SOME POSSIBLE PRODUCTION AND TRADE EFFECTS OF THE EEC'S COMMON AGRICULTURAL POLICY FOR GRAINS

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ABSTRACT

SOME POSSIBLE PRODUCTION AND TRADE EFFECTS OF THE EEC'S COMMON AGRICULTURAL POLICY FOR GRAIN

by Roger W. Fox

The development of the European Economic Community, since its inception in 1957, has led to numerous changes in agricultural policy. Important among these changes was the adoption of common regulations governing the pricing and trading of cereals by the member countries. Implementation of the cereal regulations is expected to change production, trade and resource use within the EEC. In addition, changes within the EEC will cause production and trading patterns of major grain exporters to change.

This study measured some of the possible changes in the world grain economy resulting from the EEC's grain policy. Two basic linear programming models were used for the analysis. The models were designed to utilize policy variables (prices and import levies), additional economic relationships, and technical production coefficients to yield estimates of regional grain production and resource use as well as estimates of interregional grain trade. In addition to the EEC countries, the United States, Canada, the United Kingdom, Argentina and Australia were incorporated into one or both of the basic models.

Several variations of each model were utilized. Each model was initially specified with prices, coefficients and restraints representing average conditions during the base period (1959/60-1961/62). After the base period solutions were obtained, prices, production coefficients, and certain restraints were changed to represent expected 1970 conditions. The models were re-run and estimated changes in production, resource

allocation and trade patterns were obtained.

The major conclusions of the study are as follows:

1. By 1970, the EEC will probably have an export surplus of soft wheat ranging from 3.0 to 3.5 million metric tons. The EEC is expected to import from 1.0 to 1.5 million metric tons of quality hard wheat and durum wheat for blending purposes and other special uses.

2. Feed grain production in the EEC will continue to increase during the sixties. Despite substantial increases in production, the EEC feed grain deficit in 1970 is expected to be greater than during the base period.

3. Resource use in all model regions will be characterized by continued substitution of capital for labor. Some idling of land may occur in the United States and Canada.

4. By 1970, United States' exports of wheat to the EEC will probably be eliminated, except for relatively small quantities of quality hard wheat and durum wheat. Prospects for increasing feed grain exports to the EEC and the United Kingdom are very good. Even with the elimination of wheat exports, all of the models predicted that gross revenue from U.S. grain exports to the EEC would be greater in 1970 than during the base period.

5. Canadian wheat exports to the EEC and the United Kingdom are likely to diminish during the sixties. The study clearly indicated the risks associated with Canada's role as a residual supplier of wheat. It is estimated that expansion of the EEC to include the United Kingdom will virtually eliminate Canadian wheat exports to this area.

6. Argentina will continue to export most of its feed grain surpluses to the EEC and the United Kingdom. Australia will remain a

relatively minor supplier of wheat and feed grain to the EEC and the United Kingdom.

The application of linear programming in the analysis of aggregate economic policy problems involving production location and trade appears to be quite promising. The advantage of the approach used in this study is that it allows for the incorporation of institutionally controlled variables and technical production relationships into models that yield internally consistent estimates of production and trade. In addition, the models provide estimates of future relationships as alternative assumptions about institutional and technical relationships are specified. This type of analysis is extremely useful in studying problems of economic policy in which several alternatives exist.

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CHAPTER I

INTRODUCTION

The Problem and Its Importance

Agricultural production and marketing throughout the world is subject to extensive governmental control. Wheat and feed grains are among the important commodities affected by agricultural programs. Since feed grains are a principal input in livestock production, the livestock industry is directly affected by grain policies.

Public policies are subject to change. When a public policy, such as national grain legislation changes, a number of adjustments are likely to take place. The emergence of the European Economic Community (variously identified as the EEC, the Common Market, the Community, and the Six), with its proposed uniform external commercial policy, and its movement toward a common internal agricultural program creates new policy variables. The possible adjustments resulting from EEC policy proposals are of considerable importance to all countries involved. Since the EEC agricultural policy is subject to change, knowledge of the relative effects of alternative policies is desirable for any future negotiations that may take place.

This study focuses on EEC policy proposals for wheat and feed grain. The importance of policy decisions with respect to these products has been stressed frequently. Coppock, in commenting on the North Atlantic area (EEC, EFTA, U.S. and Canada), states, "The problem of relative efficiency and geographical specialization, then, comes down mainly to the production

of cereals for direct human consumption and for use in feeding livestock..."[1] Elmer Learn has stated that, "The foundation of the EEC farm income support policy is the grain program. Grain production accounts for 45 percent of the cropland and is the major input in the production of livestock products, especially pork, poultry, and eggs. Therefore, policies for most other commodities must be tied directly or indirectly to that for grains."[2] The United States Department of Agriculture considers the EEC grain pricing policies as extremely important. USDA concern is expressed in the following typical comment: "Since grain production in recent years has utilized 45 percent of all EEC cropland and since livestock and livestock products constituted nearly 70 percent of the total value of EEC farm production the ultimate level of common grain prices is the most important single factor affecting EEC production, trade, and consumption of agricultural products."[3]

The existing and proposed EEC policies with respect to grains and livestock raise a number of questions concerning their effect on (1) the location and level of production, (2) the allocation of resources within the farm sector and between the farm and nonfarm sector, (3) internal and external trade patterns, and (4) the distribution of income. This study considers the aggregate relationships associated with changes in grain policy. Thus it is concerned with the following types of questions:

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[1]John O. Coppock, North Atlantic Policy, The Agricultural Gap (New York: The Twentieth Century Fund, 1963), p. 192.

[2]Elmer W. Learn, "Long-term Effects of Common Market Grain Policies," Foreign Agricultural Trade of the United States (January 1963), p. 7.

[3]U.S.D.A., The 1963 Western Europe Agricultural Situation (supplement No. 2 to the 1963 World Agricultural Situation), p. 8. Underscoring added.

1. What will be the effect of EEC grain pricing policy on the location of production within the EEC and between the EEC and other major grain producing countries?

2. What changes in trading patterns will result from the EEC's proposed commercial and agricultural policies for grains? How do these patterns differ from recent (base period) trade flows?

3. How will the proposed common agricultural policy of the EEC affect the allocation of resources within the grain-producing sector and between the grain sector and the non-farm economy? Will significant changes occur in resource allocation in non-EEC grain producing countries?

4. What changes in income originating from the grain sector will develop as a result of the suggested EEC agricultural policy? Will the resulting changes in production and trade be trade creating or trade diverting?

5. What would be the effect on grain production and trade of United Kingdom membership in the EEC?

Specific answers to these questions are difficult to obtain. In many cases the answers obtained are contingent upon a large number of assumptions.

Objectives

It is within the framework of the above questions that this study is formulated. The specific objectives of the study are:

1. To build models that duplicate, as closely as possible, the location of production, product flow and resource allocation in the base period for a selected group of countries and commodities.

2. To utilize the models in making estimates of changes in the location of production, income, resource allocation and trade patterns

resulting from the EEC's proposed commercial and agricultural policies for grain.

3. To estimate the effects of changes in technical production coefficients on resource allocation, on the location and level of production, and on trade flows.

4. To test the empirical usefulness, under current data conditions, of interregional linear programming in the analysis of aggregate economic policy problems.

Method

As implied above, the central technique used in this study is that of the interregional linear program. Two models were utilized. Model I comprises the countries of the EEC, United States, Canada and the United Kingdom. Model II omits the United Kingdom, but adds Australia and Argentina. The emphasis in constructing the models was on simulating relationships existing in the base period. The models do not stress static equilibrium price determination, but rather, take the politically established product prices as given, and then determine the level of production, the trade patterns and the resource allocation consistent with these predetermined prices. When a solution representing the base period was obtained, key variables subject to policy control (e.g., product prices) were adjusted according to announced EEC policy. In addition, changes in the technical production coefficients and in the restraints, especially demand, were introduced to represent alternative conditions expected to exist in 1970. The models were re-run and estimated changes in production, resource allocation and trade patterns were obtained for 1970

The major analytical contribution of this study is the incorporation of institutionally controlled variables and technical production

relationships into models that yield internally consistent estimates of production and trade. Furthermore, the models provide estimates of future production, trade and resource use as alternative assumptions about institutional and technical relationships are specified. This type of analysis is extremely useful in studying problems of economic policy in which several alternatives exist.

Organization of the Study

Chapter II reviews the development of the EEC common agricultural policy with special emphasis on grain policy. Chapter III deals with model specification. Appendix II is closely related to Chapter III in that it elaborates the data requirements and techniques used to determine coefficients and other estimates used in the models. Following the presentation of results in Chapters IV and V, Chapter VI offers a discussion of the economic and political implications. Chapter VII contains a summary, recommendations and conclusions.

