1974 Report, November 27, 1974, pp. 48-49).

This remarkable expansion of the Community production of oilseeds was due mainly to (1) the price level fixed by the Council of Ministers under Regulation 136, (2) the relatively favorable ratio between the price of oilseeds and that of other agricultural products competing with them in crop rotation, and (3) to the fact that rapeseeds and sunflower form very good main crops for rotation systems (CEC, OOPEC, The State of Agriculture in the Community, Part II, 1974 Report, November 27, 1974, p. 48).

In 1973/74, E.E.C. (the nine) production of rapeseeds amounted to 0.9 million tons while sunflower production reached a new high level of 117,000 metric tons. The future expansion in the production of rapeseeds and sunflower will depend on the level of the E.E.C. target prices and in general on the world market price level. More favorable world prices are expected to lead to an increase in the area devoted to rapeseed and sunflower seed.

Cultivation of olive trees is concentrated in Italy which historically accounts for 99 percent of the Community's olive oil production. The remainder is produced in France. These two countries supply about 70 percent of the Community's olive oil requirements. Since the establishment of the common organization of the olive oil market, there has been no signficiant change in the scale and structure of olive production in the Community, and the area cultivated has been practically stable at around 2.72 million hectares, with approximately 2.28 million in Italy and 440,000 in France (CEC, November 27, 1974, p. 41).

Production of soybeans is still in its infancy and is concentrated in France. In 1973, total output of this crop in the Community amounted to an insignificant 800 m.t. from about 9900 acres. When the price support system for soybeans was first recommended, it was argued that the system could expand production to 100,000 tons annually by 1978. If attained, this would amount to only one percent of the E.E.C. projected consumption requirements of soybeans in that year, which means the E.E.C. will continue to be heavily dependent on imports of soybeans and other oilseeds (United States Department of Agriculture, Foreign Agricultural Service [USDA, FAS], "Price Incentives for Soybeans Could Boost EC's Production," Foreign Agriculture, 12(20):2-4, May 20, 1974). Table 5 shows development that has occurred in production of oilseed crops during the period covered by the study.

Consumption of Oilseed Products

The demand for oilseeds depends upon the demand for oilseed products, namely oils and oilcakes, which are joint products of processed oilseeds. Although they are closely linked in production, the market demand for oils is largely independent of the market demand for oilcakes (Houck and Mann 1968, p. 8). This being the case, it is more appropriate to discuss the consumption of vegetable oils and oilcakes separately.

Consumption of Fats and Oils in the E.E.C.

Contrary to the situation in the major oilseed producing countries where the pattern of consumption of fats and oils reflects the available production, consumption of fats and oils in the E.E.C., as a major importing region, is spread over a wide range of products. Given that the characteristics of the different kinds of oils and fats can be

Table 5. Production of oilseed crops in the E.E.C. (the nine)--1952-1973.[a]

Year[b]	1,000 Metric Tons						
	Sunflower	Rapeseeds	Linseeds	Soybean	Cottonseeds	Groundnuts	Olive (for oil)
1952	16	334	93	--	10	8	1024
1953	10	170	73	--	12	8	2009
1954	7	139	79	--	15	10	1694
1955	8	161	46	--	22	10	1173
1956	13	156	57	--	13	10	1004
1957	9	257	94	1	14	10	2013
1958	9	284	68	1	12	11	1468
1959	7	219	60	1	18	12	1657
1960	12	182	90	--	9	12	2114
1961	18	225	90	--	9	13	2252
1962	30	347	105	--	6	12	1750
1963	48	275	101	--	9	12	2871
1964	26	426	114	--	8	11	1883
1965	20	516	70	--	7	7	2239
1966	23	472	74	--	4	7	1816
1967	21	633	56	--	4	6	2734
1968	27	696	37	--	3	4	1945
1969	38	720	45	--	3	4	2435
1970	56	811	33	--	2	3	2127
1971	93	979	41	--	2	2	3229
1972	91	1087	31	--	1	2	1880
1973	117	1059	21	--	1	2	2711

a. UN, FAO, Production Yearbook, 1952-1974.

b. The data for any particular crop refer to the calendar year in which the entire harvest or the bulk of it took place.

albered by processing, and that all soft oils are substantially interchangeable,[1] the availability of a large number of these products in the Community means that the degree of substitution between them is high. From the economic viewpoint, the possibility of substitution is enhanced by the availability of different kinds of fats and oils, their relative prices and the possibility of storage of oilseeds, oils and fats (UN, FAO, Approaches to International Action on World Trade in Oilseeds, Oils and Fats, 1971, pp. 57-73). Table 6 shows the estimated net available supplies of major vegetable oils in E.E.C. and the share of each product during selected periods of time. Table 6 also shows that only about 24 percent of the net available supplies is provided by the domestic production of oilseeds in the Community.

Trends in the Consumption of Fats and Oils. In general, human consumption of fats and oils in the E.E.C. is greatest for vegetable oils which accounted for 42.1 percent of the annual per capita consumption of total fats and oils during 1969/71. During the same period, per capita consumption of butter and animal fats accounted for 24 and 22.5 percent, respectively. The balance was contributed by marine oils and other oils and fats (Table A-7).

Considering the original six, per capita consumption of total fats and oils has steadily risen since the early fifties. From an

---

1. The different oils are defined as follows: soft oils include oils from soybeans, peanut, cottonseeds, olive, rapeseeds, sunflower seeds, and sesame; lauric oils include coconut oil and palm kernel oil; hard oils include tallow, palm oil, fish and seal oil, and whale oil.

Table 6. Estimated net available supplies of the major vegetable oils in the E.E.C. (the nine).

	Average 1962-64		Average 1965-67		Average 1968-70		Average 1971-73	
	Quantity 1000 m.t.	Percent	Quantity 1000 m.t.	Percent	Quantity 1000 m.t.	Percent	Quantity 1000 m.t.	Percent
Groundnut oil	344	14	445	15	415	13	298	11
Soybean oil	226	9	268	9	342	11	428	11
Cottonseed oil	95	4	81	3	53	2	59	2
Rapeseed oil	108	4	216	8	332	10	441	12
Sunflower oil	105	4	216	8	373	12	333	9
Olive oil	534	21	556	19	582	19	729	20
Coconut oil	468	19	504	17	380	12	488	13
Palm kernel oil	274	11	244	8	213	7	230	6
Palm oil	365	14	382	13	428	14	600	16
Total	2519	100	2912	100	3118	100	3706	100
Oil produced from domestic seeds:	548	22	659	23	753	24	965	26
Oil produced from imported seeds:	1157	46	1251	43	1110	36	1367	37
Net imports of oils:	814	32	1002	34	1255	40	1374	37

a. UN, FAO, Production Yearbook, 1952-1974, inclusive, and UN, FAO, Trade Yearbook, 1952-1974, inclusive.

average of 16.4 kilograms (k.g.) in 1953, it reached 22.5 k.g. per year during 1955-59 and 26.7 k.g. per year during 1965-69. Per capita consumption in 1971 was estimated at 28.7 k.g. (Table A-7, pp. 103-105). In the enlarged Community, per capita consumption of fats and oils increased from 25.3 k.g. per year during 1965-69 to 26.8 k.g. in 1971 (Table A-7, pp. 103-105).

Considering the individual member countries, per capita consumption varies from one country to another. During 1965-69, per capita consumption in the original six was highest in the Netherlands and Belgium-Luxembourg (31.9 and 31.0 k.g., respectively) and was lowest in Italy (19.8 k.g.). In 1971, Belgium and Luxembourg were leading (33.6 k.g.) followed by The Netherlands (33.2 k.g.), Germany (26.9 k.g.), France (25.4 k.g.), and Italy (24.9). Per capita consumption of fats and oils in Denmark, United Kingdom, and Ireland during 1971 was 29.7 k.g., 22.7 k.g., and 18.1 k.g., respectively (Table A-7, pp. 103-105).

Apart from differences in the level of per capita consumption, there are variations in the pattern of consumption among the member countries as between the different kinds of fats and oils (Table A-7, pp. 103-105). Butter is the main fat consumed in Ireland, accounting for about 54.1 percent of total fats and oils consumed per year during 1969-1971. Per capita consumption of butter is lowest in Italy and The Netherlands (1.6 k.g., 2.2 k.g., respectively), and its share in these two countries during the same period amounted to 6.7 percent of the per capita consumption of total fats and oils. Per capita consumption of vegetable oils is highest in Italy where it accounts for 86.4 percent of the per capita consumption of total fats and oils. Human consumption of vegetable oils is insignificant in the United Kingdom where the main fats include butter, margarine and animal fats. In Denmark, per capita consumption is spread evenly between vegetable oils, butter, marine oils and animal fats. Belgium-Luxembourg, France and Germany have a comparable per capita consumption of butter of about 7.3 k.g./year, and the share of butter in the per capita consumption of total fats and oils is about 26.5 percent. Animal fats play a much greater role in Belgium and Luxembourg than in any other member country, contributing about 30.5 percent of per capita consumption of total fats and oils.

Consumption of Oilcakes and Meals

Animal feeding in the E.E.C. is dependent upon a number of feeding stuffs, namely green fodder, cereals and protein containing substances. The relative importance of green fodder has been declining, and during the last ten years the area under permanent grass, pasture, and green fodder remained stable while beef and veal production increased by about 22 percent and milk output by about 10 percent (CEC, OOPEC, Report on the Community's Protein Supplies, Part IV, November 16, 1973, p. 2). Cereals are concentrated sources of energy that also have a protein content of 9-11 percent and under certain conditions can be substituted for protein containing raw materials. Protein containing substances include oilseed cake and meal, animal meal, leguminous plants, grass meal and milk powder. In the E.E.C., oil seed cake and meal represent the bulk of the protein requirements and account for about 72.3 percent of the total protein containing substances used for livestock feeding (Table 7).

Table 7. Products used for livestock feedings in the E.E.C. during 1971-72.[a]

	The Six		The Nine	
	Quantity (1000 m.t.)	Percent	Quantity (1000 m.t.)	Percent
Cereals	46902	74.3	67668	77.3
Leguminous Plant Seeds	800	1.3	890	1.0
Oil Seed Cake (Soybean)	11730 (6100)	18.6 (9.7)	14231 (7323)	16.3 (8.4)
Fish and Meat Meal	1401	2.2	2226	2.5
Grass Meal	1119	1.8	1347	1.5
Milk Powder	1163	1.8	1221	1.4
Total	63115	100	87583	100

a. CEC, OOPEC, November 27, 1974.

Trends in the Consumption of Oilseed Cakes. Consumption of oilcake in the Community has been increasing rapidly in recent years. In the Community of six, for example, consumption of cake increased from an average of 3.8 million metric tons during 1960/61-1961/62 to an average of 11.4 million metric tons during 1970/71-1971/72, giving an average annual growth rate of 10.5 percent over the ten year period as compared to 3.7 percent and 3.3 percent for animal meals and cereals respectively (CEC, OOPEC, November 16, 1973, p. 6; see also Table 8, p. 35). The trend in the United Kingdom, Denmark, and Ireland was less significant, since consumption of cake actually declined from 2.8 million metric tons in 1960/61-1961/62 to 2.3 million metric tons in 1970/71-1971-72, representing an annual decrease of 1.7 percent for the ten year period as compared to an annual rate of increase of 2.6 percent in the consumption of cereals.

For the nine member countries, consumption of cake increased from 6.5 million in 1960/61-1961/62 to 13.6 million in 1970/71-1971/72. Among the factors contributing to this increase is the expansion in animal production and the higher consumption of concentrate feeding stuff per animal unit.

Meat production (beef, veal, pigmeat, and poultry) increased from 11.7 million metric tons in 1960/61-1961/62 to 16.4 million in 1970/71-1971/72, an increase of about 40 percent, over the ten year period. Similarly, production of milk increased from 84.6 million metric tons to 93.0 million and of eggs from 2.8 million tons to 3.7

Table 8. Estimated net available supplies of the major oilcakes in the E.E.C. (the nine).[a]

	Average 1962-64		Average 1965-67		Average 1968-70		Average 1971-73	
	Quantity (1000 m.t.)	Percent	Quantity (1000 m.t.)	Percent	Quantity (1000 m.t.)	Percent	Quantity (1000 m.t.)	Percent
Groundnuts	1136	17	1033	13	841	10	903	8
Soybeans	1995	30	3104	38	3830	44	5545	50
Cottonseeds	887	14	956	12	920	10	870	8
Rapeseeds	261	4	426	5	524	6	868	8
Sunflowers	352	5	531	7	627	7	422	4
Linseeds	824	13	765	9	708	8	749	7
Copra	496	8	644	8	598	7	844	7
Palm nuts and kernels	407	6	391	5	324	4	348	3
Others	197	3	264	3	396	4	581	5
Total	6555	100	8114	100	8768	100	11130	100
Oilcakes from domestic seeds:	263	4	330	4	422	5	594	5
Oilcakes from imported seeds:	2130	33	2370	29	2634	30	3528	32
Net imports of oilcakes:	4162	63	5414	67	5712	65	7008	63

a. Computed by the author using data from UN, FAO, Production Yearbook, 1952-1974, inclusive, and UN, FAO, Trade Yearbook, 1952-1974, inclusive.

million tons over the same period. Meanwhile, production of composite feeding stuff, of which oilseed cake is a major component, increased in the enlarged Community from an average of 23.2 million metric tons in 1960/61-1961/62 to 50.9 million metric tons in 1970/71-1971/72, giving an increase of about 119 percent as compared to an increase of about 40 percent in the production of meat, indicating a higher consumption of feeding stuff per animal.

Soybean cake is the major oilcake consumed in the Community and accounts for more than one-half of the total consumption of all oilcakes (Table 7). The increase in the Community's consumption of oilcake from 6.6 million metric tons/year during 1962-1964 to 11.1 million metric tons/year during 1971-73 was met largely by increased consumption of soybean cake, which increased by 3.5 million metric tons. Table 8 shows changes in the relative share of each product in the estimated net available supplies of the major oilcakes in the E.E.C. during selected periods of time. The table also shows that only about 4 to 5 percent of the quantity available for consumption is provided from oilseeds produced in the Community. The expansion in the consumption of soybean cake is due to favorable prices as well as increased world production of soybean cake which rose from an annual average of 17.3 million metric tons during 1962-64 to 27.7 million metric tons in 1971 and further to 32.8 million metric tons in 1973 (Table 9).

Consumption of other major oilseed cakes in the Community declined in relative and in some cases in absolute terms during the period 1962-72. For example, the share of groundnut cake in the net available

Table 9. World production of major oilseed meals expressed in soybean meal equivalent (annual) --1960-1973.

	Million Metric Tons								
Year	Soybean	Peanut	Sunflower	Cotton	Rapeseed	Linseed	Copra	Palm Kernels	Total
1960	14.80	3.45	2.04	4.98	1.34	1.35	.48	.17	28.61
1961	14.74	3.82	2.25	4.98	1.45	1.44	.55	.17	29.40
1962	17.29	3.97	2.59	5.04	1.49	1.39	.51	.16	32.44
1963	17.11	4.02	2.45	5.28	1.29	1.56	.53	.16	32.40
1964	17.42	4.13	2.29	5.53	1.31	1.50	.56	.16	32.90
1965	17.54	4.53	2.96	5.76	1.74	1.52	.53	.17	34.75
1966	20.59	4.39	2.77	5.89	1.67	1.52	.55	.16	37.54
1967	22.46	4.44	3.16	5.20	1.95	1.34	.51	.15	39.21
1968	23.44	4.57	3.25	5.08	2.09	1.10	.52	.15	40.20
1969	26.30	4.16	3.25	5.79	1.68	1.29	.50	.16	43.13
1970	27.0	4.4	3.4	5.6	2.1	1.61	.51	.17	44.79
1971	27.7	4.5	3.2	5.5	2.7	1.78	.60	.18	46.16
1972	29.8	4.8	3.3	6.1	2.8	--	2.1[b]	--	48.9
1973	32.8	3.9	3.2	6.5	2.6	--	2.0[b]	--	51.0
Annual Increase:									
1965-73 Trend	1.72	- .02	.05	.08	.14	--	--	--	2.00

a. USDA, FAS, Foreign Agric. Circular, Fats and Oils, January 1974 and April 1975.

b. Total for linseed, copra, and palm kernel meals.

supplies of the major oilcakes fell from 17 percent during 1962-64 to 8 percent during 1971-73. Similarly, the share of cottonseed cake, linseed cake, and sunflower seed cake fell from 14, 13, and 5 percent to 8, 7, and 4 percent, respectively (Table 8). Consumption of copra cake and palm nuts cakes fell from 8 and 6 percent during 1962-64 to 7 and 3 percent, respectively, during 1971-73. One of the reasons for the decline in the consumption of these oilcakes is the change in their prices relative to the prices of other products used for livestock feedings. Another reason is the stagnation and in some cases the actual fall in the world production of oil cakes from groundnuts, sunflower seeds, cotton seeds, rape seeds and linseeds, as shown in the Table 9).

CHAPTER 4

THE THEORETICAL FRAMEWORK OF THE MODEL

So far this study has investigated the agricultural economy of the oilseed sector in the E.E.C., and its marketing organization as contained in the Common Agricultural Policy. The investigation indicated that the E.E.C. production of oilseed crops provides only a small part of its total requirements and as such the E.E.C. imports the bulk of its needs. In the following chapter, the information provided above will be used to construct a model of the E.E.C. import demand for oil seeds and oilseed products. First, some theoretical concepts in model construction will be outlined; second, a diagrammatic exposition of the structure of oilseed economy in the E.E.C. will be outlined; third, the economic and statistical model will be presented; and finally, the chapter will be concluded with a discussion on estimating techniques and some associated problems.

Modeling Economic Behavior[1]

An economic model is a set of relationships which are consistent with the assumptions developed by the investigator and are based on economic theory and a priori knowledge of the existing factors that are

1. There are an increasing number of texts that have a good account of econometric models and associated problems. See for example Christ (1966), Hood and Koopmans (1953), and Wold (1964).

relevant to the subject under study. The number of the relationships in the model depends upon the objectives for which it is constructed and the explanations that are being sought. The variables included in the model are usually categorized into two types, endogenous and exogenous.

Endogenous Variables

These are the variables whose values are determined by the simultaneous interaction of the relations included in the model.

Exogenous Variables

These are predetermined variables[2] whose values are determined outside of the model and are not explained by the relations included in it; however, the explanation achieved by solving the model is conditional on the values of these exogenous variables (Johnston 1972, p. 2).

The essential purpose of using models in economic analysis is to simplify the complexities of the real world and thus to be able to grasp the main factors that govern the phenomena under study and to predict its future course.