CHAPTER II

DEVELOPMENT OF THE EEC COMMON AGRICULTURAL POLICY

This chapter traces the development of the common agricultural policy (especially grain policy) from the Treaty of Rome to the present.[1] In a few cases reference to pre-EEC policy is made in order to illustrate a particular point.

Treaty of Rome

The treaty establishing the EEC was signed in Rome (hence the name, Treaty of Rome) on March 25, 1957 by representatives of Belgium, France, West Germany, Italy, Luxembourg and the Netherlands.[2] The Treaty

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[1]The following publications were of special importance in providing historical material for this chapter: Treaty establishing the European Economic Community and connected documents (an unofficial English translation); EEC Commission, The First Stage of the Common Market, Report on the Execution of the Treaty (January 1958-January 1962); EEC Commission, General Report on the Activities of the Community (Seven Reports in this series have been published, each containing a section on Common Agricultural Policy).

[2]It does not seem necessary to dwell on the historical development of the EEC, as several books have been written on the subject. For example, see: Emile Benoit, Europe at Sixes and Sevens; The Common Market, the Free Trade Association, and the United States (New York: Columbia University Press, 1962); Committee for Economic Development, The European Common Market and Its Meaning to the United States (May, 1959); Isaiah Frank, The European Common Market, An Analysis of Commercial Policy (New York: Frederick A. Praeger, c. 1961); William O. Henderson, The Genesis of the Common Market (London: Frank Cass, 1962); Don D. Humphrey, The United States and the Common Market, A Background Study (New York: Frederick A. Praeger, c. 1962); Uwe W. Kitzinger, The Politics and Economics of European Integration, Britain, Europe and the United States (Rev. and expanded edn.; New York: Frederick A. Praeger, 1963).

also includes, under special status, the associated overseas territories or former colonies and possessions of the member countries, primarily France and Belgium. Greece entered into associate membership in November 1962. The Treaty is an impressive document in size[3] as well as in its far-reaching economic, social and political implications.

Four institutional bodies of the EEC are of importance to the discussion in this chapter: the Council of Ministers, the Commission, the Assembly, and the Economic and Social Committee. The Council of Ministers has six members, one from each of the member countries. The Council is the executive of the Community and is vested with final power of decision on all matters of policy. The Council reaches decisions by a unanimous or majority vote as prescribed by the Treaty. The Commission has nine members and is the administrative body of the EEC. It has the task of developing and proposing policy for approval by the Council. The Commission also initiates and administers the procedure by which policies shall be applied. In addition, the Commission has the authority to make operational decisions on certain matters. The Commission acts on a majority vote. The Assembly has 142 delegates chosen by the Parliaments of the member countries. The Assembly is basically a review and debating body. The Economic and Social Committee has 101 representatives. Its major function is to review proposals and advise the Council of Ministers and the Commission.

General Objectives

As stated in Article 2 of the Treaty, the purpose for establishing the EEC was primarily economic:

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[3]The Treaty comprises 248 articles, four annexes, nine protocols, and three conventions.

> It shall be the aim of the Community, by establishing a Common Market and progressively approximating the economic policies of Member States, to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increased stability, an accelerated raising of the standard of living, and closer relations between its Member States.[4]

A clearer understanding of the objectives of the Community can be obtained by reading the member's commitment to action as stated in Article 3:

> For the purpose set out in the preceding Article, the activities of the Community shall include, under the conditions and with the timing provided for in this Treaty:
>
> (a) the elimination, as between Member States, of customs duties and of quantitative restrictions in regard to the importation and exportation of goods, as well as of all other measures with equivalent effect;
>
> (b) the establishment of a common customs tariff and a common commercial policy towards third countries;
>
> (c) the abolition, as between Member States, of the obstacles to the free movement of persons, services and capital;
>
> (d) the inauguration of a common agricultural policy;
>
> (e) the inauguration of a common transport policy;
>
> (f) the establishment of a system ensuring that competition shall not be distorted in the Common Market;
>
> (g) the application of procedures which shall make it possible to co-ordinate the economic policies of Member States and to remedy disequilibria in their balances of payments;
>
> (h) the approximation of their respective municipal law to the extent necessary for the functioning of the Common Market;
>
> (i) the creation of a European Social Fund in order to improve the possibilities of employment for workers and to contribute to the raising of their standard of living;
>
> (j) the establishment of a European Investment Bank intended to facilitate the economic expansion of the Community through the creation of new resources; and
>
> (k) the association of overseas countries and territories with the Community with a view to increasing trade and to pursuing jointly their effort towards economic and social development.[5]

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[4] Treaty..., p. 17.

[5] Ibid., pp. 17-18.

Objectives for Agriculture

The attainment of a common agricultural policy is clearly called for in section (d) as quoted above. Title II, Articles 38 through 47, is devoted entirely to the functioning and development of the EEC with respect to agricultural products. Article 39 states:

> 1. The common agricultural policy shall have as its objectives:
>
> (a) to increase agricultural productivity by developing technical progress and by ensuring the rational development of agricultural production and the optimum utilisation of the factors of production, particularly labour;
>
> (b) to ensure thereby a fair standard of living for the agricultural population, particularly by the increasing of the individual earnings of persons engaged in agriculture;
>
> (c) to stabilise markets;
>
> (d) to guarantee regular supplies; and
>
> (e) to ensure reasonable prices in supplies to consumers.[6]

In reading the policy objectives for agriculture as stated in the Treaty, it is interesting to note the similarity of these objectives with those of the member governments as they appeared in key agricultural legislation during the 1950's. A few examples will help illustrate the similarity. On July 8, 1955 the West German Parliament passed a general agricultural act which became effective in September 1955. The main objectives of this act were:

> (a) to achieve a reasonable standard of living for the agricultural population...;
>
> (b) to increase agricultural productivity by all means;
>
> (c) to stabilize agricultural prices as much as possible...;
>
> (d) to secure a regular food supply...[7]

The agricultural policy objectives of Belgium during the late 1950's

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[6] Ibid., pp. 47-48

[7] OEEC, Agricultural Policies in Europe and North America, Price and Income Policies, pp. 90-91.

included the following: "(a) to raise productivity and improve quality...; (b) to keep farm prices at a reasonable level and to ensure profitability of well-managed farms..."[8]

As stated in Article I of the draft law on the Italian Green Plan, the aims of agricultural policy stressed the following: "To promote economic and social development in agriculture...; to encourage increased productivity and employment, improved living conditions and a higher return on the work of the rural population;...and to secure price stability for agricultural products."[9]

France is the only EEC member whose stated policy objectives seemed to deviate from the above pattern. The aims of French policy were usually framed in terms of particular production targets. For example, the Third Modernization and Equipment Plan (1957-1961) declared as one of its aims, "to increase livestock production, particularly beef (+30 percent in 1961 compared to 1954) and to produce more fodder, fruit and vegetables with a view to the Common Market..."[10] As reported by the OEEC Ministerial Committee for Agriculture and Food, "There are no legal provisions [in French statutes] that guarantee farmers collectively or individually a particular income either in absolute value or with reference to incomes in other economic sectors."[11] Although agricultural income was not specifically mentioned in French legislation, it is a constant preoccupation of the French authorities. Production targets and pricing policies have been formulated under the restraint that deterioration in agricultural incomes be prevented. When agricultural incomes do

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[8]OEEC, Trends in Agricultural Policies Since 1955, pp. 109-110.

[9]Ibid., p. 206.

[10]Ibid., p. 138.

[11]Ibid., p. 139.

decline, special measures, such as the 1960 Law on Agricultural Guidance, are taken to assist those adversely affected.

Thus, except for France, the formulation of EEC agricultural policy objectives can readily be traced to policy statements of the member states. Of course, acceptance of a common set of objectives does not imply agreement on methods, a point that will become evident in future sections.

Formulation of the Common Agricultural Policy

Title II contains other important articles pertaining to the formulation of a common agricultural policy. Article 40 indicates the forms of organization of agricultural markets to be considered. "This organisation shall take one of the following forms according to the products concerned:

> (a) common rules concerning competition;
> (b) compulsory co-ordination of the various national market organisations; or
> (c) a European market organisation.[12]

Article 44 authorizes the use of minimum prices for certain products during the transitional period when "...the progressive abolition of customs duties and quantitative restrictions...may result in prices likely to jeopardise the achievement of the objectives set out in Article 39..."[13] To date, minimum prices have been applied primarily to fruits and vegetables.[14]

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[12] Treaty..., p. 48.

[13] Ibid., p. 51. The transitional period specified in the Treaty covers the period up to 1970.

[14] For a discussion of minimum prices see, Political and Economic Planning, Minimum Prices in European Trade in Agricultural and Horticultural Products (Occasional Paper No. 7, May 2, 1960).