In constructing models, the investigator usually specifies two sets of relations. The first is a set of behavioristic relations embodying hypotheses about the determination of the endogenous variables. These relations are assumed to hold only approximately; they contain an error which is assumed to be small and randomly distributed. The second

2. Predetermined variables denote both exogenous and lagged values of endogenous variables.

is a set of functional identities representing physical or technical relationships between the variables of the model. These identities are supposed to hold exactly in every time period and they contain no unknown magnitudes. They are used to close the model or to hold its simultaneity.

The two sets of relations, together with any specified restrictions, constitute the structural model and the model is said to be complete if and only if the number of the endogenous variables is equal to the number of the behavioristic and technical equations.

An Econometric Model of the Import Demand for Oilseeds and Oilseed Products in the E.E.C.

Oil and oilseed meal are the joint products of the oilseed crushing industry, and hence the market supplies of oil and meal are linked together through the quantity of oilseed crushed.

In the case of E.E.C., which is a major importing region for oilseeds and oilseed products, the Community satisfies its requirements through imports of oil and meal directly or in the form of oilseeds which are then crushed.

The share of each product in the total imports of the three products has not changed significantly during the last 15 years. For example, the share of meals in the total imports of meals and meal equivalent of oilseeds increased slightly from 52.2 percent during 1955-57 to 57.6 percent during 1970-72, while the share of oilseeds, expressed in meal equivalent units, declined from 47.8 to 42.4 percent. Similarly, the share of oil in the total imports of oil and oil equivalent of oilseeds increased from 43.7 percent in the first period to 50.7 percent in the second period while the share of oilseed in terms of oil-equivalent units--declined from 56.3 percent to 49.3 percent..

This relatively constant share of each product in the total imports indicates that oilseeds may not be a direct substitute for oils and meals; i.e., changes in the import price of oilseeds may not affect the level of imports of oils or oilseed meals. This point suggests that in a model for oilseeds and oilseed products, it might be more appropriate to include a separate equation for each of the three products.

To develop an understanding of the oilseeds market in the E.E.C. and at the same time to be able to determine the variables that constitute the model for import demand, the first step to be followed is to outline the factual and theoretical bases for constructing the model.

sented, and second the concept of excess demand will be discussed.

A Diagrammatic Exposition of the E.E.C. Market for Oilseeds and Oilseed Products

To be able to identify the forces that are involved in determining the level of import demand for oilseed- and oilseed products by the E.E.C., a diagram that represents the economic relations that constitute the market structure for this group of commodities was developed (Figure 1).

From the supply side, oilseeds production in the E.E.C. (mainly linseeds, rape seeds and sunflower and to some extent, cotton and

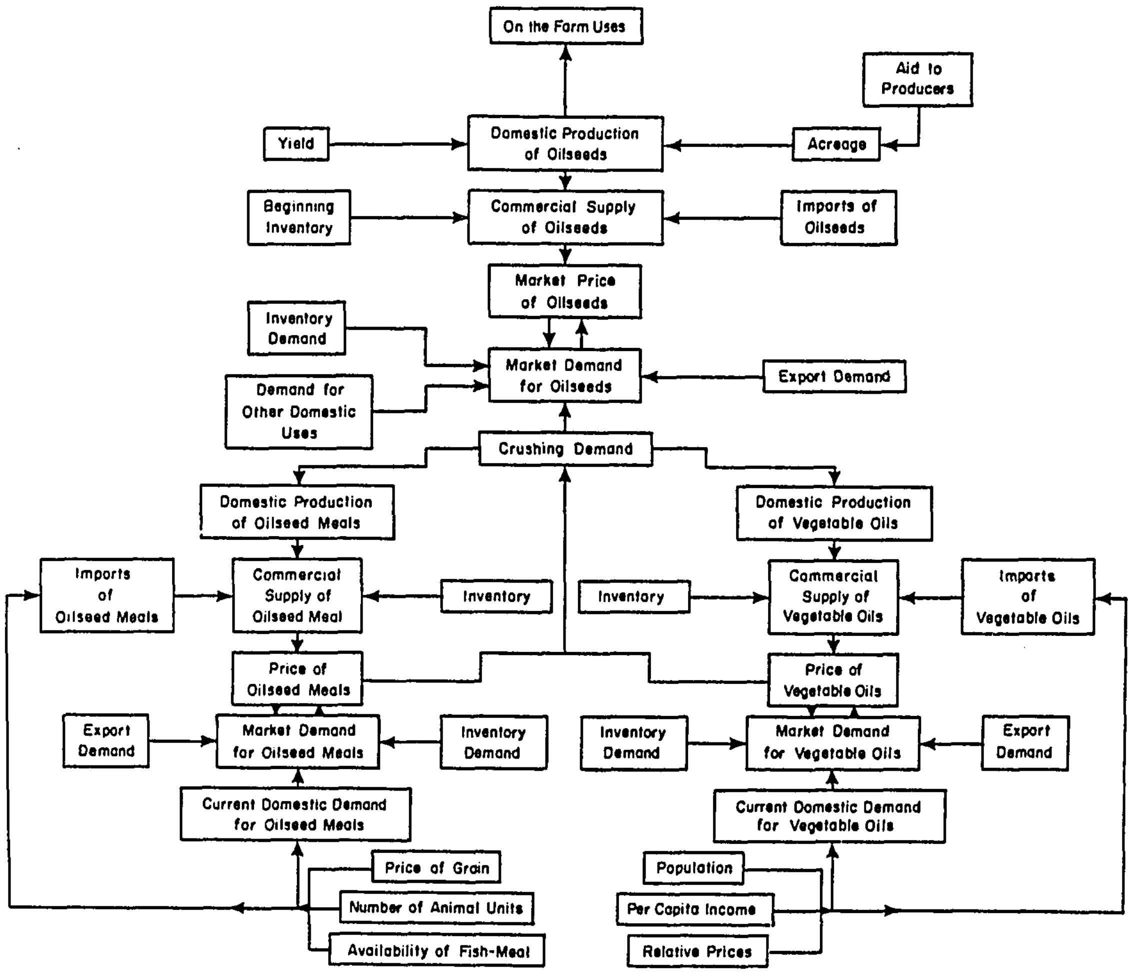

Figure 1. A simplified market structure for oilseeds and oilseed products in the E.E.C.

groundnuts; see Table 5 in Chapter 3) is determined by the acreage planted and per acre yield. The amount of the acreage planted is influenced by the level of the producer target price and by any subsidy or aid given to producers, as outlined in Chapter 2, together with input prices and relative prices of other products. After deducting the portion of total output used for seed, feed and other on-the-farm uses, the remaining output plus beginning inventory plus imports constitute the total commercial supply of oilseeds.

From the demand side, total market demand for oilseeds is the sum of the demand for crushing, direct uses, exports, and the demand for inventory. Theoretically, the interaction between the quantity supplied and the quantity demanded determine the market price of oilseeds. In the E.E.C., the bulk of the oilseeds supply is imported from non-member countries and is imported duty-free. Hence, prices normally vary in accordance with price developments on the world market. On the other hand, there is a system of market target prices designed to regulate the domestic production of oilseeds. Whenever the actual prices prevailing in the market are lower than the target prices, producers receive a subsidy equal to the difference between the two prices.

Total commercial supply of meal is the sum of the domestic production of meal plus imports plus beginning inventory. Since production of meals from oilseeds produced in the community is an insignificant part of the total supply, the level of meal imports is determined, to a large extent, by import prices, the size of the livestock population and the availability of substitutes, mainly feed grains and fishmeal.

Total demand for oilseed meal is the sum of domestic demand for direct feed and for mixed feed industry, the demand for exports and the demand for inventory. Again, the interaction between total supply and total demand determines the domestic price of meal.

In the case of oil, domestic production of oil, imports and beginning inventory constitute the total commercial supply. As in the other markets, the total supply is allocated between exports, domestic utilization and inventories. Human consumption of vegetable oils and utilization in food industries constitute the main portion of the total domestic demand for oils. Hence, the size of the population, per capita income and the prices of oils relative to the prices of substitutes are the main factors influencing the demand for oils.

A more simplified version of this model is represented by the flow chart in Figure 2. It shows total supply of oilseeds as the sum of domestic production and imports, constituting 11 percent and 89 percent of the total supply, respectively (1971-73). The crushing industry takes the bulk of the total supply, 49 percent, while the remaining part goes for export, 6 percent, and other uses, 45 percent (on-the-farm uses, direct consumption, etc.). Imports of meal constitute 67 percent of the total supply of oilseed meals and 85 percent of this total is consumed in the Community while 15 percent is exported. Figure 2 shows that imports of soybean meal alone constitute 52 percent of the total imports of all meals.

Similarly, imports of oils represent 45 percent of the total supply of vegetable oils; 74 percent of the total supply is for domestic utilization while 26 percent is for exports.

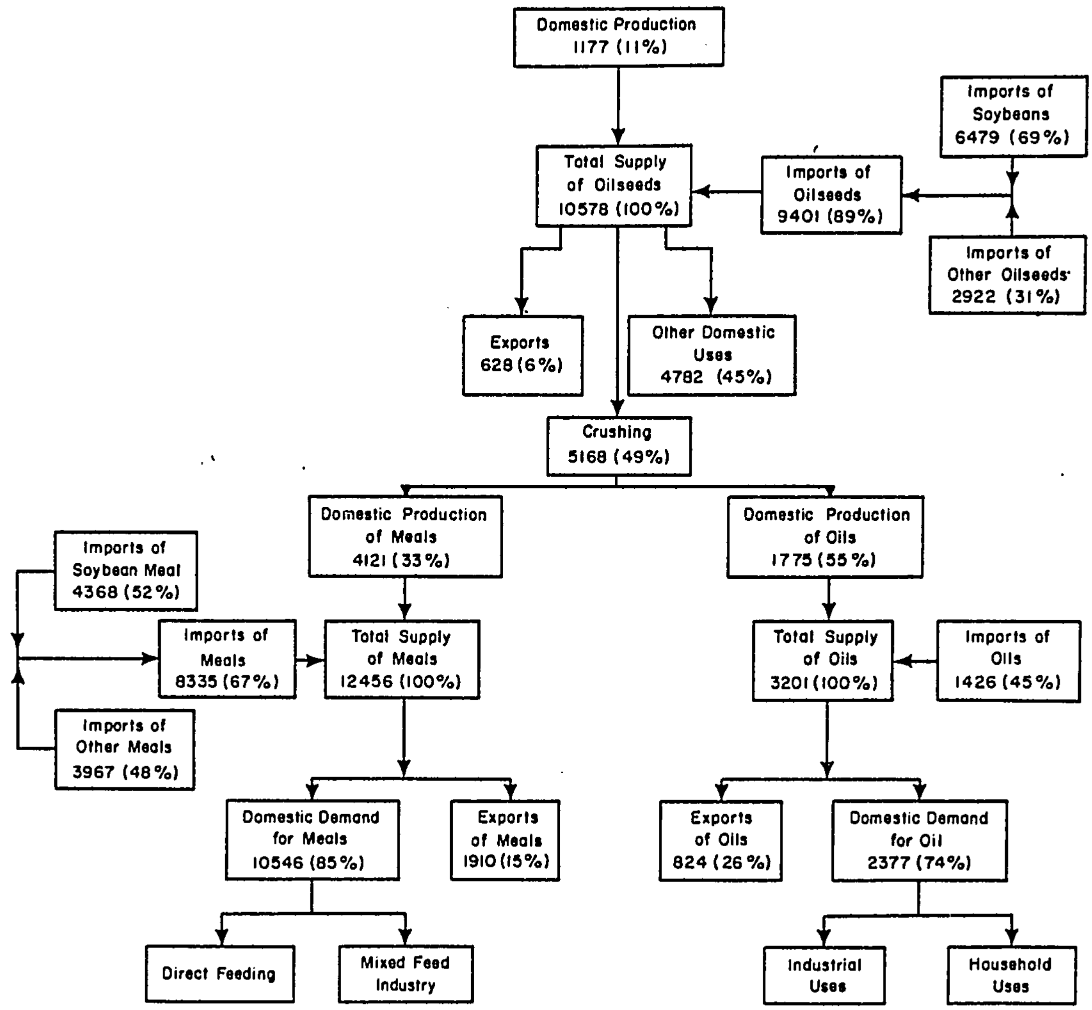

Figure 2. A simplified flow chart of the oilseed economy of the E.E.C. -- The figures represent 1971-73 averages in 1000 metric tons.

The Analysis in the Context of the Excess Supply and Excess Demand Concept

The theoretical framework of the model for import demand can be based on the concept of excess supply and excess demand. Some countries produce certain commodities in quantities greater than the amount required for domestic consumption and at a given price there exists an excess supply that moves to the world market. On the other hand, the production of these same commodities in other countries may be less than their total requirements or may even be non-existent, and, at a given price, there exists an excess demand. The countries with an excess demand satisfy their requirements by imports from the countries with an excess supply and at an equilibrium price, excess demand equals excess supply.

These concepts could be used, in the case of E.E.C., to derive its schedule of import demand for oilseeds and oilseed products. Data in the previous chapter showed that oilseeds production in the Community satisfies only a small part of its total requirements. The balance is secured from the world market at prices which tend to be lower than the target prices in the Community. This situation can be shown diagrammatically in Figure 3. For the purpose of illustration, consider oilseeds and oilseed products as one homogenous commodity whose consumption in the Community exceeds its domestic production at world price levels.

Figure 3a represents the supply-demand relationship in the exporting countries. Given a world price P_w, there is a surplus of q_a q_b. In the importing countries, and, at the same world price, P_w, there is an excess demand for the commodity under consideration equal to q_c q_d. Equilibrium in the world market is maintained when the excess supply in the exporting countries is equal to the excess demand in the importing

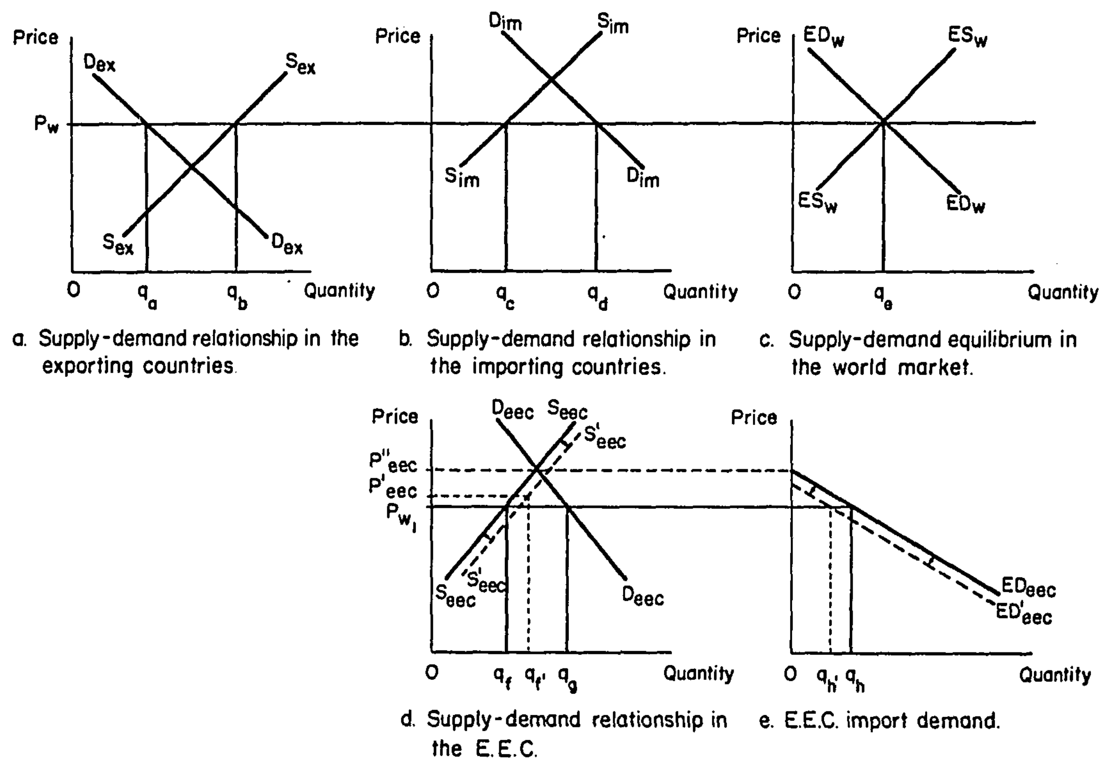

Figure 3. A hypothetical model of excess supply and excess demand of oilseeds in world trade, with reference to the oilseeds market in the E.E.C.

countries or when $q_a\ q_b = q_c\ q_d$. This is shown in Figure 3c where the excess demand curve ED_w-ED_w intersects the excess supply curve ES_w-ES_w at the equilibrium world price, P_w. Figure 3d depicts the oilseeds market in the E.E.C. and shows the effects of changes in the E.E.C. target prices for oilseeds on excess demand. In this diagram the world market price, P_w, is associated with a higher E.E.C. target price, say P_{eec} (not shown). Given these two prices, domestic production is o-q_f and domestic consumption is o-q_g and the excess demand is $q_g\ q_g$ which equals o-q_h in Figure 3e which is the schedule of import demand and shows the different quantities that are imported at different world market prices, given the E.E.C. target price. E.E.C. target prices for oilseeds are set each year in time to allow producers to plan their production. Under such a condition of certainty, producers can buy new machines, add to their production units or make other decisions according to the target price levels. This means that any increase in these prices will shift the supply curve to the right indicating an increase in the domestic production of these crops. As the target price increases to P'_{eec} the supply curve shifts to S'_{eec} and the quantity produced increases to o-$q_{f'}$. However, and since the higher target price does not affect the price paid by the consumers, the quantity demanded is not affected. As a result of the increased domestic production, with no change in the quantity demanded, excess demand will fall to $q_{f'}\ q_g$ In Figure 3e, the effect of the higher market target price with the accompanying expansion in domestic production and the fall in excess demand is to shift the import demand curve to the left. So, at the same world market price, P_w, the quantity imported will fall to o-$q_{h'}$, which is equal to $q_{f'}\ q_g$ in Figure 3d.

The Economic Model

Based on the above discussions and taking into consideration the general characteristics of the E.E.C. market for oilseeds and oilseed products, the relevant variables and relationships were specified in a model consisting mainly of two demand equations for meals and the meal-equivalent of oilseeds and two for oil and the oil-equivalent of oilseeds. The model also included four equations reflecting the way in which the observed data on prices are determined.