Article 45 sanctions the use, during the transitional period, of long-term agreements or contracts between exporting and importing member states. By July 1962 only one long-term agreement had been concluded; it covers the delivery of grain between West Germany and France.

Time guidelines for formulating and putting into effect a common agricultural policy are provided in Articles 40 and 43. Article 40 indicates that, "member states shall gradually develop the common agricultural policy during the transitional period and shall establish it not later than at the end of that period."[15] Article 43 is more specific. The EEC Commission is instructed, upon the date of the entry into force of the Treaty, to "...convene a conference of Member States, with a view to comparing their agricultural policies by drawing up, in particular, a statement of their resources and needs."[16] In addition, Article 43 specifies that the Commission shall, within a period of two years after implementation of the Treaty, "...submit proposals concerning the working out and putting into effect of the common agricultural policy, including the substitution of national organisations by one of the forms of common organisation provided for in Article 40..."[17] In formulating their recommendations the Commission is instructed to consult with the Economic and Social Committee and the Assembly. Final consideration and approval was reserved for the Council of Ministers.

Progress toward the goals implicit in the Treaty has been remarkable considering the diverse interest of the parties concerned. In nearly all cases the original schedule as outlined in the Treaty has been adhered to.

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[15] Treaty..., p. 48.

[16] Ibid., p. 50.

[17] Ibid.

In some instances the time schedule has been advanced. By July 1, 1962 internal tariffs on industrial goods were 50 percent of the basic duties. Thus, Article 14 (6) of the Treaty was put into effect with respect to all industrial products three and a half years before the deadline.

To date, the development and implementation of a common agricultural policy has provided the most serious difficulties. Each deadline seems to create a more serious crisis, such as during the fall of 1964, when President deGaulle of France threatened to withdraw France from the Community if the Council of Ministers did not reach agreement on uniform grain prices by the end of 1964.

In spite of the difficulties and setbacks encountered, considerable progress has been made since 1958 in establishing and implementing a common agricultural policy. The conference called for by Article 43 (1) met at Stresa from 3 to 11 July, 1958. The final resolution adopted by the Conference outlines the considerations, points of agreement, and recommendations for action believed to be of importance in formulating a common agricultural policy.[18]

Draft proposals for a common agricultural policy as required by Article 43 of the Treaty were first submitted by the Commission to the Council of Ministers in December 1959, i.e., within the period specified

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[18]The complete text of the final resolution is presented in: EEC Commission, First General Report on the Activities of the Community, pp. 74-77. Section three of the resolution, pertaining to points of general agreement, contains a statement of particular interest to students of beliefs and values associated with agriculture: "In view of the importance of the family structure of European agriculture and the unanimous determination to safeguard this family character, it would be proper to use all possible means to increase the economic and competitive capacity of family undertakings" (p. 76). The strong emotional attachment to the image of the family farm seems to be a universal characteristic.

in Article 43 (2). After consideration by the Economic and Social Committee, revised proposals were submitted in June 1960. In October 1960 the Assembly published its opinion on the Commission's proposals. In November 1960, the Special Committee for Agriculture, established some months earlier by the Council to make a thorough examination of the Commission's proposals and to prepare the Council's decisions, submitted their conclusions drawn from the discussions on the principles of the common agricultural policy. On November 15, 1960, the Council of Ministers ratified the conclusions reached by the Special Committee. Many of the principles approved were of a very general nature. The Council recognized that free movement of agricultural products within the EEC should be established under conditions similar to those which govern an internal market; that the common agricultural policy should be developed gradually and in harmony with the general development of the Community; that it should carry out the objectives laid down in the Treaty of Rome; and that the market policy should aim at stabilizing prices and at providing a reasonable income for agricultural workers. There were also a number of more specific principles which the Council approved. One was that a common market for agricultural products implied a common price level. Also, the Council decided that the common agricultural market must be accompanied by a common trade policy for agricultural products.

The second major decision of the Council was made on December 20, 1960, and concerned the principles for a system of levies on trade both within the EEC and at the common frontier. The Council agreed that the intra-Community levy should become the chief instrument for the alignment of national agricultural policies. The basis for this levy would be the difference between the price in the importing country and the price in

the exporting country. Levies within the Community would be progressively reduced in accordance with progress toward a uniform price level.[19]

During this period (1960, 1961) the Commission was formulating market proposals for specific products: wheat, coarse grains, sugar, milk and milk products, beef, veal, cattle, pig-meat and live pigs, poultry, eggs, fruit and vegetables, and wine. In elaborating its market proposals the Commission divided the products into three groups: the first consisting of cereals, dairy products, and sugar; the second of beef and veal, pig-meat, poultry and eggs; and the third of fruit and vegetables, and wine. Broadly speaking, these three groups correspond to the three different types of market organization which were put forward as alternatives in Article 40 of the Treaty: that is, for the first group there will be "a European market organisation", for the second, "compulsory co-ordination of the various national market organisations", and for the third, "common rules concerning competition".[20]

Over a year elapsed before the Council of Ministers made another decision concerning agricultural policy. On January 14, 1962, the Council adopted a number of regulations, decisions and resolutions to implement the common agricultural policy. The relevant texts were approved in final form on April 4, 1962. The actions called for by the Council decisions

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[19]For a more complete discussion of the Commission's proposals and the Council's decisions prior to January 1961 see: Political and Economic Planning, Agriculture, the Commonwealth and EEC (Occasional Paper No. 14, 10 July 1961); EEC Commission, First, Second, Third and Fourth General Report(s) on the Activities of the Community (September 17, 1958, March 31, 1959, May 1960, and May 1961 respectively).

[20]Treaty..., p. 48.

are extremely important. In essence, the individual policies of the member countries relating to several key products were replaced by a common system of market organization. In addition, control of the new marketing system was vested in the EEC institutions rather than with the member states. Items approved by the Council include:

1) Regulation on cereals;
2) Regulation on pig-meat;
3) Regulation on poultry;
4) Regulation on eggs;
5) Regulation on fruit and vegetables;
6) Regulation on wine-growing together with a decision on wine quotas from Germany, France and Italy;
7) Regulation on the financing of the common agricultural policy;
8) Regulation on rules of competition pursuant of Article 42 of the Treaty.

In addition, two resolutions were adopted:

1) Resolution on dairy produce;
2) Resolution on beef and sugar.[21]

Grain Policy

Regulation 19, on grain, is of primary importance to this study. Following the principles previously adopted by the Council, the grain regulation is based on a system of levies. Before we can understand the levy system, a few definitions are required.

1. Target price: A desired wholesale price "applicable in the marketing center of the area having the largest deficit, for a specified standard of quality, taking into account the price to be aimed at for the producer."[22] Secondary (derived) target prices are permitted for other marketing centers in some countries.

2. Intervention price: A price 5 to 10 percent below the basic

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[21]EEC Commission, Fifth General Report on the Activities of the Community, pp. 140-141.

[22]U.S.D.A., Foreign Agriculture Circular, FG 16-62 (November 1962), p. 6. Official EEC English translation of Regulation 19.

target price; the price at which the intervention authorities are obliged to buy domestic grains offered to them.

3. Threshold price: A national minimum import price fixed annually by the member states. It is equal to the basic target price minus transportation and marketing costs from a fixed point of entry to the target price area (area with the largest deficit). Provision is made for the gradual increase of target, intervention, and threshold prices during the crop year in order to allow for holding costs.

4. Standard amount, lump sum: A standard discount on levies for imports from member countries. Fixed annually by the Commission. It was initially set for grain at one dollar per metric ton.

5. Free-to-frontier price: A price "based on the prices ruling on the most representative markets of the exporting Member State for exports to the importing Member State in question, adjusted for any variations from the standard of quality in respect of which the threshold price is fixed."[23] It is to be fixed by the Commission.

Two levies are involved: an intra-Community levy and a levy on imports from non-member countries. The amount of the intra-Community levy is equal to the difference between the free-to-frontier price and the threshold price of the importing member, such difference being reduced by the standard amount. The amount of the levy on imports from non-member countries is equal to the difference between the most favorable c.i.f. (cost-insurance-freight) price of the product (adjusted for quality difference) and the threshold price of the importing country. Figure 1 illustrates how the levies are currently determined. To make the illustration more realistic, the following relations (wheat prices, $ per bu.)

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[23] Ibid., p. 5.

existed in May 1964: French free-to-frontier price, $2.72; intra-Community levy, $0.75; standard amount, $0.03; West German threshold price, $3.50; adjusted c.i.f. price $1.70; levy vis-à-vis non-members, $1.80.[24] The introduction of uniform grain prices will eliminate the intra-Community levy and the free-to-frontier price. The exporting member country will receive a price equal to the threshold price.