In general, the demand for meal (or oil) was conceived of as consisting of total demand and import demand. Total demand was defined as domestic production plus net imports. Some of the more important factors in determining changes in total quantity demanded for meal are prices of meal, prices of competing commodities, and the number of the consuming animal units. In addition to these factors, import demand for meal is expected to be influenced by the quantity of meal available from the domestic.

The total quantity demanded of vegetable oils is primarily influenced by the price of oil, prices of substitutes, the level of income and population. An additional factor influencing import demand for vegetable oils is the quantity of oil produced in the Community.

It should be noted that the model as specified below is applied to meal and oil in the aggregate. Meals from different types of oilseeds, processed by different methods under different conditions of temperature and pressure, have different amounts of protein, oil and fiber. The same is true among different types of vegetable oils which vary in their chemical composition and in their tendency to develop bad flavor when subjected to high temperature (Moe and Mohtadi 1971, pp. 191-200). Due to these variations among different meals and different oils, they could be classified as different commodities, though closely related. Hence, one could expect substitutions to occur among them when relative prices of the different types change. However, in order to simplify the model, the different meals and the different oils are treated as two, homogeneous commodities. In this case, the coefficients derived for meals and for vegetable oils will be assumed to represent an average of the separate types of meals and of oils, respectively.

Taking all of the above considerations into account, a preliminary model was specified as follows:

1. Total E.E.C. demand for meals: Y_1

$$Y_1 = F(Y_2, Y_3, X_1, X_2)$$

2. Wholesale price of groundnut meal in France: Y_2

$$Y_2 = F(Y_1, Y_3, X_3)$$

3. E.E.C. wholesale price of feed grains: Y_3

$$Y_3 = F(Y_2, X_4)$$

4. E.E.C. import demand for meals: Y_4

$$Y_4 = F(Y_3, Y_5, X_1, X_2, X_5)$$

5. Import price of soybean meal: Y_5

$$Y_5 = F(Y_3, Y_4)$$

6. Total E.E.C. demand for vegetable oils: Y_6

$$Y_6 = F(Y_7, X_6, X_7, X_8)$$

7. Wholesale price of groundnut oil in France: Y_7

$$Y_7 = F(Y_6, X_6)$$

8. E.E.C. import demand for vegetable oils: Y_8

$$Y_8 = F(X_6, X_7, X_8, X_9, X_{10})$$

The variables of the model were defined as follows, in order of their appearance in the equations.

Endogenous Variables

Y_1: Total domestic demand for oilseed meals in 1,000 metric tons (m.t.). This quantity is measured as net imports of meals and of meal-equivalents of oilseeds plus meals available from domestic production of oilseeds.

Y_2: Wholesale price of groundnut meal in France, U. S. dollars per m.t. in 1970 prices. This variable is used as a proxy for the domestic price of meals in the E.E.C.

Y_3: A weighted average wholesale price of rye, barley, and oats in Denmark, France, and Germany, measured in U. S. dollars per m.t. in 1970 prices.

Y_4: Total imports of meals and of meal-equivalents of oilseeds, expressed in 1,000 m.t.

Y_5: Import price of soybean meal, c.i.f. European ports, U. S. dollars per metric tons in 1970 prices.

Y_6: Total domestic demand for vegetable oils expressed in 1,000 m.t. and measured as net imports of oils and of oil-equivalents of oilseeds, plus oil available from domestic production of oilseeds.

Y_7: Wholesale price of groundnut oil in France, U. S. dollars per m.t. in 1970 prices. This variable is used as a proxy for the domestic price of vegetable oils in the E.E.C.

Y_8: Total imports of vegetable oils and of oil-equivalents of oilseeds, in 1,000 m.t.

Exogenous Variables

X_1: Population of livestock: cattle, pigs and poultry expressed in 1,000 animal units. Since these three categories are not of equal importance in the consumption of meals, their actual numbers were converted to animal units using these coefficients: cattle = .8, pigs = .2, poultry = .004.

X_2: Net supply of meals, soluble and similar animal feeding stuffs of aquatic origin expressed in 1,000 m.t.

X_3: Import price of groundnut meal, c.i.f. European ports, U. S. dollar per m.t. in 1970 prices.

X_4: Total net supply of feed grains in the E.E.C. in 1,000 m.t.

X_5: The meal-equivalents of oilseeds produced in the E.E.C. in 1,000 m.t.

X_6: A weighted average retail price of butter in the E.E.C.; U. S. dollars, per m.t. in 1970 prices.

X_7: A weighted average E.E.C. per capita consumption expenditure expressed in U. S. dollars and in 1970 prices.

X_8: Total population in the E.E.C. in millions.

X_9: Import price of groundnut oil, c.i.f. European ports expressed in U. S. dollars per m.t. and in 1970 prices.

X_{10}: The oil-equivalents of oilseeds produced in the E.E.C. in 1,000 m.t.

Thus, the model as specified consists of eight equations and it has eight endogenous variables, hence the system is complete. The model contains other variables which are considered to be external to the system, i.e., their values are not explained by the model, but taken as given or predetermined; these are the exogenous variables. This classification of the variables into endogenous and exogenous is a judgmental one and in general it depends upon the nature and extent of the system being studied and the purpose for which the model is being built (Johnston 1972, p. 342).

In this case, the classification into endogenous and exogenous is based on economic theory and a priori knowledge of the oilseeds market in the E.E.C. Hence, the variables Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7, and Y_8 are judged to be endogenous in the sense that they influence the oilseeds market and in turn are measurably influenced by it. This means that their values are determined simultaneously within the model. On the other hand, the variables X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, and X_{10} are assumed to be negligibly affected by the oilseeds market although the market is affected by changes in them. These are the exogenous variables of the system; their values are given and the explanation achieved by the model is conditional on those given values (Johnston 1972, p. 2).

The Statistical Model

For estimation purposes and hence to draw meaningful conclusions from the economic model, the model has to be set in a proper statistical form. For this purpose, it is assumed that the functional form of the equations are linear in the coefficients of the endogenous and exogenous variables, and that each relation contains a disturbance or an error term resulting from incomplete specification and/or measurement errors. Furthermore, the assumptions of the general linear model are maintained, i.e.,

1. The disturbance terms are normally distributed with zero expectation,

   $E(U) = 0$

2. The covariance matrix of the disturbances in a behavioral equation is the same for all t,

   $E(U_t U'_t) = \Sigma$; for $t = 1,2,\ldots t$

3. The disturbances are pairwise uncorrelated,

   $E(U_t U_{t+s}) = 0$ for $s \neq 0$

4. The predetermined variables are uncorrelated with the disturbances,

   $E(X'U) = 0$

5. The coefficient matrix of the endogenous variables is non-singular.

The statistical model is then specified as follows:

1. $Y_{1t} = A_1 - b_{12}Y_{2t} + b_{13}Y_{3t} + C_{11}X_{1t} - C_{12}X_{2t} + U_{1t}$

2. $Y_{2t} = A_2 - b_{21}Y_{1t} + b_{23}Y_{3t} + C_{23}X_{3t} + U_{2t}$

3. $Y_{3t} = A_3 + b_{32}Y_{2t} - C_{34}X_{4t} + U_{3t}$

4. $Y_{4t} = A_4 + b_{43}Y_{3t} - b_{45}Y_{5t} + C_{41}X_{1t}$

$$- C_{42}X_{2t} - C_{45}X_{5t} + U_{4t}$$

5. $Y_{5t} = A_5 + b_{53}Y_{3t} - b_{54}Y_{4t} + U_{5t}$

6. $Y_{6t} = A_6 - b_{67}Y_{7t} + C_{66}X_{6t} + C_{67}X_{7t} + C_{68}X_{8t} + U_{6t}$

7. $Y_{7t} = A_7 - b_{76}Y_{6t} + C_{76}X_{6t} + U_{7t}$

8. $Y_{8t} = A_8 + C_{86}X_{6t} + C_{87}X_{7t} + C_{88}X_{8t}$

$$- C_{89}X_{9t} - C_{810}X_{10t} + U_{8t}$$

In these structural relations, the A's represent the constant term, the b's are the coefficients of the endogenous variables (Y's) and the C's are the coefficients of the exogenous variables (X's) and U's are the disturbance terms. The subscripts t refer to the time period with

$t = 1, 2, 3, \ldots 22$. The sign preceding each coefficient in each equation corresponds to the expected relationship between the dependent and each explanatory variable. For example, the expected relationship between the quantity of meal demanded Y_1 and the price of meal Y_2 is negative, so b_{12} is negative.

Methods of Estimation

Before the appropriate estimating method for the above model could be selected, the identification status of each structural equation had to be established. For this reason a brief discussion of the identification problem is presented at this point.[3]

The Identification Problem. Statistical estimation of the parameters of a structural equation is impossible without having a priori restriction on some of them. In the absence of these restrictions, all equations in the model would look alike statistically in that each equation will be a linear combination of all endogenous and all exogenous variables and consequently, one could not distinguish between them in the sense that all of them will be compatible with both the theory behind the structure and the observed data. These different structures will have the same reduced form and the many sets of the simultaneous equations will have the same solutions. This means that the different structural equations will not be distinguished from each other and as a result the coefficients of these equations cannot be

3. For a good discussion of identification, see Johnston (1972, pp. 341-397), Goldberger (1964, pp. 306-318), and Koopmans (1953, pp. 27-48).

uniquely determined; they are not identified (Beals 1972, pp. 380-383; Johnston 1972, p. 354). The problem could be avoided by having some restrictions on the structural parameters or on the variance-covariance matrix. The restrictions on the parameters could state, for example, that some elements of the coefficient matrix are zero indicating that the variables to which they are related do not appear in the equation under consideration.

Necessary and Sufficient Conditions for Identification. A necessary condition for the identifiability of an equation in a system of G structural equations in N variables is that the number of variables excluded from the equation must equal at least the number of the equations in the model less one.

So if we let $R = G - g + K - k$, where,

R = number of variables excluded from the equation;

G = number of the equations in the model (= number of the endogenous variables in the model);

g = number of current endogenous variables included in the equation;

K = total number of the predetermined variables in the model;

k = number of predetermined variables included in the equation;

then the necessary condition for the identification of the equation becomes:

$$G - g + K - k \geq G-1$$

eliminating G from both sides and rearranging we get,

$$K - k \geq g-1$$

which states that identifiability of an equation requires that the number of predetermined variables excluded from the equation must be at least as great as the number of the endogenous variables included less one.

A necessary and sufficient condition for the identifiability of an equation is that the order of the determinant, formed by taking the columns of the coefficient matrix A which contain zeros in the rows corresponding to the equation under study, is equal to the number of the equations in the model less one.

So, if $A\phi$ is such a determinant[4] and G is the number of equations in the model, the necessary and sufficient conditions for the identifiability of any one equation is,

$$\rho(A\,\phi) = G\text{-}1.$$

In summary,

1. $K - k < g\text{-}1$ and $\rho(A\,\phi) = G\text{-}1$ implies under-identification;

2. $K - k = g\text{-}1$ and $\rho(A\,\phi) = G\text{-}1$ implies exact identification;

3. $K - k > g\text{-}1$ and $\rho(A\,\phi) = G\text{-}1$ implies over-identification.

With respect to the model specified above each structural equation is over-identified.

<u>Estimating Techniques</u>. Given a model consisting of a set of simultaneous equations, we are faced with a number of estimating

---

4. Where A is the coefficient matrix and ϕ is a matrix having G+K rows and a column for each restriction with ones denoting the restrictions and zeros elsewhere.

techniques, depending upon the nature of the system; i.e., whether it is exactly identified or over-identified. In cases of exact identification, a simple method of estimation is the method of indirect-least squares (ILS). This consists of estimating the parameters of the reduced form by the application of the ordinary least squares (OLS) to each reduced form equation separately and then deriving estimates of the structural parameters from the estimated reduced form parameters. For over-identified equations, ILS is not feasible and OLS results in biased and inconsistent estimates. The appropriate methods of estimation in this case include two stages least squares (TSLS), limited information single-equation (LISE), three-stages least squares (3SLS), and full information maximum likelihood (FIML). The first two methods are applied to each equation of the system separately, while the latter two are applied to the complete system as a whole.

Ordinary Least Squares (OLS). This is the classical and most widely used method of analysis. For its application, the following assumptions should be satisfied.

1. The errors are variables with zero expectation, i.e., $E(u_i) = 0$.
2. The error terms have constant variance, i.e., $E(u_i^2) = \sigma^2$.
3. The error terms are pairwise uncorrelated, i.e., $E(u_t u_{t+s}) = 0$, for $s \neq 0$.
4. The error terms should be independent of the exogenous variables.

These assumptions could easily be satisfied for a single-equation model and consequently the OLS would give consistent and efficient estimators in the case of large samples. For small samples, the estimators would be the best, linear, unbiased estimators (BLUE). But in the case of a system of simultaneous equations, one of the above assumptions may not be satisfied; for example, it might be the case that one of the endogenous variables is used as a dependent variable in one equation while it is used as an explanatory (or independent) variable in another equation; in this case it will not be uncorrelated with the error term as assumption 4 above requires, and so the OLS estimators will not be unbiased and for large samples they will not be consistent. One way to avoid this problem is to apply OLS indirectly, i.e., first express the original model in its reduced form; second, provided that the errors and the exogenous variables in the reformulated model are independent, apply OLS to each equation of the reduced form and derive estimates of the corresponding parameters; third, obtain estimates of the structural parameters using the reduced form parameters.

Two Stage Least Squares (TSLS). This method is applied to each equation in the system. The first step is to take the least square regression of the endogenous variables which are used as explanatory variables in the model on all the predetermined variables of the complete system. The purpose of this step is to eliminate any correlation that might exist between these endogenous variables and the error terms of the structural equations. The second step is to replace the original values of the endogenous variables by their estimated ones, allowing each equation to represent the dependent variable as a function of the relevant exogenous variables (those used in the equation being estimated) and the OLS regression values (predicted) of the endogenous variables. OLS is then used on the reformulated equations to attain the estimate of the structural parameters. These estimates will be consistent.

The method of two-stage least squares is commonly used for estimating an over-identified equation containing two or more endogenous variables. This method will be used in this study to estimate the structural parameters of the model, given the usual assumptions for the applications of the least square method, and the condition that the functional forms of the equations are linear in the coefficients of the endogenous and exogenous variables.

CHAPTER 5

A RESPECIFICATION OF THE MODEL AND EVALUATION OF THE STATISTICAL RESULTS

In the preceding chapter, the theoretical framework of the model for the E.E.C. import demand for oilseed and oilseed products was developed. From that, a preliminary model, consisting of a set of variables that were selected on the basis of economic theory and a priori knowledge was constructed. In this chapter, some difficulties that were encountered in the statistical estimation of the model will be examined. This will be followed by a modified version model and a discussion of its statistical results. The chapter will be concluded with a section on projections.

Difficulties in Estimating the Preliminary Model

When the preliminary model, as specified in Chapter 4, was estimated by the two-stage least squares method, the results were inconsistent with the hypothesized assumptions with respect to the direction of the relationships between the dependent and independent variables, and exhibited low levels of significance for some of the independent variables.[1]

---

1. The statistical results of the preliminary model are presented in Appendix B.

These difficulties came in part from using exogenous variables with high intercorrelation among them, as can be seen in Table B-1.

This intercorrelation between the exogenous variables violates one of the basic assumptions of the classical linear regression model, namely, the assumption that there should be no linear dependence between the exogenous variables. This means that none of these variables should be perfectly correlated with any other explanatory variable or with any linear combination of them. If this assumption is violated and an exact linear relationship connects the explanatory variables, we say that there is perfect multicolinearity between these variables. On the other hand, when all the explanatory variables are uncorrelated with each other we speak of absence of multicolinearity. A usual case, but still very serious, exists when some or all of the explanatory variables are highly but not perfectly correlated (Johnston 1972, pp. 159-168; Kmenta 1971, pp. 380-391). An examination of the statistical results of the preliminary model, as presented in Appendix B, shows that the existance of multicolinearity resulted in most variables being not significantly different from zero, although the separate equations gave high R^2, which indicated that the relationship under study had a good fit.[2] These results are not uncommon in such a situation. What happens

2. This does not mean that in the absence of multicolinearity the estimated coefficient would have been significantly different from zero. Large variance for these coefficients means that the acceptance region for the hypothesis that a given regression coefficient is zero will be wide. Accordingly the power of the test will be weak. Thus the test will not be very helpful in discriminating between the true and false hypotheses, whether the cause of large variance is the existance of multicolinearity or any other reason (Kmenta 1971, p. 391).

is that when the various exogenous variables are highly correlated, it becomes difficult, if not impossible, to separate the relative influence of the various X's and the estimates of the regression coefficients become imprecise. This imprecision arises because of the large variance of the least square estimators, which is caused by the high correlation between the X's. Very few explanatory variables may turn out to be significant and this could be the result of the fact that these particular variables are sufficiently strong and accordingly their estimated coefficients come out to be significantly different from zero in spite of the effect of multicolinearity in increasing their standard error. But, such colinearity, may obscure the presence of less strong variables.

Coping with the Problem of Multicolinearity

The literature on multicolinearity includes different approaches to cope with the problem. One approach is to use information about some regression coefficients from sources other than the sample at hand. This is the case when unbiased estimates of one or more of the regression coefficients from cross-section survey data are used in a sample of time-series observation (Kmenta 1971, p. 385). Another approach is to transform the available data to first differences. So, to take the first equation of the above model, instead of estimating,

$$Y_{1t} = A_1 + b_{12}Y_{2t} + b_{13}Y_{3t} + C_{11}X_{1t} + C_{12}X_{2t} + U_{1t}$$

the least square estimating method is applied to

$$Y_{1t} - Y_{1,t-1} = b_{12}(Y_{2t} - Y_{2,t-1}) + b_{13}(Y_{3t} - Y_{3,t-1}) + C_{11}(X_{1t} - X_{1,t-1}) + C_{12}(X_{2t} - X_{2,t-1}) + (U_{1t} - U_{1,t-1}) .$$

It is expected that this transformation may reduce the degree of multicolinearity; however, it introduces autocorrelation in the disturbances that are otherwise independent, thus resulting in large variances for the estimates of the coefficients and in inefficient predictions, i.e., predictions with needlessly large sampling variances (Kmenta 1971, pp. 390-391).

Still another approach is to increase the stock of information by, for example, combining time-series and cross-section data. The additional observations may increase the variation for some explanatory variables, thus reducing the variances of the estimated regression coefficients and hence increasing their reliability.