The adjusted c.i.f. prices mentioned above are determined on the basis of equivalence coefficients representing quality differences. A standard quality for each grain has been set by the Commission; quality differentials are based on the EEC standard. (Quality differentials used in this study are presented in Appendix II.) In the case of wheat, the EEC standard quality is below the quality of most of the wheat traded in the world market. For example, Soft Red Winter Wheat from the U.S. is valued at $3.75 per metric ton above the EEC standard quality; other differentials range upward to $12.00 per metric ton for U.S. Dark Northern Spring, U.S. Hard Red Winter (14 percent protein), and Canadian Manitoba.[25] To adjust a given wheat price to the EEC standard, the quality differential is subtracted from its c.i.f. European port price. (Specific ports of entry for each member country and type of grain have been designated.) To establish the "most favourable" c.i.f. price used in setting the external levy, adjusted c.i.f. prices for a given grain are compared and the lowest figure is selected. The EEC standard quality for feed grains, in contrast to that for wheat, is higher than that for most types of barley, corn and sorghums traded on the world market. Hence the quality differentials used

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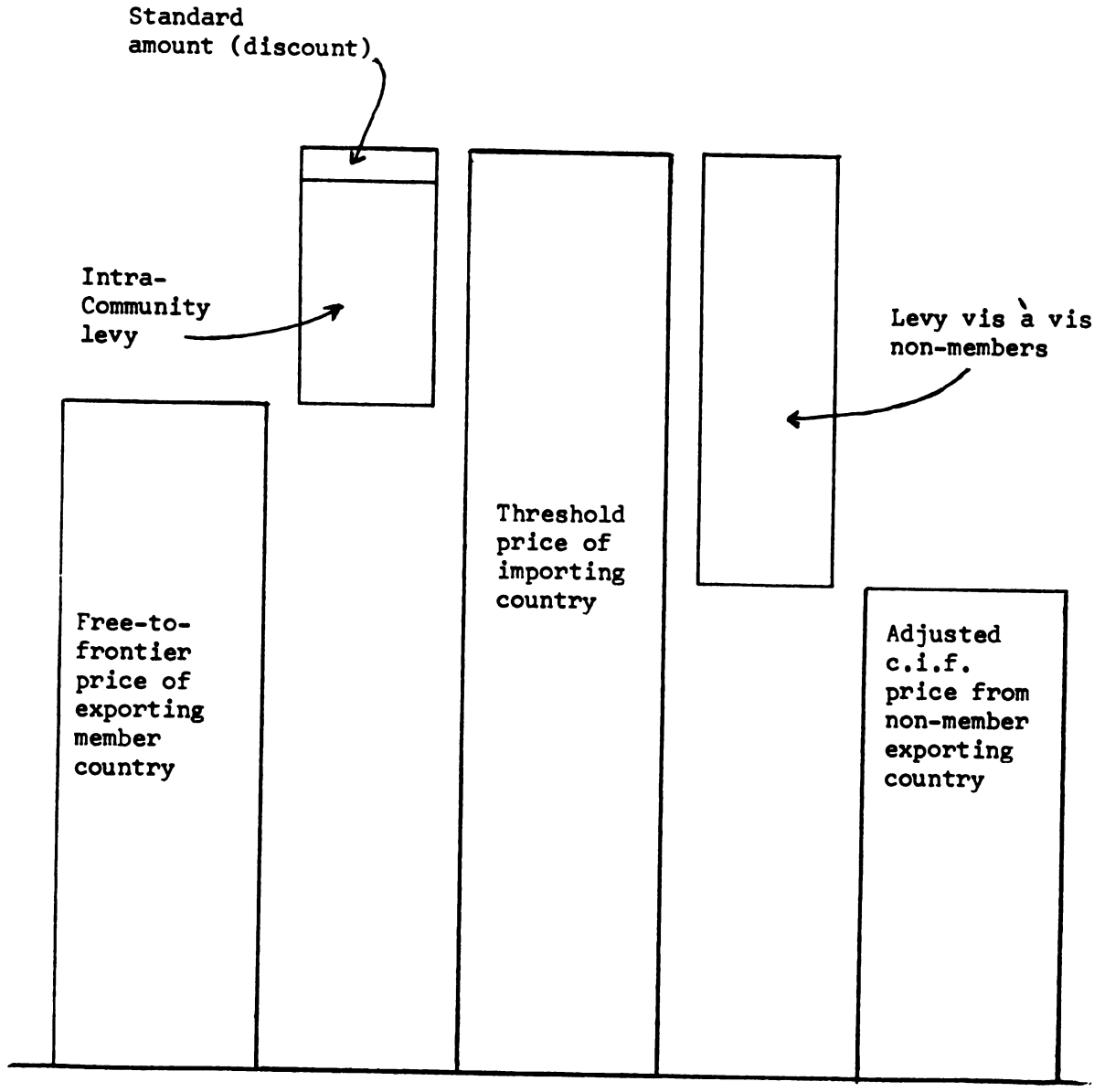
[24]U.S.D.A., Foreign Agriculture (September 14, 1964), p. 5.

[25]U.S.D.A., Basic Provisions of the European Economic Community Grain Regulations, p. 10.

Figure 1. - EEC grain levy system



in determining adjusted c.i.f. prices for feed grains are, in most cases, added to the actual c.i.f. prices.

Regulation 25, also adopted in January 1962, is relevant to the operation of the grain regulation. Regulation 25 deals with the financing of the common agricultural policy and provides for the establishment of the European Agricultural Guidance and Guarantee Fund. The two-fold purpose of the Fund is implicit in its title. The guidance section was established to deal principally with long-term structural improvement in agriculture including the marketing of agricultural products. The Fund's guarantee section was established to aid member states in implementing common agricultural regulations, such as the grain regulation, in two ways: one, by reimbursing them for their expenditures in subsidizing exports to third countries; and two, by reimbursing them for expenses incurred in intervening in the internal market. The grain regulation calls for export subsidies as well as internal market intervention. The Fund will, by the end of the transition period, have complete financial responsibility for these operations. At present, expenditures originate from the member states and the Fund according to an established schedule. To date the Fund has been financed partially through direct contributions from member states and partially through contributions in proportion to net agricultural imports from third countries.[26]

The target date for introduction of the grain levy system was July 1, 1962; actual implementation was postponed until July 30. Concurrent with

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[26]For additional information on the organization and operation of the Fund see: EEC Commission, Fifth General Report on the Activities of the Community, pp. 147-149; U.S.D.A., "How the EEC's Agricultural Guidance and Guarantee Fund Works," Foreign Agriculture (November 16, 1964), pp. 3-4.

the introduction of the levy system, nearly all quantitative restrictions were to be removed by the member states. Three exceptions were made on a temporary basis: one, Italy would retain state-trading of wheat for at least one year; two, Belgium would continue its wheat mixing regulation until December 31, 1962; and three, all EEC countries would continue, at least until December 31, 1962, to use quotas to regulate trade with Communist countries. For the 1962-63 crop year the EEC Commission specified upper and lower limits for grain target prices. The individual member countries were permitted to set their own target prices within the prescribed limits. In general, the target prices arrived at for the 1962-63 crop year were similar to wholesale prices for the preceding year.

Unification of the EEC grain market was to come about gradually during the 7 1/2 year transition period from July 1962 to 1970. During the transition period the intra-Community levy was to be gradually reduced to zero. Elimination of the intra-Community levy implies a uniform target price for the Community. Such a uniform price is clearly called for in Article 13 of Regulation 19: "The Council shall adopt, in accordance with the procedure laid down in Article 43 of the Treaty, ...,

> a) a basic target price applicable to the whole Community;
> b) a single threshold price;
> c) a single method of determining intervention prices;
> d) a single frontier crossing point for the Community as a basis for determining the ci.i.f. prices of products from third countries."[27]

Uniform Grain Prices

The explicit intent to arrive at a set of uniform grain prices as directed by Regulation 19 set off a wave of discussion and speculation as

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[27]U.S.D.A., Foreign Agriculture Circular, FG 16-62 (November 1962), p. 12.

to what level the prices would take and what effect the uniform prices would have on internal and external production and trade. By the fall of 1963, pressure for establishment of the uniform grain prices was mounting. The Kennedy Round of tariff negotiations was imminent, and EEC authorities indicated they were not prepared to proceed with agricultural negotiations until uniform grain prices were established. Also the desire to make decisions with respect to other agricultural products covered by the common agricultural policy, required knowledge of expected grain prices.