Neither of the two possible approaches to multicolinearity was pertinent to our study. On one hand, time-series data on the relevant variables and for the period before 1952 is limited. On the other hand, cross-section studies that could provide some information on the coefficients of some variables are not available. Hence, the alternatives are limited. One approach was to eliminate some of the explanatory variables which required a respecification of the model into two simple ones: one for the import demand for oilseeds and oilseed meals and the other for the import demand for vegetable oils.

The import demand for oilseed and oilseed meal (Model I) is specified as follows:

<u>Behavioral equations:</u>

1. $Y_{1t} = A_1 - b_{12}Y_{2t} + C_{11}X_{1t} - C_{12}X_{2t} + U_{1t}$

2. $Y_{2t} = A_2 - b_{23}Y_{3t} + C_{21}X_{1t} + U_{2t}$

3-A. $Y_{4t} = A_3 - b_{35}Y_{5t} + C_{31}X_{1t} - C_{33}X_{3t} + U_{3t}$

3-B. $Y_{4t} = A_3 + b_{32}Y_{2t} - b_{35}Y_{5t} + C_{31}X_{1t} - C_{33}X_{3t} + U_{3t}$

4. $Y_{5t} = A_4 - b_{46}Y_{6t} + C_{41}X_{1t} + U_{4t}$

Identity Equations:

$Y_{1t} = Y_{3t} + Y_{7t}$

$Y_{4t} = Y_{6t} + Y_{8t}$

$X_{4t} = Y_{1t} + Y_{4t}X_{5t} + X_{3t}X_{5t}$

$X_{4t} = X_{6t}$

where the variables are defined as follows:

Endogenous Variables:

Y_{1t} = total imports of oilseeds meals, m.t. per 1,000 of animal units

Y_{2t} = import price of soybean meal, 1970 U. S. dollars per metric ton

Y_3 = total imports of soybean meal, m.t. per 1,000 of animal units

Y_{4t} = total imports of oilseeds, m.t. per 1,000 of animal units

Y_{5t} = import price of soybeans, 1970 U. S. dollars

Y_{6t} = total imports of soybeans m.t. per 1,000 animal units

Y_{7t} = total imports of oilseed meals other than soybean meal, m.t. per 1,000 of animal units

Y_{8t} = total imports of oilseeds other than soybean, m.t. per 1,000 of animal units

Exogenous Variables:

X_{1t} = a weighted average producer price of barley, and oats in Denmark, France and Germany, 1970 U. S. dollars per m.t.

X_{2t} = net supply of meals, solubles and similar animal feeding stuffs of aquatic origin, m.t. per 1,000 of animal units

X_{3t} = production of oilseeds in the E.E.C., m.t. per 1,000 of animal units

X_{4t} = total consumption of oilseed meal, m.t. per 1,000 of animal units

X_{5t} = conversion factor for meal

X_{6t} = total supply of oilseed meals, m.t. per 1,000 of animal units

In this modified model for oilseeds and oilseed we have 8 endogenous variables and 8 equations (4 behavioral equations and 4 identity equations). The number of the exogenous variables is reduced to 5 (X_1, X_2, X_3, S_4, and X_5, with X_4 = X_6 indicating a supply demand equilibrium).

The import demand for vegetable oils comprises Model II and is specified as follows:

$$Y_t = A_1 - C_1X_{1t} + C_2X_{2t} + C_3X_{3t} - C_4X_{4t} + U_t \qquad [t = 1,2,\ldots,22]$$

where

Y_t = total imports of vegetable oils in metric tons per 100,000 of population

X_{1t} = import price of goundnut oil c.i.f. European ports, U. S. dollars per m.t. 1970 prices

X_{2t} = a weighted average retail price of butter, U. S. dollars per m.t., 1970 prices

X_{3t} = per capita personal consumption expenditures, U. S. dollars, 1970 prices

X_{4t} = domestic production of olive oil plus oil equivalent of domestic production of oilseeds, m.t. per 100,000 of population

All the explanatory variables are treated as exogenous.

Evaluation of the Statistical Results

Model I: Import Demand for Oilseeds and Oilseed-Meals

Model I, as specified above, consists of four behavioral equations and four identities and was estimated by two-stage least square method (TSLS) and ordinary least square method (OLS). The results will be discussed in light of econometric considerations, economic theory, and the available information on the E.E.C. market for oilseeds and oilseed meals.

In general OLS estimates of a simultaneous equation model give biased and inconsistent estimates, mainly because not all the independent (right-hand side) variables are uncorrelated with the error term, thus violating one of the basic assumptions for the application of the OLS. On the other hand, for finite sample sizes, the distribution of the TSLS parameter estimates is not known and accordingly the confidence limits for the parameter estimates cannot be constructed. Under these circumstances, the traditional significance tests are not appropriate for TSLS and OLS estimates of a simultaneous model (Houck and Mann 1968, p. 16). However, with respect to the OLS method of estimation, evaluation of the coefficient of multiple determination, R^2, and the standard error of estimated coefficients are useful; the first gives an indication of the goodness of fit based on the proportion of the variance in the dependent variable which is explained by variation in the endogenous and exogenous variables, and the second provides an approximate measure of significance for each estimated coefficient.

In the following presentation, the identification of the variables for each equation is the same as specified above. The standard error of regression is denoted by S. The numbers contained in parentheses beneath the estimates of the structural parameters are their standard errors. The coefficient of multiple determination is denoted by R^2. The symbol * indicates that the corresponding variable is significantly different from zero at five percent level. For each equation of the model, the results of both formulations (TSLS and OLS) are presented.

Equation 1: Import Demand for Meal.

$$\text{TSLS--}Y_1 = 484.876 + 1.202\, Y_2^* - 4.927\, X_1^* - 5.955\, X_2^*$$

$$(0.1281) \qquad (0.4841) \qquad (0.9674)$$

$$R^2 = .96 \qquad S = 5.732$$

$$\text{OLS--}Y_1 = 210.439 + .318\, Y_2^* - 1.809\, X_1^* - .263\, X_2$$

$$(0.1478) \qquad (0.6437) \qquad (1.4518)$$

$$R^2 = .81 \qquad S = 12.413$$

Comparing the results of the two methods of estimation and judging by the size of the residual mean square (32.85 for TSLS as compared to 154.09 for OLS), those obtained by the TSLS are better. On the other hand, all the estimated coefficients in both formulation are significantly different from zero, although the sign for the import price of meal Y_2 is questionable. Contrary to what was expected theoretically, the import price of meal is positively related to the total quantity imported. There are two possible explanations for this. One, there might be a problem of identification in the sense that the true demand schedule cannot be determined from the observations at hand; i.e., given a sample of the jointly observed values of Y_1 and Y_2, the structural equation is compatible with both a demand and a supply relation. In this case, the price-quantity relationship could be positive or negative (Koopmans 1953, p. 30). The second explanation is that the import price of soybean meal was used as a proxy for the import price of all meals, while soybean meal is only one component, though the dominant one, of the several types of meals which are imported to the E.E.C. Consequently, a specification error might have been introduced resulting in the inconsistent sign for Y_2.

The influence of the E.E.C. price of feed grains on the quantity of meals imported is indicated by a negative sign. This means that the relation between the two feed stuffs is one of complementarity. Holding other factors constant, if the E.E.C. price of feed grains rises $10.00, total imports of meals falls by 49.3 m.t. per 1,000 animal units, or 3.9 million m.t., considering the 1973 population of livestock in the E.E.C. This positive relationship between feed grains and oilseed meal is expected to exist in mixed feed industries where both are used in a fixed proportion.[3]

---

3. Moe and Mohtadi (1971, pp. 82-86), using an equation where the quantity of oilseed meal consumed (Q_m), was regressed on the price of meal (P_m), price of grain (P_g), quantity of other high-protein supplements (Q_{os}), and meat production in the previous years (LP_{t-1}), obtained a positive direct price coefficient,

$$\frac{dQ_m}{dP_m} \frac{P_m}{Q_m} > 0,$$

for western Europe countries other than U. K. and E.E.C., Canada and U.S.A. They argued that this result is caused by the interrelationship between oilseed meals and feed grains in the manufacture of mixed feeds, where meals and feed grains are combined in rather stable proportions with no significant competitive relationship existing between them. In this case, the price of feed grains, the major ingredient in mixed feeds, appears to have more influence than the price of meals in determining the level of oilseed meals use. Their results also confirmed the complementarity relationship between meals and feed grains for U.K., other western European countries, Japan, Canada, and U.S.A. For the E.E.C. (the Six) in particular their results showed a negative direct price coefficient,

$\frac{dQ_m}{dP_m} \cdot \frac{P_m}{Q_m} < 0$, and a positive cross price coefficient

$\frac{dQ_m}{dP_g} \cdot \frac{P_g}{Q_m} > 0$, showing a competitive relationship between meals and feed grain in the case of E.E.C.

The competitive influence of fishmeal, on the other hand, is indicated by the negative relationship between the net supply of fishmeal, X_2, and the quantity of oilseed meal imported. Both are considered high protein foods and consequently they compete for the same market.

According to the OLS results, the explanatory variables specified in this equation account for 81 percent of the total variation in the quantity of oilseed meal imported to the E.E.C. region.

Equation 2: Import Price of Soybean Meal.

$$\text{TSLS--}Y_2 = -96.172 + \underset{(.4220)}{.936}\, Y_3^* + \underset{(.4267)}{2.212}\, X_1^*$$

$$R^2 = .64 \qquad S = 22.732$$

$$\text{OLS--}Y_2 = -99.304 + \underset{(.4046)}{.966}\, Y_3^* + \underset{(.4136)}{2.236}\, X_1^*$$

$$R^2 = .65 \qquad S = 22.367$$

Here also, the import price, Y_2, and the total quantity imported, Y_3, exhibit a positive relation which is contrary to what was expected. The sign of the coefficient of the E.E.C. price of feed grains, X_1, on the other hand, confirms the complementarity relationship indicated by equation (1) between oilseed meals and feed grains. According to the OLS formulation, the two explanatory variables included in the relation, Y_3 and X_1, account for 65 percent of the total variation in the import price of meal.

Equation 3: Import Demand for Oilseeds.

Equation 3(A): The equation without the price of meal:

$$\text{TSLS--}Y_4 = 90.393 - .128\ Y_5 - .164\ X_1 + 3.839\ X_3^*$$
$$(.5411)\quad(1.2524)\quad(1.0455)$$
$$R^2 = .85 \qquad S = 8.919$$

$$\text{OLS--}Y_4 = 98.574 - .034\ Y_5 - .382\ X_1 + 3.702 X_3^*$$
$$(.1155)\quad(.3015)\quad(.7134)$$
$$R^2 = .85 \qquad S = 8.911$$

Considering the results of the OLS method of estimation, the explanatory variables included in this relation account for 85 percent of the variation in the E.E.C. total imports of oilseeds. All the estimated coefficients except the one corresponding to the domestic production of oilseeds, X_3, have a sign consistent with the theoretical expectation.

Import price and total quantity imported are negatively related, and according to the specified relation a $10 increase in the import price will result in a decrease in total imports equal to 1.28 m.t. per 1,000 of animal units, or 100,031 m.t. considering 1973 livestock population in the E.E.C.

Again, the complementarity influence of the E.E.C. price of feed grains is indicated by a negative relationship between the price of feed grain and the quantity of oilseed imported. So, we notice that for each $10 increase in the E.E.C. price of feed grain, the quantity of oilseed imported decreases by 1.64 m.t. per 1,000 animal units. This was equivalent to 128,164 m.t. in 1973.

The importance of the two explanatory variables, Y_5 and X_1, may, however, be questioned, since their estimated coefficients are smaller than the corresponding standard errors.

Although one would expect the quantity of oilseeds imported to decline as domestic production increases, the model shows a positive relationship between the two variables Y_4 and X_3.

The TSLS and OLS estimates for this relation are close and in both formulations, the specified variables explain 85 percent of the variation in the quantity of oilseeds imported by the E.E.C.

Equation 3(B): The equation with the price of meal as an explanatory variable:

$$\text{TSLS--}Y_4 = 157.425 + .266\ Y_2 + .405\ Y_5 - 1.913\ X_1 + 2.121\ X_3$$

$$(.1279) \quad (.5596) \quad (1.4261) \quad (1.2679)$$

$$R^2 = .88 \qquad S = 8.196$$

$$\text{OLS--}Y_4 = 105.020 + .158\ Y_2 - .102\ Y_5 - .534\ X_1 + 3.239\ X_3{}^*$$

$$(.0880) \quad (.1156) \quad (.2969) \quad (.7213)$$

$$R^2 = .87 \qquad S = 8.411$$

This equation was introduced to investigate the effect of changes in the price of meal (Y_2) on the quantity of oilseeds imported to the E.E.C. (Y_4). It shows a competitive relationship between the two variables as indicated by the positive sign preceding the estimated coefficient of Y_2. So, other things being equal, an increase of $10 in the import price of meal will result in an increase of 2.66 m.t. in the total imports of oilseeds, or 207,876 m.t. according to the 1973 population of livestock in the E.E.C. However, this influence is expected to be weak since the estimated coefficient is smaller than its standard error.

Equation 4: Import Price of Soybeans.

$$\text{TSLS--}Y_5 = -85.507 + .195\ Y_6 + 2.329\ X_1{}^*$$
$$(.2654) \qquad (.3714)$$
$$R^2 = .83 \qquad S = 17.946$$

$$\text{OLS--}Y_5 = -81.159 + .168\ Y_6 + 2.298\ X_1{}^*$$
$$(.2603) \qquad (.3671)$$
$$R^2 = .83 \qquad S = 18.004$$

Contrary to economic theory, this equation displays a positive relationship between the quantity of soybeans imported, Y_6, and its price, Y_5. One explanation for this inconcsistency could be that the effect of the large expansion in soybean imports to the E.E.C., mainly because of higher use of protein feeds in animal feeding, might have overridden any negative relationship between import price and the quantity imported. Another explanation could be the existence of an identification problem in the equation.

The positive relationship between the E.E.C. price of feed grain, X_1, and the import price of soybeans again confirms the complementarity relationship that exists between the two commodities as livestock feed sources.

<u>Demand Elasticities Derived from Model I</u>. The price elasticity of demand is defined as the relative responsiveness of quantity demanded to changes in price. Direct price elasticities are assumed to be negative since quantity demanded and price vary inversely. However, the results of Model I were inconsistent with this assumption since the price coefficients were preceded by a positive sign rather than a negative, except for equation 3(A) which gave a price elasticity of import demand for oilseeds of -.15.[4] This indicates a highly inelastic import demand and may suggest that factors shifting the demand schedule, such as changes in the number of the consuming units, changes in feeding technology, etc., have been exerting more influence on the quantity of oilseed imported to the E.E.C. and that the effect of price changes tended to be small.

The effects of changes in the E.E.C. price of feed grains, X_1, on the total imports of meals, and of oilseeds, Y_4, is given by the cross elasticities,

$$\frac{dY_1}{dX_1} \cdot \frac{X_1}{Y_1}$$, Equation 1, TSLS, and

$$\frac{dY_4}{dX_1} \cdot \frac{X_1}{Y_4}$$, Equation 3(A), TSLS, respectively.

---

4. This elasticity and those discussed below were computed using the estimated coefficients and the averages of the relevant variables for the five-year period 1969-1973.

The estimated elasticity coefficients are -4.16 for meals and -.124 for oilseeds. Accordingly, each one percent change in the E.E.C. price of feed grains will result in 4.16 percent and .124 percent change, in the opposite direction, in the quantity of meal and the quantity of oil seeds imported to the E.E.C., respectively. This model also suggests that the two commodities, oil seeds and feed grains, are complements rather than substitutes.

The cross elasticity between meals and oilseeds,

$\frac{dY_4}{dY_2} \cdot \frac{Y_2}{Y_4}$, as given by Equation 3(B), TSLS is + .313. This

implies that an increase in the import price of meal, Y_2, of one percent will result in an increase of about .3 percent in total imports of oilseeds.

The quantity $\frac{dY}{Y} \div \frac{dX}{X} = \frac{dY}{dX} \cdot \frac{X}{Y}$ can be defined as the elasticity of substitution between the two commodities, Y and X. It measures the relative responsiveness of one variable, say, Y, to a proportional change in another, say, X, other things being equal. This concept can be used to investigate the effect of changes in the E.E.C. net supply of fishmeal on its imports of oilseed meals. According to the model and using 1969-73 averages, a one percent increase in the net supply if fishmeal, X_2, was associated with a 1.2 percent decrease in the total imports of oilseed meal (Equation 1--TSLS). This means that, during the specified period, 1.2 percent of the E.E.C. total oilseed meal imports would have had to be given up for every one percent increase in its net supply of fishmeal. Clearly the two commodities are close substitutes as sources of protein in animal feeding.

Model II: Import Demand for Vegetable Oils

As specified above, this model consists of one equation with all the explanatory variables taken as exogenous. The equation was estimated by the OLS method and the results were as follows:

$$Y = -1.004.709 + .436\, X_1{*} + .148\, X_2 + .838\, X_3{*} + .050\, X_4$$

$$(.1844) \quad (.0703) \quad (.0929) \quad (.2761)$$

$$R^2 = .94 \qquad S = 44.921$$

The influence of the import price of oil, X_1, though significantly different from zero, displays a sign which is inconsistent with economic theory.

In this model butter is hypothesized to be a substitute for vegetable oil. The results obtained confirm this hypothesis as indicated by the positive relationship between the E.E.C. retail price of butter, X_2, and the total quantity of vegetable oil imported. According to the model a $10 increase in the price of butter will result in an increase in total imports of vegetable oil of 1.48 m.t. per 100,000 population per year, or 3796.6 m.t., according to 1973 population of the E.E.C. This influence, however, is weak, considering that the price of butter, X_2, is insignificant at the five percent level.

Per capita income, X_3, has a significant effect on total imports of vegetable oil, Y, as indicated by the size of income coefficient relative to its standard error. The positive relationship between the two variables indicates that vegetable-oils are a "normal" good in the E.E.C. economy. In this case, income works as a demand shifter for vegetable oil, shifting the total import schedule to the right for increases in per capita income.

The fourth explanatory variable is the domestic production of vegetable-oils expressed as the sum of the oil-equivalent of the oil seeds produced in the E.E.C. and the production of olive oil. Theoretically, one would expect this variable to have an inverse relationship with the quantity of vegetable oil imported. The results obtained do not support this hypothesis as indicated by the positive sign of the coefficient of X_4. However, conclusions based on this result are questionable since the variable denoting domestic production of vegetable oil, X_4, is not significantly different from zero.

The R^2 for this equation is 0.94, indicating that the variables included in the model explain 94 percent of the total variation in the dependent variable.