The main stumbling block to arriving at uniform prices was the disparity between high grain prices in West Germany and lower prices in other EEC countries, especially France (for wheat) and Italy (for barley). Nevertheless, in November of 1963, Sicco Mansholt, the Commission's Vice President for Agriculture, submitted a proposal calling for common prices roughly halfway between German and French prices. Mansholt urged that his proposal take effect for the 1964-65 season. The Council of Ministers were unable to reach agreement on the original Mansholt proposal. The main objection to fixing uniform grain prices at this time came from Chancellor Erhard of West Germany. Erhard wanted to wait two years until after the 1965 German national elections, thereby postponing possible alienation of the West German farmers.

On June 3, 1964, the Council finally accepted the Commission's alternative proposal to set 1964-65 target prices within the same range as the previous year's target prices. At the same meeting, the Council deferred until December 15 action on a single grain price.

President deGaulle, on the other hand, was anxious for common grain prices to be adopted. His ultimatum in October 1964 maintained pressure on the Commission and the Council. Thus, on December 15, 1964, after an

all night session, the Council of Ministers adopted a schedule of uniform grain prices. This schedule is to take effect on July 1, 1967, 2 1/2 years ahead of the deadline implicit in the Treaty of Rome. Table 1 contains the agreed upon target prices as well as the Mansholt price proposal and basic target prices existing in July 1964. The uniform target prices shown in Table 1 apply to grain delivered alongside the warehouse in Duisburg, Germany. Derived target prices, intervention prices and threshold prices must be established on the basis of the announced target prices.

Table 1. EEC uniform basic target prices for grains, with comparisons

Nature of prices	Soft Wheat (1)	Durum Wheat (2)	Rye (3)	Barley (4)	Corn[1] (5)
	--------U.S. dollars per metric ton----------				
Basic target prices adopted Dec. 15, 1964, effective July 1, 1967.	106.25	125.00	93.75	91.25	90.625
Mansholt Proposal November 1963	106.25	125.00	93.75	92.50	93.75
Basic target prices July 1964:					
France	100.22	117.26	81.79	83.00	89.93
Netherlands	104.83	------	74.59	82.32	-----
Belgium	104.60	------	83.60	89.00	-----
Italy	113.60	143.20	-----	72.22	69.12
Luxembourg	117.00	------	108.00	89.00	-----
Germany	118.88	------	108.12	103.00	-----
C.I.F. Price Netherlands, July 1, 1964[2]	61.75	75.50	57.75	54.10	59.70

[1]October prices.

[2]C.I.F. prices for standard grades, as determined by the EEC Commission.

Source: U.S.D.A., Foreign Agricultural Trade of the United States (February 1965), p. 6.

The December 15 agreement contained several important concessions. First, special rules permitting price subsidies to durum wheat growers were

adopted. Interestingly, the use of price subsidies is contrary to the principles of the common agricultural policy established by the Council in 1960. Second, the $90.625 per metric ton basic target price for corn is modified by a $77.00 minimum intervention price; this is $4.56 below the intervention price obtained by using the rules in Regulation 19 (minimum intervention price 10% below the basic target price). The lower intervention price for corn was a concession to Italy. Third, Italy is permitted to discount the variable levy on seaborne imports of corn and barley from third countries. The following ceilings have been set for this levy discount:[28]

Marketing Year	$ per m. ton
1967/68	10.625
1968/69-1969/70	10.00
1970/71-1971/72	7.50

Fourth, malting barley and rye for human consumption may be supported by each member country at a special quality premium; an important concession to West Germany. And fifth, special compensation is to be granted through the Agricultural Guidance and Guarantee Fund to West Germany, Italy and Luxembourg because of wheat price reductions. Compensation will be disbursed according to the following schedule:[29]

	1967/68	1968/69	1969/70	Total
	million dollars			
W. Germany	140.0	93.50	46.75	280.25
Italy	65.0	44.00	22.00	131.00
Luxembourg	1.25	0.75	0.50	2.50
Total	206.25	138.25	69.25	413.75

There is little doubt that additional concessions and modifications will have to be made as new proposals for implementation of the uniform

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[28]U.S.D.A., "The Uniform Grain Price in the European Economic Community," Foreign Agricultural Trade of the United States (February 1965), p. 9.

[29]Ibid., p. 11.

grain prices are introduced. As mentioned earlier, important decisions on derived target prices, intervention prices, and threshold prices must be reached before July 1, 1967. Nevertheless, the establishment of uniform grain prices, after nearly seven years of debate, must be viewed as a significant landmark in the development of the EEC's common agricultural policy.

CHAPTER III

FORMULATION OF THE MODELS

The previous chapter outlined the politically determined variables (viz., prices and levies) of the EEC grain policy. This chapter incorporates the policy variables, additional economic relationships, and technical production relationships into formal models designed for empirical use.

Theoretical Considerations

In formulating models to analyze the possible effects of EEC grain policy proposals, the theory of economic integration provided several useful guidelines. Most of the concepts of economic integration used in this study were obtained from Bela Balassa's book, The Theory of Economic Integration.[1] Balassa's book is an excellent summary and synthesis of recent theories of economic integration.

Balassa defines five forms of economic integration: a free-trade area, a customs union, a common market, an economic union, and complete economic integration.[2] A free-trade area exists when tariffs and quantitative restrictions between the participating countries are abolished, but each country retains its own tariffs against non-members. A customs union goes one step further and adds a common tariff on trade with non-members to its features. The common market is a higher form of integration, where not only trade restrictions, but also restrictions on factor

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[1]Bela Balassa, The Theory of Economic Integration (Homewood, Illinois: Richard D. Irwin, Inc., 1961).

[2]Ibid., p. 2.

movements are abolished. An economic union combines the supression of restrictions on commodity and factor movements with some degree of harmonization of national economic policies. Finally, total economic integration presupposes the unification of monetary, fiscal, social, and counter-cyclical policies and requires the setting up of a supra-national authority whose decisions are binding for the member states.

The EEC, although popularly called a Common Market, seems to have as its goal the establishment of an economic union (using Balassa's definition). By the end of the transitional period, internal tariffs and quantitative restrictions will be removed and a common external tariff established. In addition, restrictions on certain factor movements (labor) have been abolished. And finally, the framers of the Treaty recognized the need for unified policy when they called for a common transport policy and a common agricultural policy. Thus, the characteristics of an economic union are clearly recognizable. There are leaders in the EEC who feel that complete economic and political integration should be the long-run goal of the EEC.

In discussing the effects of economic integration, Belassa contends, "the ultimate objective of economic activity is an increase in welfare." After discussing the difficulties associated with the concept of economic welfare, Belassa states, "In the case of integration, economic welfare will be affected by (a) a change in the quantity of commodities produced, (b) a change in the degree of discrimination between domestic and foreign goods, (c) a redistribution of income between the nationals of different countries, and (d) income redistribution within individual countries."[4]

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[3] Ibid., p. 10.

[4] Ibid., p. 11.

One can look at the changes in welfare resulting from economic integration in terms of statics, comparative statics, and/or dynamics. Balassa concentrates on the statics and dynamics of economic integration. Static welfare improvement is represented by greater efficiency in the allocation of resources at a point-in-time. In other words, static efficiency requires the economy to operate on its production possibilities frontier. Dynamic welfare improvement, in Balassa's framework, is represented by the movement of the production possibilities curve upward and to the right. Factors affecting dynamic efficiency are, technological change, economies of scale, and various forms of external economies.

In discussing the impact of a customs union on economic welfare, Balassa considers four effects as significant: production effects, consumption effects, terms of trade effects, and administrative economies. The first two or these effects were useful in formulating the models used in this study. Production effects result from shifting purchases of a given commodity from more expensive domestic to cheaper member country sources of supply (positive effect), and from shifting sources of supply from lower cost foreign to higher cost member country producers (negative effect). The consumption effects of a union entail the substitution of commodities of the member countries for domestic goods and foreign goods. As in the case of production effects, consumption effects may be beneficial or detrimental to efficiency in resource allocation.

Balassa's positive and negative production effects include the concepts of "trade creation" and "trade diversion" as developed by Jacob Viner.[5]

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[5]Jacob Viner, The Customs Union Issue (New York: Carnegie Endowment for International Peace, 1950).

Trade creation represents a movement toward the free-trade position, since it entails a shift from high-cost to low-cost sources of supply. Trade diversion acts in the opposite direction and occurs when customs union members shift purchases from lower-cost to higher-cost producers. Viner concluded that the beneficial effects of the union will predominate if trade creation outweighs trade diversion.