<u>Demand Elasticities Derived from Model II</u>. The cross elasticity of import demand for vegetable oil with respect to the price of butter is +.650. A one percent increase in the retail price of butter will increase the import quantity of vegetable oils by .65 percent. This means that total imports of vegetable oils are relatively insensitive

to changes in the domestic prices of butter. It should be noted, however, that the elasticity is based on a coefficient whose standard error is larger than the estimated coefficient.

Income elasticity of imports of vegetable-oils is positive and according to the model a one percent increase in per capita income would increase imports of vegetable-oils by 1.7 percent, other things being equal. This is a rather high figure for a developed country where it is assumed that the per capita consumption level of fats and oils is reaching a saturation level, and hence only a small increase in their consumption is expected with increased income (Houck, Rayan and Subotnik 1972, p. 12; Moe and Mohtadi 1971, p. 45). However, this high income elasticity may reflect a shift away from the consumption of animal fats and marine oils to the consumption of vegetable-oils as per capita income increases.

The Projections

This section will deal with the projection of the import demand for oilseeds and oilseed meals for the period 1980 through 1985. Projection of the import demand for vegetable oils will not be discussed since the sign of the coefficient of the import price in the equation of vegetable oils (Model II) is inconsistent with economic theory. Although this was also the case in the equation for import demand for meal (Model I -- Equation 1), projection of meal demand is attempted on the assumption that the positive relationship between total imports of meal and its import price was due to the inclusion of the price of feed grain in the equation and the high influence of this price in determining the level of oilseed meal use. It is assumed also that this influence will continue during the projection period.

The coefficients of the reduced form and a set of projected values for the exogenous variables have been used to project the values of all endogenous variables of Model I. The projection will be made under the following assumptions:

1. Oilseeds and oilseed meals will continue to be imported to the E.E.C. duty free.
2. The policy of supporting domestic production of oilseeds will continue.
3. The E.E.C. prices of feed grains, X_1, will remain constant at their 1973 level ($105.78/metric ton).
4. During the projection period, the meal conversion ratio will remain constant at the 1973 level of 0.67.
5. The exogenous variables, X_2, X_3 and X_4, as defined above, together with the E.E.C. population of livestock, will take their projected values, which are shown in Table A-17, p. 115).

The projection values for the endogenous variables for the years 1980 through 1985 are shown in Table 10.

It can be seen from Table 10 that imports of oilseed meals, Y_1, will be continuously increasing during the projection period.

Table 10. Projected values of the endogenous variables--1980-1985, and actual average data for 1971-73.[a]

	Total Imports Oilseed Meal	Import Price Soybean Meal	Total Imports Soybean Meal	Total Imports Oilseeds	Import Price Soybeans	Total Imports Soybeans	Total Imports Oilseed Meals Other than Soybean Meal	Total Imports Oilseeds Other than Soybean
	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_7
Average 1971-73 (actual)	8336.9	155.33	4369.5	9400.6	146.67	6471.1	3967.5	2926.6
1980	19699.3	450.54	11738.8	32321.7	161.36	26455.3	7960.5	5866.5
1981	22059.8	480.61	13069.8	33497.2	175.00	27979.8	8990.0	5517.4
1982	24634.0	513.21	14542.6	34781.0	189.78	29640.8	10091.3	5140.2
1983	27457.6	548.55	16140.2	36142.7	205.73	31435.3	11317.4	4707.4
1984	30555.0	586.89	17874.4	37588.9	222.96	33375.7	12680.7	4213.2
1985	33934.8	627.66	19774.6	39146.7	241.59	35484.0	14160.2	3662.7

a. Quantities are in 1,000 metric tons; prices are in U. S. dollars per metric ton.

So, while total imports of oilseed meals were 8.3 million metric tons (m.t.) per year during 1971-73, the projected value for 1985 is 33.9 million m.t. This gives an increase of 308 percent over the 1971-73 average. One of the main reasons for this expansion in meal imports is the expected increase in livestock population in the E.E.C., as indicated in Table A-17 (p. 115). Another reason could be the effect of the demand for feed grains. Under the assumption of constant prices, and given the projected increase in livestock population, the demand for feed grains in the community could be expected to increase during 1980-1985. On the other hand, the evaluation of the statistical results indicated that the relationship between oilseed meals and feed grain in the E.E.C. is one of complementarity. Under these conditions, the effect of the expected increase in the demand for feed grains will probably override any negative effect of the rising import prices, resulting in higher total imports of oilseed meals.

The table indicates that most of the increase in total imports of meals is accounted by imports of soybean meals, Y_3. Total imports of all oil seed meals in 1985 is projected to be 33.9 million m.t. Imports of soybean meal alone is projected to be 19.8 million tons; thus accounting for about 58 percent of the total imports. This indicates that soybean meal will continue to be the major protein source in livestock feeding in the E.E.C. Imports of other oilseed meals, Y_7, will be expanding during the projected period and is expected to reach 14.2 million m.t. in 1985 as compared to 4.0 million m.t. per year during 1971-73 period.

Total imports of oilseeds, Y_4, is projected to increase from 9.4 million metric tons per year during 1971-73 to 32.3 million m.t. in 1980 and further to 39.1 million m.t. in 1985. Imports of soybean alone is projected to increase from 6.5 million m.t. during 1971-73 to 26.5 million m.t. in 1980 and to 35.5 million m.t. in 1985. In fact, the projected increase in imports of soybean is more than offset by the effect of the projected decline in the total imports of all other oilseeds, (Y_8), such as goundnuts, cotton seeds, copra and palm kernels. Table 10 shows that although the level of imports of these products will be higher in 1980 as compared to the figure for 1971-73, imports will be continuously declining during the projection period and are expected to reach a low level of 3.7 million m.t. by 1985. One possible explanation for the projected decline in total imports of groundnuts, cotton seeds, copra and palm kernel is that while the E.E.C. will be importing increased amounts of soybeans, it will depend on its own production of oilseeds to satisfy a larger share of its requirements. Actually, and given the assumption that the present policy of encouraging domestic production of oilseeds will continue into the future, production of these crops, and mainly production of rape seeds, sunflower and linseed, in the Community, is expected to reach a high level of 1.9 million m.t. in 1980 and further to 2.5 million m.t. in 1985 (Table A-17, p. 115). These two figures compare with a total production of oilseeds of 1.2 million m.t. during 1971-73.

CHAPTER 6

SUMMARY AND IMPLICATIONS

Production of oilseed crops in the European Economic Community is still in its infancy in spite of a number of regulations that have been initiated to increase their production. Consequently, the Community still imports a considerable part of its total requirements of oilseeds and oilseed products from non-member countries. In fact, the E.E.C. is the largest importer of these products in world trade today.

During 1952-73 period, E.E.C. imports of oilseed meals and meal-equivalents of oilseeds increased rapidly. Total imports increased from 3.9 million m.t. per year during 1952-56 to 9.5 million m.t. per year during 1962-66 and further to 15.2 million m.t. per year during 1970-73. Most of this increase was contributed by the increase in the imports of soybeans and soybean meal, which rose from 884,448 m.t. per year during 1952-56 to 4.0 million m.t. per year during 1962-66 and further to 9.2 million m.t. per year during 1970-73. The increase in the E.E.C. imports of meals and meal equivalents of seeds resulted from increased livestock populations, higher feeding rate per animal and the long-term movement toward concentrated, protein-rich animal feeds.

The increase in the Community's total imports of vegetable oils was much slower and in general reflected the increase in the E.E.C. population and higher per capita income.

This study investigated the economic forces that influence the E.E.C. import demand for oilseeds and oilseed products. Annual data for the period 1952-73 were used to attain the following objectives.

1. To construct an economic model of the structural behavior of the oilseed market in the E.E.C.
2. To estimate the structural parameters of the model and to determine the relevant elasticities.
3. To make projections of the import demand for the period 1980-85.
4. To derive the policy implications for Sudan's development strategy in the field of production and exports of oilseed crops.

To achieve these objectives, a preliminary model was first developed. This model consisted of eight behavioral equations incorporating a set of endogenous and exogenous variables and reflecting the simultaneous structure of the oilseed market. When this model was estimated, some of the results were unsatisfactory from the economic and statistical viewpoint. The major problems were due to the high intercorrelation between the exogenous variables of the model. The preliminary model was then replaced by two simpler models: Model I for imports of oilseeds and oilseed meal and Model II for imports of vegetable oils.

In Model I, the import demand for oilseed and oilseed meal was related to the E.E.C. livestock population, the E.E.C. price of feed grains, net supply of fishmeal and the production of oilseeds in the E.E.C. The statistical model was based on a linear relationship between the variables and was estimated using two stage least squares and ordinary least squares. The latter method was used for comparative purposes.

Model I captures most of the relevant economic forces that shape the behavior of the E.E.C. import demand for oilseeds and oilseed meals. The over-all statistical results were satisfactory. In the meal import equation, for example, the import price of meal, the price of feed grains, and the net supply of fishmeal were significant explanatory variables. In the oilseed import equation, however, prices were not significant.

One consistent outcome of Model I was the complementary relationship between oilseeds and oilseed meal on the one hand, and feed grains on the other. This was derived from the negative relationship between the price of feed grains and the quantity of oilseed meal (Equation 1, Model I), and the quantity of oilseeds (Equation 3, Model I).

Model II consisted of one equation relating total imports of vegetable oils to the import price of peanut oil, per capita consumption expenditures, the E.E.C. retail price of butter, and domestic production of olive oil plus the oil-equivalent of E.E.C. production of oilseeds. The statistical results showed the first two variables to be significant in explaining variations in total imports of vegetable oils while the other two variables were not.

Projections with the Estimated Model

Because of the inconsistency of the sign of the direct price coefficient in the oil import equation of Model II, no projection was made for total imports of vegetable oils.

Model I, on the other hand, was used to project the E.E.C. import demand for oilseeds and oilseed meal for the period 1980 through 1985. The projections were made using reduced form coefficients and a set of projected values of the exogenous variables. The projections indicate that total imports of oilseeds and oilseed meal will be continuously increasing during the projection period and will reach 60.1 million m.t. by 1985. This is an increase of 313 percent over average total imports during 1971-73. Imports of soybeans and soybean meals, in particular, are projected to reach 43.5 million m.t. by 1985, an increase of 358 percent over 1971-73 imports. In fact, imports of soybeans and soybean meals will account for a considerable share of the increase in total imports of oilseed and oilseed meal, thus reflecting its dominant role in the E.E.C. market that prevailed during the whole period, 1952-1973, but more importantly since the late sixties.

A surprising feature of the projections is the decline in total imports of "other" oilseeds. While total imports of this group are projected to increase from 2.9 million m.t. per year during 1971-73 to 5.9 million m.t. in 1980, the projections show a declining trend through the period until 1985 when their total imports reach a low level of 3.7 million m.t.

The principal components of this group are the traditional oilseeds such as peanut, cottonseed, copra and palm kernels. Besides the effect of relative prices, one main reason for the decline in the demand for these products is the effect of their characteristics in animal feeding as compared to those of soybeans. Soybean meal has a high content of most of the essential amino acids and thus is considered one of the best protein supplements for dairy and beef cattle. For swine and poultry, it ranks ahead of all other common protein supplements of plant origin because of the high quality of its protein. The traditional oilseeds, on the other hand, either have a high fiber content (e.g., copra meal), or are deficient in some essential amino acids (e.g., cotton seed meals), or they may be less palatable in feeding (e.g., palm kernel meal in swine feeding). In the case of peanut meal in particular, the danger of aflatoxin has limited its use in mixed feed industries (Moe and Mohtadi 1971, pp. 196-200).

Implications for the Sudanese Economy

The results of the projections yield some important implications for the Sudanese economy. Until recently, the E.E.C. has been considered one of the major markets for Sudan's exports of oilseeds and oilseed products. During 1968-1970 for example, the share of the Community in the total value of Sudan's exports of these products was 51 percent. The main oilseeds exported were peanuts and cotton seeds and their products, meal and oil. With the projected decline in the E.E.C. total imports of these products it is likely that the quantity Sudan can export to this market will be declining even if it continues to maintain its relative share.

In order to cope with this situation, it is necessary for Sudan to initiate new policies and programs in the field of production and exports of oilseeds.

First, cooperation with other major oilseed exporting countries is necessary to negotiate trade policies with the E.E.C., with the objective to increase the Community's imports of the traditional oilseeds. For example, in the face of increasing imports of meals, it is possible that the oilseed processing industries may ask the E.E.C. Commission to impose duties on imports of oilseed meals. To avoid this, Sudan and other exporting countries are required to negotiate a long-term agreement with the E.E.C. to guarantee the continuation of the present duty-free policy for imports of oilseeds and oilseed meals.

Second, in order to increase its market share, Sudan should undertake major market promotional activities in the E.E.C. These should go together with plans for improved qualities, better grades, more competitive prices, and more efficient handling and distribution systems.

Third, it is important to start to be more concerned with other markets. The developing countries, particularly in the Middle East, present potentially expanding markets for oilseeds and oilseed products. With the expected increase in per capita income, the demand for meat and dairy products in these countries is expected to be increasing rapidly. Consequently, the demand for animal feeding-stuffs may be increasing. Sudan has a geographic advantage over other oilseed exporting countries, and with an efficient and capable marketing system it can capture a considerable share of the oilseed market in these countries.

Fourth, viable and well-established meat and dairy product industries within Sudan is one assured market for the oilseed sector of the country, beside the fact that these industries, being labor-intensive type of industries, offer substantial employment opportunities. The investment here will be a firm and justifiable one given the expanding demand for meat and dairy products in the countries of the region.

Still another approach, and a more fundamental one, is to introduce some changes into the structure of the Sudan's oilseeds sector. This is necessary if the country is to be able to meet the challenges of the changes that are occurring presently in the oilseed market in the developed countries. This is illustrated in the case of the E.E.C. for example, by the fact that the demand for soybeans and soybean products is expanding faster than the demand for all other oilseeds. Taking the climatic conditions into consideration, the Sudanese oilseeds sector should be diversified by introducing new crops with potentially good markets. Production of soybeans should receive the major attention.[1]

Suggestions for Future Research

Research Related to the E. E. C.

One of the major limitations to the study was the unavailability of official and detailed E.E.C.-wide data. Most of the data used in this study were obtained from OECD and UN, FAO publications and were based on individual country data, which were then aggregates to obtain E.E.C.-wide data. This situation constrained the construction of a more representative model that takes into account

1. Experiments on soybean production in the Agricultural Research Farm, Wad Medani, Sudan, during the 1967-68 season gave a yield of 450 kilos per hectare. This compares with a world average of 1263 kilos per hectare.

the many forces that affect the oilseed sector in the E.E.C. For future research, then, more detailed and reliable data must be generated. These should include data on consumption of individual oilseed products, livestock numbers and prices, feeding rates, feed conversion ratio for each category of livestock, share of oilseeds and oilseed meals in concentrated ratios, prices of individual oilseed products, oilseed crushing capacity in the E.E.C., and meal and oil extraction ratios. Other information on stocks and on other sectors using oilseed products as raw materials (e.g., soap, paints and varnishes) is also required.

Another problem encountered in the study was the problem of multicolinearity which resulted from the high number of exogenous variables used in the preliminary model. One way to overcome this problem is to combine time series data with cross section data and to use coefficients obtained from budget studies. Hence, further research should be conducted to generate cross section data and to develop budget studies which are applicable to the oilseed sector of the Community.

One of the shortcomings of the model used in this study is its static nature. Dynamic models are generated by using the concept of distributed lag which involves adding the dependent variable lagged one period as an additional independent variable in the structural equation. Beside giving a coefficient of adjustments which expresses the relationship between long run and short run elasticities, the dynamic model usually gives high R^2 indicating that such models have somewhat greater predictive powers (Sharma 1968, pp. 138-141). Hence, more satisfactory results on E.E.C. import demand could be obtained if future researches are based on dynamic models.

In general, economic models for future researches on the E.E.C. oil sector should reflect the following characteristics.

1. The joint-product aspects of meals and oils.
2. The multiple market outlets that compete for the available supply of oilseeds, oilseed meals and oils (e.g., in the case of meals domestic demand versus export demand; in the case of oils human consumption versus industrial uses).
3. The position of oilseed and oilseed products within the fats and oils market on the one hand, and feed-livestock sector on the other.
4. The simultaneous determination of oilseeds, oilseed meals, and oil prices within each period of time.

This means that more representative models should contain as many relations as possible so as to reflect the different aspects of the oilseed sector and the fact that decisions affecting this sector also affect other sectors of the economy.

Research Related to Sudan

Oilseeds and oilseed products occupy an important place in the Sudanese economy. Future development of this sector should be based on wise decisions by agricultural policy makers. This requires availability of quantitative studies that give guidance as to how the forces that affect this sector are going to behave in the future.

It is recommended that these studies should include the following:

1. Demand for oilseeds and oilseed products in the different regions, e.g., in the E.E.C., in non-E.E.C. European countries, in the Middle East, etc. These studies should be carried out periodically to follow up any changes that might occur in any one region.
2. Demand studies on the domestic market should also be considered. This should give consideration to developments in other sectors that are related to the oilseed sector, such as soap, paint and varnishing industries.
3. From the supply side, it is necessary to conduct studies and obtain information as to how producers respond to changes in relative prices of different oilseeds and of competing crops. This information is necessary to discover the effective forces in determining the allocation of land among different crops. Furthermore, studies on the supply side together with the studies on domestic demand are required to quantify the size of the excess supply, if any, and to form export policies accordingly. Such studies require detailed and reliable data. Hence, steps should be taken to strengthen the Department of Statistics in particular and the statistical units in the various ministries, in general.

APPENDIX A

SUPPLEMENTARY DATA ON PRODUCTION AND TRADE OF OILSEEDS AND OILSEED PRODUCTS

Table A-1. E.E.C. total imports of major oilseeds by type--1952-1973.[a]

Year	Soybeans	Peanuts	Cotton Seeds	Rape Seeds	Sunflower Seeds	Linseeds	Copra	Palm Kernels	Total
	1,000 Metric Tons								
1952	230	575	184	65	---	244	758	704	2763
1953	444	656	218	119	---	174	566		2948
1954	516	807	191	47	---	294	684	775	3314
1955	917	781	242	49	---	346	607	746	3688
1956	1022	911	171	41	---	501	715	701	4062
1957	1188	868	167	104	25	596	869	655	4472
1958	1239	944	130	206	24	408	607	692	4250
1959	1915	943	187	156	30	435	425	665	4756
1960	2564	745	141	107	80	408	659	655	5359
1961	2032	920	130	146	120	392	721	620	5081
1962	2651	997	212	188	65	335	598	598	5644
1963	2612	1043	207	174	102	294	631	587	5650
1964	3189	846	117	135	100	372	662	597	6018
1965	3071	861	117	308	100	348	696	560	6061
1966	3534	947	53	396	155	453	712	523	6773
1967	3720	940	28	395	220	343	577	298	6521
1968	3625	1066	21	409	255	345	499	336	6556
1969	3975	821	28	486	275	387	498	344	7114
1970	5690	643	8	445	280	366	351	343	8126
1971	5788	496	2	951	147	483	494	402	8763
1972	6531	422	1	825	191	672	702	322	9666
1973	7117	534	1	753	260	368	514	229	9770

a. Taken from United Nations, FAO, Trade Yearbook, 1952-74, inclusive.

Table A-2. E.E.C. total imports of major oilseed meals by type--1952-1973.

Year	1,000 Metric Tons									
	Soybean Meal	Peanut Meal	Cotton Seed Meal	Rapeseed Meal	Sunflower Seed Meal	Linseed Meal	Copra Meal	Palm Ker-nel Meal	Other Oil-seed Meals	Total
1952	238	197	327	39	120	155	99	67	---	1242
1953	363	300	497	59	183	236	151	102	---	1891
1954	408	337	559	66	206	266	170	114	---	2126
1955	411	351	722	70	134	294	183	111	177	2453
1956	485	382	683	72	200	302	199	126	187	2636
1957	463	393	452	84	352	290	189	145	183	2551
1958	312	715	673	109	386	579	180	173	169	3296
1959	610	790	891	153	438	478	187	204	188	3939
1960	751	763	745	103	352	480	212	187	294	3887
1961	663	925	703	115	400	501	250	183	291	4031
1962	1152	1087	803	151	426	645	256	213	285	5018
1963	1263	1035	838	138	313	649	328	166	252	4982
1964	1477	933	822	136	234	697	424	223	266	5212
1965	1864	945	982	166	295	745	423	227	354	6001
1966	2390	933	1005	233	554	614	565	257	404	6955
1967	2444	885	842	204	579	502	480	217	294	6447
1968	2586	653	822	206	557	462	457	204	341	6288
1969	2264	757	986	243	482	542	478	244	497	6493
1970	3566	805	947	223	538	644	521	238	590	8072
1971	4205	714	758	335	395	748	620	259	634	8668
1972	4554	892	877	393	366	487	703	301	773	9346
1973	4344	940	1064	347	353	378	711	260	664	9061

a. UN, FAO, Trade Yearbook, 1952-74, inclusive.

Table A-3: E.E.C. total imports of major vegetable oils by type--1952-1973.[a]

	1,000 Metric Tons									
Year	Soybean Oil	Peanut Oil	Cotton Seed Oil	Rape Seed Oil	Sunflower Oil	Coconut Oil	Palm Kernel Oil	Olive Oil	Palm Oil	Total
1952	92	141	10	17	28	200	17	48	458	1011
1953	62	164	41	31	14	129	21	52	494	1008
1954	41	152	123	16	12	112	21	67	474	1018
1955	27	240	137	6	12	140	15	52	452	1081
1956	50	209	118	16	9	149	18	69	456	1097
1957	78	182	147	6	8	129	22	99	453	1124
1958	47	191	60	8	13	97	26	49	446	937
1959	79	196	122	27	16	88	30	90	456	1104
1960	108	218	139	38	28	106	17	155	450	1259
1961	50	181	87	9	58	116	18	132	439	1090
1962	37	202	47	12	55	95	29	143	351	971
1963	70	238	76	20	76	120	30	149	383	1162
1964	70	261	94	11	82	125	25	89	419	1176
1965	64	295	129	23	93	132	35	63	385	1219
1966	48	353	68	43	146	112	51	119	440	1380
1967	59	356	21	61	281	136	70	129	373	1486
1968	73	372	38	109	321	168	68	83	409	1641
1969	122	311	40	88	416	132	92	144	467	1812
1970	241	333	78	65	324	148	105	155	486	1935
1971	257	296	76	90	313	187	121	221	644	2205
1972	176	400	58	101	338	264	129	171	651	2288
1973	184	389	47	90	366	252	148	239	711	2426

a. UN, FAO, <u>Trade Yearbook</u>, 1952-74, inclusive.

Table A-4. Price series of major oilseeds, c.i.f. European ports--1952-1973.[a]

	Dollars per Metric Ton[b]							
Year	Peanuts	Cotton Seed Meal	Soybean	Sunflower	Rape Seed	Copra	Palm Kernels	Flax Seed
1952	---	82	112	---	162	190	147	185
1953	229	65	119	---	146	235	309	143
1954	218	64	122	---	144	207	146	138
1955	190	106	111	110	141	186	143	155
1956	208	108	112	118	152	183	144	175
1957	204	98	106	111	136	179	141	142
1958	165	89	94	96	114	205	153	145
1959	181	90	96	109	128	249	190	153
1960	198	97	92	104	128	207	164	145
1961	196	99	111	106	135	170	136	150
1962	171	89	101	108	107	166	136	149
1963	173	92	110	108	110	186	152	136
1964	187	98	111	103	116	198	151	136
1965	206	104	117	124	124	225	179	133
1966	187	104	128	138	131	187	156	128
1967	182	99	114	117	122	207	164	136
1968	168	102	111	109	104	232	174	143
1969	207	---	107	---	110	202	153	126
1970	229	---	119	---	137	215	168	136
1971	256	---	131	---	142	188	145	116
1972	263	---	144	---	142	141	114	144
1973	372	---	223	---	252	344	228	265

a. For 1952-54: UN, FAO, Production Yearbook, 1952-54, inclusive.
For 1955-68: Moe and Mohtadi, 1971.
Data on sunflower seed oil and rapeseed oil for 1969-73 were taken from USDA, Foreign Agric. Circular, Fats and Oils, February 1974.

b. The price series used for each item is: peanuts: Nigerian, shelled; cottonseed: 1952-54--Mozambique and 1955-68--Sudanese, bulk; soybeans: U.S. No. 2 yellow; sunflower seed: East African, pure; rape seeds: 1952-54: Ethiopian and 1955-73: Canadian, 40 percent bulk; copra: Straits; palm kernels: Nigerian; flaxseed: Canadian No. 1, 2½ percent bulk, c.i.f. U.K.

Table A-5. Price series of major oilseed meals, c.i.f. European ports--1952-1973.[a]

Year	Dollars per Metric Ton[b]					
	Peanut Meal	Cotton Seed Meal	Soybean Meal	Sunflower Seed Meal	Copra	Linseed
1952	98	---	96	---	---	98
1953	97	---	93	---	---	102
1954	106	---	92	---	---	103
1955	112	---	102	101	84	104
1956	110	89	98	91	86	105
1957	98	78	90	77	70	84
1958	87	65	92	67	72	75
1959	101	84	95	77	89	97
1960	98	79	91	69	88	88
1961	93	78	100	67	71	85
1962	102	83	106	81	77	95
1963	106	93	113	89	---	101
1964	108	102	112	88	76	100
1965	119	96	115	84	96	103
1966	111	94	124	83	103	121
1967	111	---	119	82	98	108
1968	105	---	120	79	---	108
1969	110	87	117	80	---	107
1970	127	106	103	87	91	103
1971	116	102	101	90	91	102
1972	144	120	129	98	---	140
1973	306	229	306	195	---	234

a. For 1952-54: UN, FAO, Production Yearbook, 1952-54, inclusive.
For 1955-68: Moe and Mohtadi, 1971.
Data on sunflower seed oil and rapeseed oil for 1969-73 were taken from USDA, Foreign Agric. Circular, Fats and Oils, February 1974.

b. The price series used for each item is peanut meal: Nigerian, 56 percent; cotton seed meal: Argentine, 44/45 percent--1969: Indian 43 percent; soybean meal: Canadian, 45 percent; sunflower seed meal: Argentine, 37/38 percent; copra meal: Indian, 30 percent; linseed meal: 1952-53--London made, bulk, ex-mill and from 1954-73: Argentine, 37/38 percent.

Table A-6. Price series of major vegetable oils, c.i.f. European markets--1952-1973.[a]

	Dollars per Metric Ton[b]									
Year	Peanut Oil	Cotton Seed Oil	Soybean Oil	Sunflower Oil	Rape Seed Oil	Coconut Oil	Palm Kernel Oil	Olive Oil	Palm Oil	Linseed Oil
1952	372	338	274	---	---	263	256	618	293	---
1953	378	357	307	---	---	327	315	651	171	---
1954	333	285	333	---	---	302	284	601	190	---
1955	287	265	295	293	308	260	259	608	240	247
1956	369	335	344	355	377	264	262	952	258	329
1957	358	323	320	345	358	271	267	769	252	271
1958	275	291	261	268	261	316	296	644	229	266
1959	300	252	233	269	221	378	358	589	238	226
1960	326	235	225	244	219	317	305	624	224	254
1961	329	305	283	316	280	254	253	567	228	280
1962	274	266	218	241	221	252	249	651	210	254
1963	269	243	215	236	215	283	279	923	218	213
1964	213	250	228	254	252	296	294	585	234	237
1965	323	278	265	292	263	360	350	663	269	213
1966	296	333	259	262	244	311	292	660	233	191
1967	287	278	216	212	206	332	256	689	226	202
1968	269	269	178	194	161	393	330	681	140	234
1969	332	---	198	212	185	324	286	---	197	241
1970	378	358	289	333	262	359	336	708	270	227
1971	443	399	304	375	295	322	289	708	256	195
1972	423	329	240	326	231	273	220	977	208	203
1973	543	437	439	483	344	330	431	1418	391	541

a. For 1952-54: UN, FAO, Production Yearbook, 1952-54, inclusive.
For 1955-68: Moe and Mohtadi, 1971.
Data on sunflower seed oil and rapeseed oil for 1969-73 were taken from USDA, Foreign Agric. Circular, Fats and Oils, February 1974.

b. Price series used for each item is: Peanut Oil--Nigerian 3-6% bulk; cotton seed oil: American, crude, bulk; soybean oil: any origin, crude; sunflower oil: Argentine, semi-refined, bulk; rape seed oil: any origin, ex-tank Rotterdam; coconut oil: White Ceylon, 1% bulk--from 1969, Malayan, 1%; palm kernel oil: net, naked, ex-mill London--from 1969, Zaire bulk, c.i.f. Marseilles; olive oil: Spanish, edible, 1% drums, f.o.b.--from 1969, Tunisian, edible, 1%; and palm oil: Nigerian, 5% c.i.f. U.K.--from 1969: Zaire, c.i.f. north sea ports.

Table A-7. E.E.C. per capita consumption of fats and oils (fat content) in the member countries.[a]

Country	Period	Vegetable Oils	%[b]	Marine Oils and Fats	%	Butter	%	Slaughter Fats	%	Total Fats and Oils	%	Margarine[d]	Butter[d]
		(kilos per year)											
Belgium - Luxembourg	1952	....		....		9.8		....		22.7		8.1	....
	1953	....		....		9.4		....		22.2		8.2	....
	1954	....		....		9.4		....		22.3		9.2	....
	1955-59	10.7	41.5	1.1	4.6	8.8	34.1	5.1	19.8	25.8	100	10.6	10.5
	1960-64	12.3	43.5	1.4	5.2	8.0	28.3	6.5	23.0	28.3	100	12.5	9.6
	1965-69	13.8	44.5	.9	3.0	7.7	24.8	8.6	27.7	31.0	100	13.1	9.2
	1969	14.1	44.6	.7	2.3	8.2	25.9	8.6	27.2	31.6	100	12.8	9.8
	1970	14.8	43.9	.8	2.4	7.8	23.1	10.3	30.6	33.7	100	13.1	9.4
	1971	14.4	42.9	.6	1.8	7.5	22.3	11.1	33.0	33.6	100	13.0	8.8
France	1952	....		....		5.1		....		15.7		1.8	
	1953	....		....		5.3		....		16.5		1.9	
	1954	....		....		5.5		....		16.6		1.9	
	1955-59	9.0	46.4	.4	2.0	6.2	32.0	3.8	19.6	19.4	100	2.1	7.4
	1960-64	10.5	48.6	.6	2.8	6.7	31.0	3.8	17.6	21.6	100	2.8	8.0
	1965-69	12.3	50.6	.8	2.9	7.6	31.3	3.7	15.2	24.3	100	3.1	9.1
	1969	12.8	50.4	.8	3.2	7.8	30.7	4.0	15.7	25.4	100	3.1	9.3
	1970	12.4	49.6	.8	3.2	7.5	30.0	4.3	17.2	25.0	100	3.2	9.0
	1971	13.0	51.2	.9	3.5	6.9	27.2	4.6	18.1	25.4	100	3.4	8.3
Germany	1952	....		....		5.1		....		23.0		11.5	
	1953	....		....		5.6		....		24.3		12.0	
	1954	....		....		5.7		....		24.9		12.4	
	1955-59	11.2	44.1	2.1	8.3	6.1	24.0	6.0	23.6	25.4	100	12.2	7.3
	1960-64	11.6	44.1	1.3	5.0	7.4	28.1	6.0	22.8	26.3	100	10.1	8.7
	1965-69	12.0	46.0	1.1	4.2	7.1	27.2	5.9	22.6	26.1	100	9.4	8.5
	1969	12.1	45.8	1.0	3.8	7.2	27.3	6.1	23.1	26.4	100	9.1	8.5
	1970	12.7	46.2	.9	3.3	7.4	26.9	6.5	23.6	27.5	100	9.0	8.8
	1971	12.8	47.6	.9	3.3	6.7	24.9	6.5	24.2	26.9	100	9.0	7.9
Italy	1952	....		....		1.3		....		12.1		....	....
	1953	....		....		1.2		....		12.0		....	....
	1954	....		....		1.2		....		12.5		....	....
	1955-59	10.2	76.1	....		1.3	9.7	1.9	14.2	13.3	100	.7	1.6
	1960-64	14.1	81.0	....		1.4	8.1	1.9	10.9	17.4	100	1.1	1.8
	1965-69	16.7	84.8	....		1.5	7.6	1.5	7.6	19.8	100	.4	1.9
	1969	19.8	86.0	....		1.6	7.0	1.6	7.0	23.0	100	.5	2.0
	1970	20.9	86.4	....		1.6	6.6	1.7	7.0	24.2	100	.5	2.0
	1971	21.6	86.7	....		1.6	6.5	1.7	6.8	24.9	100	.5	2.0

Table A-7. - Continued.

Country	Period	Vegetable Oils	%[b]	Marine Oils and Fats	%	Butter	%	Slaughter Fats	%	Total Fats and Oils	%	Margarine[d]	Butter[d]
		(kilos per year)											
The Netherlands	1952	....		....		2.1		....		26.3		17.6	....
	1953	....		....		2.5		....		23.5		18.3	....
	1954	....		....		2.6		....		23.5		18.7	....
	1955-59	16.7	58.6	4.3	15.1	3.2	11.2	4.3	15.1	28.5	100	20.0	3.8
	1960-64	14.9	48.5	6.4	20.8	4.3	14.1	5.1	16.6	30.7	100	19.9	5.1
	1965-69	16.3	51.1	6.6	20.7	2.9	9.1	6.1	19.1	31.9	100	19.2	3.4
	1969	16.5	52.1	6.5	20.5	2.3	7.2	6.4	20.2	31.7	100	18.4	2.8
	1970	17.0	51.1	6.2	18.6	2.4	7.2	7.7	23.1	33.3	100	18.0	2.8
	1971	17.4	52.4	6.3	19.0	1.9	5.7	7.6	22.9	33.2	100	17.8	2.3
Average of the Six	1952	....		....		4.7		....		20.0		9.8	....
	1953	....		....		4.8		....		19.7		10.1	....
	1954	....		....		4.9		....		20.0		10.6	....
	1955-59	11.6	51.6	1.6	7.0	5.1	22.7	4.2	18.7	22.5	100	9.1	6.1
	1960-64	12.7	51.0	1.9	7.6	5.6	22.5	4.7	18.9	24.9	100	9.3	6.6
	1965-69	14.2	53.2	1.9	7.1	5.4	20.2	5.2	19.5	26.7	100	9.0	6.4
	1969	15.1	54.7	1.8	6.5	5.4	19.6	5.3	19.2	27.6	100	8.8	6.5
	1970	15.6	54.4	1.7	5.8	5.3	18.5	6.1	21.3	28.7	100	8.8	6.4
	1971	15.8	55.1	1.7	5.8	4.9	17.1	6.3	22.0	28.7	100	8.7	5.9
Denmark	1952	....		....		6.7		....		24.8		17.9	....
	1953	....		....		7.1		....		25.1		18.4	....
	1954	....		....		7.2		....		24.9		18.8	....
	1965-69	10.6	38.5	4.3	15.6	8.6	31.3	4.0	14.6	27.5	100	19.2	10.4
	1960-64	7.5	26.7	5.6	19.9	8.9	31.7	6.1	21.7	28.1	100	18.7	10.6
	1965-69	7.0	24.7	6.0	21.2	8.0	28.3	7.3	25.8	28.3	100	18.0	9.6
	1969	7.0	24.7	5.9	20.8	7.6	26.9	7.8	27.6	28.3	100	17.8	9.2
	1970	6.9	24.1	5.9	20.7	7.5	26.2	8.3	29.0	28.6	100	17.6	9.1
	1971	7.0	23.6	6.0	20.2	7.2	24.2	9.5	32.0	29.7	100	18.1	8.7
Ireland	1952	....		....		15.3		...		20.0		2.7	....
	1953	....		....		13.9		....		19.2		2.6	....
	1954	....		....		14.3		....		19.5		2.6	....
	1955-59	3.3	16.8	.3	1.5	14.0	71.4	2.1	10.3	19.7	100	....	17.2
	1960-64	3.9	20.0	....		13.0	66.7	1.5	13.3	18.4	100	3.6	16.0
	1965-69	4.4	24.2	....		11.2	61.5	2.6	14.3	18.2	100	4.2	13.9
	1969	4.8	26.8	....		10.3	57.5	2.8	15.7	17.9	100	4.8	12.7
	1970	5.1	27.7	....		10.2	55.4	3.1	16.9	18.4	100	....	12.6
	1971	4.0	22.1	....		10.4	57.5	3.7	20.4	18.1	100	....	13.1

Table A-7. - Continued.