Although exact empirical content could not be imparted to all the concepts of economic integration discussed above, important guidelines for this study were obtained from the theory of economic integration. In looking at only a small component of the economies involved, viz., the grain sector, it is not possible to make statements about the overall static or dynamic efficiency of the EEC. Rather, one has to be satisfied with judgments based upon comparative statics about one sector of the economy. With these concepts and limitations in mind, three measures of the overall effect of the EEC grain policy were defined. Trade creation is defined as an increase in the value of commodities purchased from low-cost producers (non-EEC regions). Trade diversion is an increase in the value of commodities purchased from high-cost, protected EEC members, and/or a reduction in the value of commodities purchased from low-cost producers (non-EEC regions). Negative production effect (cost of protection) is defined as an increase in the total value of production by EEC countries minus the cost of providing the increased quantity with imports from low-cost, non-EEC regions. All three measures are based on estimated changes occurring between the base period (1959/60-1961/62) and 1970. Estimates of trade creation, trade diversion, and the cost of protection are presented in Chapter VI.

In addition to the above broad measures of change, it was decided that analysis of EEC grain policy should be primarily concerned with

production effects (quantity and location), changes in resource use, changes in trade patterns, and price (the political parameter).

As was mentioned in Chapter I, linear programming seemed to be the best technique for handling the information available and for answering the important questions posed by the emergence of uniform grain prices in the EEC. Linear programming has been applied extensively to problems of spatially separated markets during the past ten years.[6] In general, the spatial equilibrium models reviewed were single product models with the objective of determining an equilibrium set of prices and product flows consistent with known supply and demand relationships (either predetermined fixed quantities or in functional form such as the step function). The problem posed by the EEC grain policy was somewhat different. Rather than solving for a set of equilibrium prices, a set of politically determined product prices was among the predetermined variables (initially the Mansholt proposal, but by the time the models were run, the prices established in December 1964 were available). Using the predetermined prices established and information about the level of demand and resource availability, estimated changes in production (quantity and location), resource use, and trade flows were desired. Consequently, two standard

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[6]Applications of importance to agricultural economics include the following: C.C. Dennis and L.L. Sammett, "Interregional Competition in the Frozen Strawberry Industry," Hilgardia, XXXI (December 1961), pp. 499-604; Alvin C. Egbert and Earl O. Heady, Regional Adjustments in Grain Production, A Linear Programming Analysis (U.S.D.A. Technical Bulletin No. 1241 and Supplement), June 1961; Karl A. Fox, "A Spatial Equilibrium Model of the Livestock-Feed Economy in the United States," Econometrica, XXI (October 1953), pp. 547-566; W.R. Henry and C.E. Bishop, "North Carolina Broilers in Interregional Competition," Agricultural Economics Information Series No. 56, 1957; George G. Judge, Competitive Position of the Connecticut Poultry Industry, No. 7, A Spatial Equilibrium Model for Eggs, Connecticut Agricultural Experiment Station Bulletin 318; G.A.King and L.F. Schrader, "Regional Location of Cattle Feeding--A Spatial Equilibrium Analysis," Hilgardia, XXXIV (July 1963), pp. 331-416.

linear programming production models were augmented by transfer activities and special restraints to create the models desired.[7]

General Characteristics of the Models

Before discussing the individual characteristics of the models, the similarities will be presented. Both models deal with three product classifications; wheat for food, wheat for feed, and feed grain. Feed grain includes barley, oats, sorghum, and corn. The four feed grains are assumed to be perfect substitutes in consumption on a per ton basis. Brandow's study of 1961 lends support to this assumption. He stated, "Substitution among individual feed grains is so high that analysts making demand studies have not been able to distinguish clearly among major price changes for corn, other feed grains, and feed grains collectively."[8] Even though this may not be true today in the EEC farm economy where custom is a heavy factor in farm management decisions, the tendency will be to move in this direction.

Feed wheat was considered a separate product in order to gain some insight into the competitive relationships between feed wheat and feed grain. In addition, feed wheat generally is not traded, whereas food wheat and feed grain are. All three products (food wheat, feed wheat, and feed grain), are measured in metric tons; their prices are given in U.S. dollars per metric ton.

The time periods for both models are the same. The base period represents the period from June 1959 to July 1962. This period was

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[7]Appendix II is complementary to the remaining sections in this Chapter. It contains in detail, the development of coefficients, prices and other estimates used in the programming models.

[8]G.E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply, p. 75.

selected for two reasons: one, it immediately preceeded the implementation of the common grain regulations on July 30, 1962; and two, a three-year period was needed to eliminate the effect of weather on production coefficients. The prediction period is 1970, roughly a period from 1969 to 1971. The year 1970 was selected because it represents the end of the EEC transitional period and because several studies predicting demand for 1970 are available.

Model I

Model I is a maximization model. Each region in the model produces three commodities; food wheat, feed wheat, and feed grain. Minimum levels of production are specified for feed wheat. Food wheat and feed grain are traded between certain regions of the model; feed wheat is not traded. The production activities use three resources--land, labor, and capital--that are limited in supply. In addition, resources cannot be used in grain production unless they earn greater than a minimum, predetermined amount. Production and trade between regions must be sufficient to satisfy requirements for domestic use in each region. Thus, the model maximizes revenue from production and trade by all regions, net of transfer costs, and subject to minimum prices on the limited resources.

Regional Specification

Regional specification and assumed locational centers for Model I are as follows:

1. United States (excluding Alaska and Hawaii)--Kansas City, Kansas;
2. Canada--Regina, Saskatchewan;
3. United Kingdom--London;
4. France--Paris;
5. West Germany--Duisburg;
6. Italy--Milan;
7. Benelux (Belgium, Netherlands, and Luxembourg)--Rotterdam.

The regions specified do not possess the homogeneity characteristics generally considered desirable in location analysis. Regional selection was a compromise between the ideal and the feasible. The regions utilized represent political units with distinct grain policies, a desirable feature for this study. In addition, the availability of certain data only on a national basis made it necessary to use the above specification.

The reason for including the EEC countries is obvious. The United Kingdom was included because there has been considerable discussion about the possibility of expanding the EEC to include the United Kingdom. In addition, the United Kingdom is a major grain importer and might be affected by the uniform grain policy of the EEC. Although immediate membership is unlikely, one run of this model simulated an expanded EEC with the United Kingdom as a member. The United States and Canada were included in the model because they are important suppliers of wheat and feed grain to the EEC and the United Kingdom. In 1960/61, the United States and Canada provided 64 percent of the EEC wheat imports and 40 percent of EEC grain imports (barley, oats, sorghums, corn). Canada alone provided 59 percent of the United Kingdom's wheat imports in 1960/61.

Objective function

The objective function of Model I maximizes revenue over the seven regions. The multiplying constants are the product prices taken at the production level, the transfer costs, and the reservation prices on the variable resources. The solution variables represent metric tons of grain for the production and transfer activities, and units of land, labor or capital for the reservation activities. The objective function used in Model I was selected primarily because it permitted the explicit use of politically supported producer prices as constants. Such a feature was

felt to be necessary in order to make the model useful for policy analysis.

Activities

Three types of activities were specified for Model I: (1) production, (2) transfer, and (3) reservation. Each region has three production activities, one for each product classification (food wheat, feed wheat and feed grain). The coefficients for the food wheat and feed wheat activities, in a given region, are identical. Thus, product price is the only difference between these two activities. The quantity of feed wheat utilized tends to vary with the price of food wheat and the relative prices of feed grain and feed wheat. As food wheat prices fall, the quantity of wheat used for feed increases. On a per ton basis, feed wheat is about 10 percent more valuable as a feed than feed grain.

Transfer activities were specified for food wheat and feed grain. As mentioned above, feed wheat was assumed to be entirely of domestic origin and therefore not traded. Transfer activities were established on the basis of trade flows existing in the base period. Table 2 indicates sources and destinations (by regions) used in determining transfer costs. An "X" at the intersection of a column and a row indicates that a transfer activity exists (for the particular commodity), representing movement from the region in that column to the region in that row.

Reservation activities were included for each region in order to put a minimum price on the variable resources, land, labor and capital. In a linear programming model the restricted resources are treated as having a zero price unless they are limiting in the solution.[9]

[9]A resource is said to be "limiting" and the corresponding restraint "binding," when all the available resource is used in the optimal solution.

Table 2. Model I, transfer activities[a]

Source: / Destination:	United States		Canada		France		United Kingdom
	Food Wheat	Feed Grain	Food Wheat	Feed Grain	Food Wheat	Feed Grain	Feed Grain
Benelux	X	X	X	X	X	X	X
France	X	X	X				
West Germany	X	X	X	X	X	X	X
Italy	X	X	X			X	X
United States				X			
Canada		X					
United Kingdom	X	X	X	X	X	X	

[a]An X indicates that a transfer activity was included for the commodity and countries represented in the column and row headings.

By specifying a reservation activity for each resource, the resources will be used in the grain production activities only if their imputed value exceeds the reservation price. Resources not used in grain production will be transfered to the reservation activities. The reservation prices in the objective function, represent in a rough manner, the opportunity cost of the particular resource outside of grain production. Thus, for land an estimate of the average yearly rental value was used. The wage of a permanent agricultural worker was used as the reservation price on labor. It was hoped that some insight into farm versus nonfarm labor relationships could be obtained by varying the reservation price on labor. A minimum return on capital of 4 1/2 percent was assumed for all countries.