Country	Period	Vegetable Oils	% [b]	Marine Oils and Fats	%	Butter	%	Slaughter Fats	%	Total Fats and Oils	%	Margarine [d]	Butter [d]
		(kilos per year)											
United Kingdom [c]	1952	....		....		4.1				21.6		8.7	....
	1953	....		....		5.1				21.3		8.0	....
	1954	....		....		5.5				22.4		8.5	....
	1955-59	....		....		6.3	28.8	3.5	16.0	21.9	100	6.9	7.8
	1960-64	....		....		7.1	30.9	4.2	18.3	23.0	100	6.0	8.8
	1965-69	....		....		7.3	31.9	3.7	16.2	22.9	100	5.3	7.1
	1969	....		....		7.2	31.0	3.8	16.4	23.2	100	5.4	8.9
	1970	....		....		7.1	30.6	3.8	16.4	23.2	100	5.4	8.8
	1971	....		....		6.7	29.5	3.4	15.0	22.7	100	5.8	8.3
Average of the Nine [e]	1952	....		....		6.2				20.8		9.6	....
	1953	....		....		6.3				20.5		9.9	....
	1954	....		....		6.4				20.9		10.3	....
	1955-59	9.0	42.2	1.8	8.5	6.8	31.9	3.8	17.4	21.3	100	10.2	8.2
	1960-64	9.4	40.0	2.6	11.1	7.1	30.2	4.4	18.7	23.5	100	9.4	8.6
	1965-69	10.3	41.9	2.6	10.6	6.7	27.2	5.0	20.3	24.6	100	9.1	7.8
	1969	10.9	43.6	2.5	10.0	6.5	26.0	5.1	20.4	25.0	100	9.0	7.9
	1970	11.2	43.6	2.4	9.3	6.4	24.9	5.7	22.2	25.7	100	9.6	7.8
	1971	11.3	43.6	2.5	9.7	6.1	23.6	6.0	23.1	25.9	100	9.6	7.5

a. OECD, Food Consumption Statistics for the years 1952-1963, 1954-1960 and 1955-1971.

b. Percentage out of total fats and oils.

c. For U.K. the total includes margarine (fat content) other oils and fats and compound cooking fats.

d. Product weight.

e. The individual figures do not add up to the total, since the total includes, in the case of Ireland and U.K. fats and oils which are not mentioned in the table.

.... indicates that data are unavailable or insignificant.

Table A-8. E.E.C. percentage crushed of specified oilseeds.[a]

Type of oilseeds	Crushing period	Percentage crushed
Soybeans	Year following harvest	50
Groundnuts	Year following harvest	35
Cotton seed	Year following harvest	90
Rape seed	Year of harvest	90
Sunflower seed	Year following harvest	92
Flaxseed	Year following harvest	85
Copra	Year of harvest	100[b]
Palm Kernel	Year of harvest	100[b]

a. Data were obtained directly from USDA, Foreign Agricultural Service.

b. Applied to commercial productions.

Table A-9. E.E.C. meal conversion factors for specified oilseeds--1952-1973.[a]

Year	Soybeans	Groundnuts	Cotton Seed	Rape Seed	Sunflower Seed	Flax Seed	Copra	Palm Kernel
1952	.805	.554	.425	.62	.72	.62	.35	.49
1953	.805	.554	.425	.62	.72	.62	.35	.49
1954	.805	.554	.425	.62	.72	.62	.35	.49
1955	.805	.554	.425	.62	.72	.62	.35	.49
1956	.805	.554	.425	.62	.72	.62	.35	.49
1957	.805	.554	.425	.62	.72	.62	.35	.49
1958	.805	.554	.425	.62	.72	.62	.35	.49
1959	.805	.554	.425	.62	.72	.62	.35	.49
1960	.795	.54	.465	.60	.45	.63	.35	.51
1961	.795	.54	.465	.60	.45	.63	.35	.51
1962	.795	.54	.465	.60	.45	.63	.35	.51
1963	.795	.54	.465	.60	.45	.63	.35	.51
1964	.795	.54	.465	.58	.45	.63	.35	.51
1965	.795	.54	.465	.58	.45	.63	.35	.51
1966	.795	.54	.465	.58	.45	.63	.35	.51
1967	.795	.54	.465	.58	.45	.63	.35	.51
1968	.795	.54	.465	.58	.45	.63	.35	.51
1969	.795	.54	.465	.57	.45	.63	.35	.51
1970	.795	.54	.465	.57	.45	.63	.35	.51
1971	.795	.54	.465	.57	.45	.63	.35	.51
1972	.795	.54	.465	.57	.45	.63	.35	.51
1973	.795	.54	.465	.57	.45	.63	.35	.51

a. Data for 1952-59: Moe and Mohtadi, 1971.
Data for 1960-73 obtained directly from USDA, Foreign Agricultural Service, Washington, D. C.

Table A-10. E.E.C. oil conversion factors for specified oilseeds--1952-1973.[a]

Year	Soybeans	Groundnuts (shelled)	Cotton Seed	Rape Seed	Sunflower Seed	Flax Seed	Copra	Palm Kernel
1952	.17	.43	.20	.35	.25	.35	.64	.49
1953	.17	.43	.20	.35	.25	.35	.64	.49
1954	.17	.43	.20	.35	.25	.35	.64	.49
1955	.17	.43	.20	.35	.25	.35	.64	.49
1956	.17	.43	.20	.35	.25	.35	.64	.49
1957	.17	.43	.20	.35	.25	.35	.64	.49
1958	.17	.43	.20	.35	.25	.35	.64	.49
1959	.17	.43	.20	.35	.25	.35	.64	.49
1960	.177	.45	.16	.35	.25	.34	.64	.47
1961	.177	.45	.16	.35	.25	.34	.64	.47
1962	.177	.45	.16	.35	.35	.34	.64	.47
1963	.177	.45	.16	.35	.35	.34	.64	.47
1964	.177	.45	.16	.36	.35	.34	.64	.47
1965	.177	.45	.16	.36	.35	.34	.64	.47
1966	.177	.45	.16	.37	.35	.34	.64	.47
1967	.177	.45	.16	.38	.35	.34	.64	.47
1968	.177	.45	.16	.39	.35	.34	.64	.47
1969	.177	.45	.16	.40	.35	.34	.64	.47
1970	.177	.45	.16	.40	.35	.34	.64	.47
1971	.177	.45	.16	.40	.35	.34	.64	.47
1972	.177	.45	.16	.40	.35	.34	.64	.47
1973	.177	.45	.16	.40	.35	.34	.64	.47

a. Data for 1952-59: Moe and Mohtadi, 1971.
Data for 1960-73 obtained directly from USDA, Foreign Agricultural Service, Washington, D. C.

Table A-11. E.E.C. total available supply of meals, solubles and similar animal feeding stuffs, of aquatic animal origin--1952-1973.[a]

Year	1,000 Metric Tons				
	Production	Trade			Total Available Supply
		Imports	Exports	Net	
1952	174.9	124.6	21.5	103.1	278.0
1953	193.1	188.9	20.1	168.8	361.9
1954	200.7	279.9	33.5	246.4	447.1
1955	192.1	300.2	42.8	257.4	449.5
1956	187.0	372.9	49.9	323.0	510.0
1957	266.6	410.8	60.3	350.5	617.1
1958	258.1	455.0	76.3	378.7	636.8
1959	288.6	518.2	81.9	436.3	724.9
1960	252.2	654.7	59.5	595.2	847.4
1961	237.7	850.8	64.3	786.5	1024.2
1962	271.7	1012.3	93.1	919.2	1190.9
1963	280.5	984.4	86.0	898.4	1178.9
1964	309.4	1269.3	106.7	1162.6	1472.0
1965	319.5	1271.7	128.8	1142.9	1462.4
1966	324.9	1148.0	132.4	1015.6	1340.5
1967	369.0	1365.3	163.3	1202.0	1571.0
1968	437.5	1589.1	266.0	1323.1	1760.6
1969	442.6	1616.5	261.5	1355.0	1797.6
1970	434.0	1390.9	268.7	1122.2	1556.2
1971	446.4	1272.9	315.9	957.0	1403.4
1972	409.9	1393.7	351.5	1042.2	1452.1
1973	434.1	1452.6	292.7	1159.9	1594.0

a. UN, FAO, Yearbook of Fishery Statistics, 1952-1973, inclusive.

Table A-12. E.E.C. production of compound feeds by country--1960-1968.[a]

Year	Belgium	Denmark	France	Germany	Ireland	Italy	Luxem-bourg	The Neth-erlands	United Kingdom	E.E.C.
					1,000 Metric Tons					
1960	1550.0	------	2198.5	3576.1	------	850.0	13.9	4650.0	8979.0	21817.5
1961	2050.5	------	2781.0	4604.5	------	975.0	19.9	5153.0	9489.0	25072.9
1962	2056.2	------	3274.9	5015.6	------	1175.0	21.2	5044.0	9454.0	26050.9
1963	2039.8	------	3484.5	5128.4	------	1400.0	17.1	5199.0	9283.0	26551.8
1964	2339.2		4140.4	6090.9	------	1750.0	26.3	5705.0	9667.0	32348.6
1965	2637.0	2712.2	4761.4	7203.1	------	2150.0	24.7	6169.0	9850.0	35507.4
1966	3034.1	2738.5	5429.0	7578.9	------	2400.0	33.5	6386.0	9475.0	37075.0
1967	3085.6	2574.8	5582.0	7701.0	------	2500.0	33.5	6629.0	10114.0	38219.9
1968	3206.3	------	5516.3	7545.3	------	3188.0	34.1	7117.0	10394.0	37001.0

a. Data obtained from Organization for Economic Cooperation and Development, Study on the Factor Influencing the Use of Cereals in Animal Feeding, Paris, 1971.

Table A-13. E.E.C. percentage of oilcakes used in compound feeds by country--1960-1967.[a]

Year	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	The Netherlands	United Kingdom
1960	-----	-----	20.0	20.8	-----	-----	-----	15.9	16.9
1961	-----	-----	16.0	18.7	-----	-----	-----	15.9	16.7
1962	18.3	-----	19.1	19.2	-----	-----	-----	17.7	15.7
1963	16.4	-----	24.1	19.0	-----	19.5	-----	18.0	14.2
1964	15.5	-----	22.8	20.3	-----	17.7	-----	18.8	13.6
1965	15.9	-----	22.3	23.9	-----	18.9	-----	21.2	13.7
1966	15.9	-----	20.6	25.9	-----		-----	20.7	11.7
1967	-----	-----	23.2	26.2	-----		-----	21.6	11.4

a. Data obtained from Organization for Economic Cooperation and Development, *Study on the Factor Influencing the Use of Cereals in Animal Feeding*, Paris, 1971.

Table A-14. E.E.C. population of cattle, swine and poultry: actual numbers and total in animal units.

Year	Cattle: Actual Numbers	Cattle: Numbers in Animal Units	Swine: Actual Numbers	Swine: Numbers in Animal Units	Poultry: Actual Numbers	Poultry: Numbers in Animal Units	Total Livestock in Animal Units
			In 1,000 Units				
1952	59116	47293	37625	7525	218969	876	55694
1953	60222	48178	38205	7641	222341	889	56708
1954	61255	49004	38910	7782	221915	888	57674
1955	61429	49143	41066	8213	422865	1691	59047
1956	61748	49398	41046	8209	451114	1804	59411
1957	62281	49825	42463	8483	455913	1824	60132
1958	63220	50576	44326	8865	472916	1892	61333
1959	65196	52157	44095	8819	494128	1977	62953
1960	66877	53502	45003	9001	489575	1958	64461
1961	68942	55154	47651	9530	534202	2137	66821
1962	70297	56238	50896	10179	530480	2122	68539
1963	69372	55498	50739	10148	540914	2164	67810
1964	67920	54336	52339	10468	603422	2414	67218
1965	69609	55687	56139	11228	608454	2434	69349
1966	71788	57430	54595	10919	620877	2484	70833
1967	72842	58274	56003	11201	639094	2556	72031
1968	72903	58322	58644	11729	616571	2466	72517
1969	74020	59216	60178	12036	618783	2475	73727
1970	74342	59474	66127	13225	663766	2655	75354
1971	73378	58702	70281	14056	652879	2612	75370
1972	74018	59214	68925	13785	629342	2517	75516
1973	77137	61710	68945	13789	662450	2650	78149

a. UN, FAO, Production Yearbook, 1952-1974, inclusive.

b. Actual numbers were converted to animal units using the following ratios: Cattle - .8; Swine - .2; and Poultry - .004.

Table A-15. E.E.C. total population by country--1952-1972.[a]

Year	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	The Netherland	United Kingdom	Total
					1,000,000 Persons					
1952	8.73	4.34	42.36	48.68	2.95	47.35	.30	10.38	50.43	215.52
1953	8.78	4.37	42.65	49.15	2.95	47.60	.30	10.49	50.59	216.88
1954	8.82	4.41	43.06	49.68	2.94	47.90	.30	10.62	50.77	218.50
1955	8.87	4.44	43.43	50.17	2.92	48.20	.30	10.75	50.95	220.03
1956	8.92	4.47	43.84	50.78	2.90	48.47	.31	10.89	51.18	221.76
1957	8.99	4.49	44.31	51.43	2.89	48.74	.31	11.02	51.43	223.61
1958	9.05	4,52	44.79	52.06	2.85	49.04	.31	11.19	51.65	225.46
1959	9.10	4.55	45.24	52.67	2.85	49.36	.31	11.35	51.96	227.39
1960	9.15	4.58	45.68	53.37	2.83	49.64	.31	11.48	52.37	229.41
1961	9.18	4.61	46.16	54.03	2.82	49.90	.32	11.64	52.81	231.47
1962	9.22	4.65	47.00	54.77	2.83	50.24	.32	11.90	53.31	234.24
1963	9.29	4.68	47.82	57.61	2.85	50.64	.32	11.97	53.64	238.82
1964	9.38	4.72	48.31	58.20	2.86	51.57	.33	12.12	53.85	241.34
1965	9.46	4.76	48.76	59.04	2.88	51.94	.33	12.29	54.18	243.64
1966	9.53	4.80	49.16	59.68	2.88	52.28	.33	12.45	54.45	245.56
1967	9.58	4.84	49.55	59.87	2.90	52.60	.34	12.60	54.75	247.03
1968	9.62	4.86	49.91	60.17	2.91	52.91	.34	12.72	55.05	248.49
1969	9.65	4.89	50.32	60.84	2.93	53.23	.34	12.87	55.27	250.34
1970	9.66	4.93	50.77	61.56	2.95	53.57	.34	13.03	55.41	252.22
1971	9.67	4.96	51.25	61.29	2.98	53.90	.34	13.19	55.61	253.19
1972	9.71	4.99	51.72	61.67	3.01	54.35	.35	13.33	55.80	254.93
1973	9.76	5.03	52.13	61.97	3.03	54.89	.35	13.44	55.93	256.53

a. UN, DESA, Demographic Yearbook, 1952-1974, inclusive.

Table. A-16. E.E.C. per capita private consumption expenditures by country--1952-1973.[a]

Year	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	The Netherlands	United Kingdom
					In U. S. Dollars[b]				
1952	660	654	656	389	---	260	628	354	592
1953	672	597	684	434	363	297	650	369	636
1954	696	627	710	440	364	291	672	404	658
1955	725	661	759	502	403	326	718	430	720
1956	747	694	834	552	404	354	748	469	750
1957	797	709	761	593	418	372	819	494	796
1958	792	742	733	633	452	407	850	498	833
1959	822	796	782	667	459	480	884	520	871
1960	859	851	846	774	486	454	901	561	905
1961	892	943	875	875	521	494	919	624	946
1962	935	1049	983	937	559	552	969	665	992
1963	1004	1093	1086	953	589	637	1077	735	1044
1964	1067	1214	1174	1015	653	675	1172	823	1106
1965	1152	1325	1245	1094	686	717	1257	903	1175
1966	1215	1455	1320	1170	722	783	1310	971	1233
1967	1286	1469	1426	1192	661	860	1305	953	1110
1968	1374	1586	1553	1254	746	911	1386	1112	1174
1969	1499	1792	1568	1484	848	986	1496	1251	1247
1970	1602	1902	1682	1648	933	1118	1641	1399	1344
1971	1955	2152	1967	2049	1109	1256	2017	1704	1588
1972	2187	2397	2246	2283	1157	1387	2185	1912	1648
1973	2651	2934	2727	3811	1362	1552	2621	2411	1850

a. UN, DESA, Yearbook of National Accounts Statistics. The national currencies were converted to U.S. dollars using current exchange rates as reported in the UN, DESA, Statistical Yearbook, 1952-1974.

b. At current prices and current exchange rates.

Table A-17. E.E.C. projected values of the exogenous variables--1980-1985.[a]

Year	Price of feed grains [b]	Net supply of fish meal	Production of oilseeds in the E.E.C.	Total consumption of oilseed meals	Conversion factor for for for meals [b]
	X_1	X_2	X_3	X_4	X_5
1970-73 (actual)	90.94	19.4	15.4	200.6	.66
1980	105.78	24.4	22.6	461.2	.67
1981	105.78	24.6	23.5	498.7	.67
1982	105.78	24.9	24.6	539.2	.67
1983	105.78	25.2	25.7	583.0	.67
1984	105.78	25.5	26.8	630.4	.67
1985	105.78	25.7	28.0	681.6	.67

a. Projections were made by using, for each variable, four trend equations and selecting the one with the highest R^2
The four equations are:

$$y = a + bt$$

$$\log y = a + bt$$

$$y = a - b/t$$

$$\log y = a + b \log t$$

Quantities are in metric tons per 1,000 animal unit.
Prices are in dollars per metric ton.

b. Assumed to be constant during the projection period at the 1973 level.

Table A-18. E.E.C. projected numbers of cattle, swine and poultry--1980-1985.[a]

	In 1,000 Units						
	Cattle		Swine		Poultry		
Year	Actual Numbers	Numbers in Animal Units	Actual Numbers	Numbers in Animal Units	Actual Numbers	Numbers in Animal Units	Total Livestock in Animal Units
1973 (actual)	77137	61710	68945	13789	662450	2650	78149
1980	80363	64298	83583	16717	760246	3041	84056
1981	81017	64814	85507	17101	772058	3088	85003
1982	81662	65330	87431	17486	783871	3135	85951
1983	82306	65845	89356	17871	795684	3183	86899
1984	82950	66360	91380	18256	807497	3230	87846
1985	83595	66876	93204	18641	819310	3277	88794

a. The projected numbers were generated by using a linear trend equation: $Y = a+bt$. Actual numbers were converted to animal units using the following coefficients: cattle - .8; swine - .2; and poultry - .004.