Restraints

Four types of retraints were used in Model I: (1) resource restraints, (2) demand restraints, (3) minimum production restraints on feed wheat and (4) import balance restraints. Availability restraints were placed on each of the three broad categories of resources, land,

labor and capital. Thus for a given region, the typical resource restraint would read as follows: the sum of the land used in the production of food wheat, plus the land used in the production of feed wheat, plus the land used in the production of feed grain, plus the land transferred to the reservation activity must be less than or equal to the land available. Levels of resource availability for the base period model were established on the basis of estimates of actual resource use in grain production. For the 1970 models upper limits were placed on the quantities of capital and labor available; the quantity of land available was based on historical land use patterns.

The use of demand restraints is of critical importance in the operation of both Model I and Model II. In Model I, each region has a predetermined level of demand specified for each commodity. Thus, for a given point in time, the regional product demand functions are assumed to be perfectly inelastic. Considering the nature of the commodities involved and the level of aggregation used in this study, the use of a fixed level of demand seems reasonable. Satisfaction of demand within the model involves three quantities, viz., production, exports, and imports. For a given region, production and imports increase available supply, while exports reduce it. Hence, for a region that is both an importer and an exporter of food wheat, the demand restraint would read as follows: the quantity of food wheat produced, plus the quantity of food wheat imported from other model countries, minus the quantity of food wheat exported to model countries must equal a fixed amount. When each region in the model is constrained by demand restraints similar to the above example, aggregate supply and aggregate demand for the model as a whole must be equal.

In general, levels of demand used in the base period model were derived from food balance sheets. From the consumption data, wheat for food was defined as the sum of wheat used for food, plus wheat for seed, plus wheat for industrial use. Feed wheat demand included wheat for animal feed and waste. Feed grain demand in the base period was derived from estimates of domestic disappearance.[10] Gross demand figures for food wheat and feed grain were adjusted by subtracting imports from non-model countries. Therefore, implicitly, it was assumed that trade with non-model countries would remain proportional to base period levels.

Food wheat and feed wheat demand for 1970 were based on projected balance sheets prepared for that period by FAO and EEC researchers.[11] The demand for wheat is fairly stable; hence it was decided to use only one set of demand estimates for 1970.

Estimating the 1970 demand for feed grain was another problem. Available estimates of feed grain demand by EEC countries in 1970 were based on linear trends of use during the 1950's and do not appear to reflect the rapid increase in EEC meat production and consumption predicted for 1970. The relationship between the demand for feed grain and the consumption of meat is complicated. It was not possible in this study to investigate all the factors influencing the demand for feed grain. Only the simplest feed-livestock relationships were used.

Three estimates of the 1970 demand for feed grain were utilized.

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[10]Domestic disappearance equals production, minus exports, plus imports, minus changes in stocks (where a reduction in stocks is a negative number and an increase a positive number).

[11]European Economic Community, Le marché commun des produits agricoles, Perspectives "1970" (Serie: Agriculture, No. 10); FAO, "Agricultural Commodities--Projection for 1970," FAO Commodity Review 1962, Special Supplement.

One is based on the trend projections published by the EEC and FAO.[12] The second is based on a constant ratio of feed-grain-to-meat-consumption; that is, the ratio of feed grain disappearance to meat consumption that existed in the base period was assumed to hold for 1970. The third is based on a 25 percent increase in the feeding ratio for the EEC countries and the United Kingdom, and a 10 percent increase for the United States and Canada. The principal assumption behind using a feed-grain-to-meat-consumption ratio to estimate the demand for feed grain is that production, imports, and exports of meat will increase by the same rate between the base period and 1970. Meat consumption was used rather than meat production because 1970 estimates of meat production were not available for all the countries in the model.

The arbitrary 25 percent increase in the feeding ratio for the EEC countries was introduced to represent a change in the grain-roughage feeding relationship. EEC experts have argued that due to limitations on land, roughage production cannot be substantially expanded. Hence an increase in the production and consumption of meat implies an increase in the feed grain used per ton of meat produced. As shown in Column 1 of Table 3, the base period feed-grain-to-meat-consumption ratio (as well as the feed-grain-to-meat-production ratio) in the EEC countries is approximately one-half of what it was in the United States and Canada. Thus, increasing the ratio by 25 percent for the EEC still leaves it considerably below the United States ratio for 1959/60-1961/62. Table 3 also compares the base period level of feed grain demand with the three levels of demand used in

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[12] Ibid.

[13] EEC, L'augmentation de la production de viande bovine dans les pays de la C.E.E. (Serie: Agriculture, No. 5), 1961.

the 1970 models. Additional assumptions about the grain-livestock sector could have been made and new levels of feed grain demand derived.

Table 3. Base period feed grain-meat relationships and feed grain demand estimates used in Model I

Region	Feed-grain -to-meat- con- sumption[a] (1)	Feed-grain -to-meat- produc- tion[b] (2)	Model I feed grain demand--million metric tons			
			Base period (3)	1970 (1)[c] (4)	1970 (2)[d] (5)	1970 (3)[e] (6)
United States	8.20	7.27	120.3	135.3	151.0	166.1
Canada	7.78	7.81	10.4	12.3	13.8	15.1
United Kingdom	3.05	5.01	9.0	10.3	10.3	12.8
France	2.89	2.42	8.9	9.9	10.8	13.5
West Germany	3.86	4.54	7.2	9.1	9.8	12.3
Italy	5.05	5.89	5.1	7.5	8.5	10.6
Benelux	5.89	4.76	5.1	5.7	6.75	8.4
EEC	3.92	3.82	26.3	32.2	35.85	44.8

[a]Domestic disappearance of feed grain (barley, oats, corn, sorghums), average 1959/60-1961/62 in metric tons, divided by all meat consumption, 1960/61 (metric tons).

[b]Domestic disappearance of feed grain divided by all meat production.

[c]Based on EEC and FAO projections.

[d]Feed-grain-to-meat-consumption ratio equal to base period ratio.

[e]Increased feed-grain-to-meat-consumption ratio: 10% for U.S. and Canada, 25% for remaining regions.

Source: Columns (1) and (2) are based on food balance sheets published by the EEC and the OECD. Columns (3), (4), (5) and (6) are based on information contained in Appendix II.

Minimum feed wheat production restraints were utilized for each region. Since feed wheat is not traded, use of an equality restraint on feed wheat demand, in effect, forced production to equal demand. To avoid this situation, the feed wheat demand restraint was specified as

less than or equal. A minimum level of feed wheat production, equal to the minimum year during the base period, was specified. For a given region, the minimum production restraint reads: the production of feed wheat must be greater than or equal to a fixed minimum. The demand and the production restraint act together to place an upper and a lower limit on feed wheat production. This feature permits the flexibility desired in considering feed wheat-feed grain relationships.

The import balance restraints are not essential to the model. They were utilized to save work by having the program sum up the imports of a particular grain by a given region.

Model II

Model II is a minimization model. It was formulated after experience with Model I had been obtained. Model II uses much of the information utilized by Model I and in some respects acts as a check on the results of Model I. Model II minimizes gross expenditures by the EEC for food wheat, feed wheat and feed grain. Each EEC region in the model has a production activity for each commodity. Minimum levels of production are specified for each commodity and producing region. Food wheat and feed grain are traded interregionally; feed wheat is not traded. The non-EEC regions in the model supply food wheat and feed grain to the EEC regions at fixed prices. An upper limit is placed on the quantity of exports available in each of the non-EEC regions. Finally, production and imports must be sufficient to satisfy requirements for domestic use in each EEC region.

Regional Specification

Regional specification was expanded by including two new regions,

Australia and Argentina. Both of these countries are important suppliers of grains to the EEC; Australia supplying wheat and barley, and Argentina supplying wheat and corn. The United Kingdom was dropped from Model II for three reasons. One, information on the effect of expanding the EEC to include the United Kingdom was obtained from Model I. Two, modification of Model II to simulate an expanded EEC with the U.K. as a member would require substantial changes, whereas in Model I, only product prices had to be changed. Three, inclusion of the United Kingdom as a supplier of grain (similar to the U.S., Canada, etc.) was unreasonable as the U.K. exports only minor quantities of barley; in fact, the U.K. is a net importer of feed grain.