Table A-19. Sudan: Production and exports of oilseeds and oilseed products,[a] by type of oilseeds for selected periods.

		1000 m.t.					
		Meal			Oil		
Period	Type of Oilseeds	Production[b]	Exports[c]	%[d]	Production[e]	Exports[f]	%[d]
1964-66	Peanuts	203	143	70	127	74	58
	Cottonseeds	188	146	78	48	20	42
	Sesame	78	64	82	75	38	51
	Total	469	353	75	250	132	53%
1967-69	Peanuts	196	115	59	122	48	39
	Cottonseeds	176	158	90	70	19	27
	Sesame	84	63	75	80	43	54
	Total	456	336	74	272	110	40%
1970-72	Peanuts	246	121	46	165	52	32
	Cottonseeds	206	185	89	83	34	41
	Sesame	149	69	46	143	40	28
	Total	621	375	60	391	126	32%
1973	Peanuts	331	151	46	206	74	36
	Cottonseeds	161	98	61	64	19	30
	Sesame	120	69	58	115	49	43
	Total	612	318	52	385	142	37

a. Computed using data from UN, FAO, Production Yearbook, 1952-74, and Trade Yearbook, 1952-74.

b. Production in terms of meal equivalent.

c. Exports of meal plus meal equivalent of seeds.

d. Exports as percentage of production.

e. Production in terms of oil equivalent.

f. Exports of oil plus oil-equivalent of seeds.

Meal conversion ratio:
- Peanuts : .5400
- Cottonseeds : .4650
- Sesame : 48%

Oil conversion ratio:
- Peanuts : .450
- Cottonseeds : .160
- Sesame : 4%

APPENDIX B

THE PRELIMINARY MODEL

<u>Statistical Results</u>[a]

(1) Total demand for meals: Y_1

$$Y_1 = -19317.424 + 2.108\ Y_2 - 23.164\ Y_3 + 0.430\ X_1^*$$
$$\quad (9.727) \qquad (34.127) \qquad (0.060)$$
$$-1.851\ X_2^*$$
$$(0.828)$$

$R^2 = .97$ $\qquad$ $S = 500.36$

(2) Whole sale price of groundnut meal in France: Y_2

$$Y_2 = -9.577 + 0.003\ Y_1 + 0.247\ Y_3 + 0.619\ X_3^*$$
$$\quad (0.002) \qquad (0.484) \qquad (0.121)$$

$R^2 = .87$ $\qquad$ $S = 10.56$

(3) Wholesale price of feed grains: Y_3

$$Y_3 = 121.321 + 0.255\ Y_2^* - 0.001\ X_4^*$$
$$(0.041) \qquad (0.000)$$

$R^2 = .94$ $\qquad$ $S = 4.55$

(4) Import demand for meals: Y_4

$$Y_4 = -12363.931 - 26.259\, Y_3 - 0.892\, Y_5$$

(34.669) (7.217)

$$+ 0.353\, X_1^* - 1.438\, X_2 + 4.594\, X_5^*$$

(0.072) (0.754) (2.060)

$R^2 = .98$ $S = 416.85$

(5) Import price of soybean meal: Y_5

$$Y_5 = -201.144 + 2.860\, Y_3^* + 0.012\, Y_4^*$$

(0.531) (0.004)

$R^2 = .68$ $S = 21.31$

(6) Total demand for vegetable oils: Y_6

$$Y_6 = 6318.128 + 0.638\, Y_7 - 0.161\, X_6 + 13.174\, X_7^*$$

(0.522) (0.292) (2.984)

$$-31.628\, X_8$$

(18.591)

$R^2 = .94$ $S = 144.46$

(7) Wholesale price of groundnut oil in France: Y_7

$$Y_7 = -226.192 - \underset{(0.048)}{0.087\, Y_6} + \underset{(0.080)}{0.516\, X_6^{*}}$$

$$R^2 = .83 \qquad S = 95.43$$

(8) Import demand for vegetable oils: Y_8

$$Y_8 = 3482.649 + \underset{(0.180)}{0.069\, X_6} + \underset{(2.705)}{7.004\, X_7^{*}}$$

$$- \underset{(16.669)}{15.785\, X_8} + \underset{(0.599)}{0.325\, X_9} + \underset{(0.265)}{0.160\, X_{10}}$$

$$R^2 = .92 \quad S = 104.54$$

---

a. The endogenous (Y's) and the exogenous (X's) variables of the the model are defined in the text, Chapter 4.

An asterisk (*) above any variable indicates that it is significant at 5 percent.

Table B-1. Correlation coefficients between the exogenous variables of the preliminary model.[a]

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_2	.937								
X_3	-.495	-.610							
X_4	.984	.938	-.512						
X_5	.875	.753	-.277	.854					
X_6	-.793	-.839	.788	-.791	-.457				
X_7	.985	.906	-.452	.977	.928	-.712			
X_8	.988	.950	-.507	.985	.891	-.762	.989		
X_9	-.837	-.889	.774	-.841	-.637	.890	-.787	-.838	
X_{10}	.906	.807	-.392	.876	.893	-.632	.927	.904	-.704

[a]The X's in this table are the exogenous variables of the preliminary model and are defined in the text, chapter 4.

SELECTED BIBLIOGRAPHY

Abaelu, J. N. and Lester V. Manderscheid. "U.S. Import Demand for Green Coffee by Varieties." American Journal of Agricultural Economics, 50(2):232-242, May 1968.

Abel, M. E. "Price Discrimination in the World Trade of Agricultural Commodities." Journal of Farm Economics, 48(2):194-208, May 1966.

Adams, F. G., H. Eguchi and R. Meyer-Zwchlochtern. An Econometric Analysis of International Trade: An Interrelated Explanation of Imports and Exports of OECD Countries. Paris: Organization for Economic Cooperation and Development, 1969.

Adler, J. H. "Discussion of Harberger Paper." American Economic Review, 43(2):160-163, May 1953.

Ahalt, J. D. and Alvin C. Egbert. "The Demand for Feed Concentrates: A Statistical Analysis." U.S.D.A. Agricultural Economics Research, 17(2):41-49, April 1965.

Andrews, S. Agriculture and the Common Market. Ames: The Iowa State University Press, 1973.

Antoine, Banna. "Oilseeds, Fats and Oils and Their Products, 1908-53." U.S.D.A. Agricultural Marketing Service, Statistical Bulletin No. 147, June 1954.

Armore, S. J. "The Demand and Price Structure for Food Fats and Oils." U.S.D.A. Technical Bulletin 1068, Washington, D.C., June 1953.

Armore, S. J. and Edgar L. Burtis. "Factors Affecting Consumption of Fats and Oils Other than Butter in the United States." U.S.D.A. Agricultural Economics Research, 2(1):1-9, January 1950.

Ayob, A. M. and Anthony Prato. "United States Import Demand and Prices of Natural Rubber." The Malayan Economic Review, 18(1):24-35, April 1973.

Ball, R. J. and K. Marwah. "The U.S. Demand for Imports, 1948-1958." The Review of Economics and Statistics, 44(4):395-401, November, 1962.

Barten, A. P. "Estimating Demand Equations." Econometrica, 36(2): 213-251, April 1968.

Beals, Ralph E. Statistics for Economists. Chicago: Rand McNally and Company, 1972.

Berge, E. R. "Structure of the Soybean Oil Export Market." University of Illinois Agricultural Experiment Station Bulletin 674, Urbana, August 1961.

Bulletin of Agricultural Statistics of the Sudan, Ministry of Agriculture, Department of Agricultural Economics, Statistics Section, Khartoum, Sudan, 1964/65-1969/70.

Butterwick, M. W. Agricultural Marketing and the E.E.C. London: Hutchinson of London, 1972.

Butterwick, M. W. and E. Neville-Rolfe. Food, Farming, and the Common Market. London: Oxford University Press, 1968.

Christ, C. F. "Aggregate Econometric Models." The American Economic Review 46(3):385-408, June 1956.

Christ, C. F. "Simultaneous Equation Estimation: Any Verdict Yet?" Econometrica, 28(4):835-845, October 1960.

Christ, C. F. Econometric Models and Methods. New York: John Wiley and Sons, Inc., 1966.

Commission of the European Communities, Office for Official Publications of the European Communities [CEC, OOPEC]:

CEC, OOPEC. The Common Agricultural Policy, July 1974.

CEC, OOPEC. Information Memo, P. 13, February, 1975.

CEC, OOPEC. Official Journal of the European Communities [OJEC], No. 172, September 30, 1966.

CEC, OOPEC. OJEC, No. L160, July 17, 1971.

CEC, OOPEC. OJEC, No. L201, July 23, 1974.

CEC, OOPEC. Report on the Community's Protein Supplies, Part IV, November 16, 1973.

CEC, OOPEC. The State of Agriculture in the Community, Part II, 1974 Report, November 27, 1974.

Dahl, R. P. "Demand for U.S. Soybeans in the Euroopean Common Market: A Case for Optimism." Journal of Farm Economics, 47(4):979-992, November 1975.

Elz, Dieter. Oilseed Product Needs of the European Economic Community, 1970: A Report Financed under a Contract between the Author and the U.S. Department of Agriculture, May 1967.

Foote, R. J. "Analytical Tools for Studying Demand and Price Structures." U. S. Department of Agriculture, Agricultural Handbook No. 146, Washington, D. C., August 1958.

Foreign Trade Statistics, Ministry of Planning, Department of Statistics, Khartoum, Sudan, 1960-1971.

Fox, Karl A. Intermediate Economic Statistics. New York: John Wiley and Sons, nc., 1968.

General Agreement on Tariff and Trade. International Trade, 1965. Geneva, 1966.

General Agreement on Tariff and Trade. International Trade, 1973-74, Geneva, 1974.

Goldberger, Arthur S. Econometric Theory. John Wiley and Sons, Inc., New York: 1964.

Goolsby, O. Halbert. "Changes in E.E.C. Imports of Commodities Affected by the Variable Levy System," U.S.D.A., Economic Research Service, ERS-Foreign 225, June 1968.

Gudmundsson, G. "Time Series Analysis of Imports, Exports, and other Economic Variables." Journal of Royal Statistical Society, Series A (General), 134(3):383-412, 1971.

Harberger, A. C "A structural Approach to the Problem of Import Demand." The American Economic Review, 43(2):148-159, May 1953.

Hood, W. C. and T. C. Koopmans (eds.). Studies in Econometric Methods. New York: John Wiley and Sons, Inc., 1953.

Houck, J. P. "Demand and Price Analysis of the U. S. Soybean Market." University of Minnesota Agricultural Experiment Station Technical Bulletin 244, June 1965.

Houck, J. P. and J. S. Mann. "An Analysis of Domestic and Foreign Demand for U. S. Soybean and Soybean Products." Minnesota Agricultural Experiment Station, Tech. Bull. 256, 1968.

Houck, J. P., M. E. Rayan and A. Subotnik. Soybeans and Their Products, Markets, Models, and Policy. Minneapolis: University of Minnesota Press, 1972.

Houthakker, H. S. and Stephen P. Magee. "Income and Price Elasticities in World Trade." The Review of Economics and Statistics, 51(2): 111-125, May 1969.

Ibigbami, P. O. "Instability of Earnings from Oilseeds Exports of Nigeria." Unpublished Master's Thesis, University of Arizona, Tucson, 1968.

International Trade Centre. "The Market for Cottonseed Oil in Five Selected European Countries and Japan." GATT International Trade Centre, Geneva, 1967.

"The Major Import Markets for Oilcake." GATT International Trade Centre, Geneva, 1972.

Johnston, J. Econometric Methods. New York: McGraw-Hill Book Company, 1972.

Junghaus, Y. N. "An Econometric Analysis of Import Demand for Rice in the European Economic Community: Special Reference to U.S. Rice." Unpublished Doctoral Dissertation, Texas A & M University, 1971.

Kakwani, N. C. "On the Bias in Estimates of Import Demand Parameters." International Economic Review, 13(2):239-244, June 1972.

Kemp, M. C. "Errors of Measurement and Bias in Estimates of Import Demand Parameters." The Economic Record, 38(83):369-372, September 1962.

Kmenta, J. Elements of Econometrics. New York: The Macmillan Company, 1971.

Koopmans, T. C. "Identification Problems in Economic Model Construction." Chapter 2 in Studies in Econometric Method, Cowls Commission Monograph 14, W. C. Hood and T. C. Koopmans, editors, New York: John Wiley and Sons, Inc., 1953, pp. 27-48.

Kreinin, M. E. "Disaggregated Import Demand Functions--Further Results." The Southern Economic Journal, 40(1):19-25, July 1973.

Kwack, S. Y. "The Determination of U. S. Imports and Exports: A Disaggregated Quarterly Model, 1960 III-1967 IV." The Southern Economic Journal, 38(3):302-314, January 1972.

Leamer, E. E. "Empirically Weighted Indexes for Import Demand Functions." The Review of Economics and Statistics, 55(4):441-450, November 1973.

Llewellyn, G. E. "The Determinants of United Kingdom Import Prices." The Economic Journal, 84(333):18-31, March 1974.

Mackie, A. B., T. E. Full and J. F. Falck. "World Trade in Selected Agricultural Commodities 1951-1965, Vol. V, Oilseeds, Oil Nuts, and Animal and Vegetable Oils." U.S.D.A. ERS, Foreign Agric. Econ. Report No. 47, 1968.

Mehta, V. M. "India's Position in the World Peanut and Peanut Oil Markets." Unpublished Doctoral Dissertation, North Carolina State University, Raleigh, 1970.

Moe, L. E. and M. M. Mohtadi. "World Supply and Demand Prospects for Oilseeds, Oilseed Products in 1980 with Emphasis on Trade by the Less Developed Countries." U.S.D.A. ERS Foreign Agric. Econ. Report No. 71, March 1971.

Norton, W. E., G. H. Jackson and K. M. Sweeny. "A Demand Equation for Imports." The Economic Record, 45(112):589-595, December 1969.

Orcutt, G. H. "Measurement of Price Elasticities in International Trade." The Review of Economics and Statistics, 32(2):117-132, May 1950.

Organization for Economic Cooperation and Development [OECD]. "Agricultural Policy of the European Economic Community." Paris: 1974.

OECD. "Agricultural Projections for 1975 and 1985, Europe, North America Japan, Oceania--Production and Consumption of Major Food Stuffs," Paris: 1968.

OECD. Agriculture and Food Statistics, 1952-1963. Paris: 1965.

OECD. Food Consumption Statistics, 1954-1966. Paris: 1968.

OECD. Food Consumption Statistics, 1955-71. Paris: 1973.

OECD. Foreign Trade." 1960-1974, inclusive.

OECD. National Account Statistics. 1955-1974, inclusive.

OECD. Statistical Bulletin. 1960-1974, inclusive.

OECD. Study on the Factors Influencing the Use of Cereals in Animal Feeding. Paris: 1971.

Price, J. E. and J. B. Thornblade. "U.S. Import Demand Functions Disaggregated by Country and Commodity." The Southern Economic Journal, 39(1):46-57, July 1972.

Reimer, R. "The United States Demand for Imports of Materials, 1923-1960." The Review of Economics and Statistics, 46(1):65-75, February 1964.

Rogers, S. T. and B. A. Davey (eds.). The Common Agricultural Policy and Britain. England: Saxon House, 1973.

Sharma, V. V. "An Econometric Analysis of the Indian Oilseeds Economy and International Trade in Fats and Oils." Unpublished Doctoral Dissertation, University of Illinois, Urbana, 1968.

Shultz, H. The Theory and Measurement of Demand. Illinois: University of Chicago Press, 1938.

Simantov, A. "Economic Problems Affecting Agricultre in Europe and Policies Called For." Kyklos, 19(2):231:259, 1966.

Sinclair, S. "EEC's Trade in Agricultural Products with Non-Member Countries." International Journal of Agrarian Affairs, IV(5): 287-299, April 1965.

Stopforth, J. and J. P. O'Hagan. "Structure of the Oilseed Crushing Industry and Factors Affecting its Location." Monthly Bulletin of Agricultural Economics and Statistics, (FA), 16(4):1-9, April 1967 and 16(5):1-15, May 1967.

The Commonwealth Secretariat. "Vegetable Oils and Oilseeds, A Review." Published in London, 1966, 1967, 1972, and 1973.

Tweeten, L. G. "The Demand for United States Farm Output." Food Research Institute Studies, 7(3):343-369, 1967.

United Nations, Food and Agricultural Organization (U.N., F.A.O.). Agricultural Commodiities Projections for 1975 and 1985, Vols. I and II. Rome, 1967.

UN, FAO. Approaches to International Action on World Trade in Oilseeds, Oils and Fats. Rome, 1971.

UN, FAO. The European Common Market: Fats and Oils Regulations. Rome, 1965.

UN, FAO. Production Yearbook. Rome, 1952-74.

UN, FAO. Trade Yearbook. Rome, 1952-74.

UN, FAO. Yearbook of Fishery Statistics. 1952-1973.

United Nations, Department of Economics and Social Affairs (UN, DESA), Demographic Yearbook. New York, 1952-1974.

UN, DESA. Statistical Yearbook. New York, 1952-1974.

United States Department of Agriculture, Foreign Agricultural Service (USDA, FAS), Foreign Agriculture Circular, Fats and Oils, 1970-1974, inclusive.

USDA, FAS. "EEC Oilseed Meal Use in 1970-1980 Should Surpass Record Set in Calendar Year 1971." Foreign Agriculture (10(43): 5, 16; October 23, 1972.

USDA, FAS. "Price Incentives for Soybeans Could Boost EC's Production." Foreign Agricultrue, 12(20):2-4, May 20, 1974.

Vandenborre, R. J. "Demand Analysis of the Markets for Soybean Oil and Soybean Meal." Journal of Farm Economics, 48(4):920-934, November 1966.

Vigen, J. W. "Analysis of Demand for Wheat in the European Economic Community with Projections to 1970 and 1975." Unpublished Doctoral Dissertation, The Ohio State University, Miami, 1965.

Walters, F. E. "The Economic Structure of the Oilseeds Market and the Spatial Price Equilibrium Flows of Oilseed Meals." Unpublished Doctoral Dissertation, University of Illinois, Urbana, 1963.

West, Quentin M. "Foreign Supply and Demand Projections: Outlook for U. S. Agricultural Exports." Journal of Farm Economics, 48(5): 1359-1372, December 1966.

Wold, H. O. A. (ed.) Econometric Model Building. Amsterdam: North-Holland, 1964.

Ypersele, J. V. "The Financing of the Common Market's Agricultural Policy." International Monetary Fund Staff Papers, XV(2):267-287, July 1968.