Objective function

The objective function of Model II minimizes gross expenditure by the EEC for grains. By minimizing EEC expenditures on grain, this model corresponds with two of the Treaty's agricultural objectives, namely, "to guarantee regular supplies; and to ensure reasonable prices in supplies to consumers."[14] At the same time, EEC grain production is tied to land use restraints that partially fulfill the agricultural policy objective of "ensuring the rational development of agricultural production and the optimum utilization of the factors of production..."[15] In a sense, Model II suggests an alternative grain policy for the EEC. It allows the EEC to produce grain efficiently on a given land area and at a fixed price. The remainder of the demand is filled by importing from non-EEC

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[14]Treaty establishing the European Economic Community and connected documents, p. 48.

[15]Ibid., p. 47.

members at world market prices. The multiplying constants of the objective function are EEC wholesale grain prices and import prices, both estimated at the four regional centers: Duisberg, Paris, Rotterdam and Milan. The solution variables represent quantities of domestically produced grain or imported grain, delivered to the regional centers.

Activities

Only two types of activities were specified for Model II, production and transfer. Reservation activities were not utilized. Only the four EEC regions have production activities. The production activities are similar to those used in Model I. The transfer activities allow for the exchange of food wheat and feed grain within the EEC as well as allowing for imports from the non-EEC countries in the model: United States, Canada, Argentina and Australia.

Restraints

Four types of restraints were used in Model II: (1) resource restraints, (2) demand restraints, (3) minimum production restraints, and (4) import supply restraints. As in Model I, three categories of resources were considered, land, labor and capital. The manner in which the resource restraints entered the model was different. Resource allocation in Model II was built around fixed areas of land. Experience with Model I indicated that the coefficients used were fairly reliable in reproducing base period production. Consequently, it was assumed that the coefficients were a fair approximation of the relationship between land, labor and capital. Hence, in Model II the land restraint was fixed with an equality, and the amount of complementary labor and capital used depended on the availability of land. By setting the level of labor and capital available at greater

than or equal to zero, the program solution indicated how much was actually used.

The demand restraints used in Model II were similar to those in Model I, and further explanation does not seem necessary. Contrary to Model I, minimum production restraints were used on all production activities in Model II. The minimum production restraints put a lower limit on the amount of food wheat, feed wheat, and feed grain produced by the four EEC regions. On the other hand, the fixed area of land available in each EEC region puts an upper limit on total grain produced by the three activities. After meeting the minimum production requirements, the model efficiently allocates any land remaining. Minimum production levels for the base period were based on actual production. Estimates for 1970 were based on projections published by the EEC.[16]

Import supply restraints were used to put an upper limit on the quantities of imports available to the EEC from the four non-EEC regions (United States, Canada, Argentina and Australia). These restraints imply that each non-EEC region in Model II has a perfectly elastic export supply function up to the limit prescribed by the restraint. Observation of the relationships illustrated in Table 4 provided partial support for the use of perfectly elastic export supply functions (over a specified range). Table 4 shows, for the non-EEC regions in the model, the percentage that wheat and feed grain exports to the EEC were of total wheat and feed grain production. Except for Canadian wheat, Argentine feed grain, and Australian feed grain, grain exports to the EEC by the countries listed in Table 4 were less than 15 percent of production. Small changes in the

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[16]European Economic Community, Le marché commun des produits agricoles, Perspectives "1970".

Table 4. Wheat and feed grain production and exports to the EEC, major exporters, 1959/60-1961/62 average

Country and Commodity	Production (1)	Exports to the EEC (2)	Percent[e]
	----------1000 metric tons----------		
United States			
Wheat[a]	33,684	1,661.3	4.93
Feed grain[b]	134,788	4,862.3	3.61
Canada			
Wheat[a]	11,025	1,754.0	15.91
Feed grain[c]	10,284	69.6	.68
Argentina			
Wheat[a]	4,966	659.5	13.28
Feed grain[b]	7,781	2,460.8	31.63
Australia			
Wheat[a]	6,526	417.0	6.39
Feed grain[d]	2,163	500.3	23.13

[a]Wheat exports include the wheat equivalent of wheat flour.

[b]Barley, oats, corn, sorghums

[c]Barley, oats, corn

[d]Barley, oats

[e]Column (2) divided by Column (1) times 100.

Source: FAO, Production Yearbook; FAO, World Grain Trade Statistics.

quantity of exports should not significantly affect price. An additional argument for the above assumption is that the four exporting countries concerned tend to fix, by government or quasi-government authority, the export price of the grains they export. The fixed prices do not necessarily represent the marginal cost of production or the export demand situation.

The import supply restraints entered Model II as follows: the sum of the imports of a given grain (say food wheat) by the four EEC regions from a given supplier (say Canada) must be less than or equal to a fixed amount (Canada's export availability). Base period availabilities were

based on actual exports. For 1970, the base period quantities were adjusted on the basis of projected net exports published by the FAO.[17]

At first glance Model II may appear overly restricted. In operation it proved quite useful in illustrating marginal adjustments resulting from changes in demand, land availability and product price.

The use of Model I and Model II was essentially the same. After the basic data for the models had been assembled, the models were run using base period relationships. The objective was to secure a solution that approximated the actual patterns existing during the base period. After the base period models were run, changes to represent expected 1970 relationships were introduced and the models re-run.

The linear programming problems were run on a Control Data computer, Model 3600. A modified CDM 2 routine developed by Donald Kiel and George Irwin was used.[18]

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[17]FAO, op. cit., pp. A-51, A-52.

[18]George D. Irwin and Donald F. Kiel, Use of the Modified CDM2 Linear Programming Routine on the CDC 3600 (AES Program Description 17, Mimeo) February 14, 1964.

CHAPTER IV

QUANTITATIVE RESULTS: MODEL I

Chapter III discussed the general development of the two basic models used in this study. Specification of the estimates used in the models is presented in Appendix II.

Recall that Model I is a maximizing model. Each region in the model has three production activities: food wheat, feed wheat and feed grain. Minimum levels of production are specified for feed wheat. Food wheat and feed grain are traded interregionally; feed wheat is not traded. Reservation activities for each region fix minimum prices for the constrained resources: land, labor and capital. Demand restraints specify the quantity of each commodity required for domestic use by a given region. Thus, the objective function maximizes revenue from production and trade by all regions, net of transfer costs, and subject to minimum prices on the constrained resources.

Variations of Model I

Before presenting the results of Model I, let us consider the features of the model variations utilized. Five variations of Model I were employed:

1. Base period simulation
2. 1970(1)
3. 1970(2)
4. 1970(3)
5. 1970(U.K.)

Model I--base period simulation was the model used to reproduce

the average conditions existing during the base period (1959/60-1961/62). The product prices used in the objective function represent producer prices at the regional centers. Transfer costs and reservation prices were estimated from base period data. Production coefficients were based on relationships existing during the base period. Resource availability was estimated as the actual quantity of resources used for base period production. Demand reflected base period utilization (domestic disappearance). Minimum feed wheat production was derived from minimum utilization during the base period.

Model I--1970(1) was based on a set of assumptions about expected relationships in 1970 (roughly a period from 1969 to 1971). Only the changes from the base period simulation model will be indicated. Product prices were changed to represent producer prices under the EEC uniform grain price policy. Land and labor coefficients were changed to reflect increased productivity. Land availability remains unchanged, but labor and capital availabilities were set at an upper limit. Demand was based on 1970 estimates published by the FAO and the EEC.

Model I--1970(2) contains only one change from 1970(1). Feed grain demand for each region was based on a feed-grain-to-meat-consumption ratio equal to the base period ratio.

Model I--1970(3) differs from 1970(2) in two respects. One, a high upper limit, based on historical utilization, was placed on land availability for the EEC regions. Two, feed grain demand was changed to represent an increase in the feed-grain-to-meat-consumption ratio.

Model I--1970(U.K.) is the same as 1970(1), except that product prices for United Kingdom food wheat, feed wheat and feed grain were changed to reflect an expanded EEC with the United Kingdom as a member.

The results of this model will be discussed separately.

Base Period Simulation

In discussing the results of Model I, initial consideration will be given to comparing the base period simulation results with actual base period data. It should be remembered that Model I is a closed model. Production for export to non-model countries and imports from non-model countries are not included in the simulated or actual base period data. Total regional base period production and trade are presented in Tables 5 and 7 in order to illustrate the proportion of total production and trade covered by the model. The results for 1970 also pertain only to the regions included in the model.

In making comparisons between actual and simulated conditions, insight into the ability of the model to reproduce the base period will be gained. Unfortunately, no statistical tests exist to indicate whether or not results from the simulation model should be accepted or rejected. Acceptance or rejection rests on what the researcher is willing to accept. Obviously, differences of opinion will exist on what is acceptable. But one should remember that selecting levels of significance in statistical hypothesis testing also involves subjective judgment.

Production

The base period simulation model did an excellent job of reproducing regional grain production levels for Model I requirements. Actual and base period simulation production levels for Model I are presented in Table 5.

In addition, Table 5 contains average total production by the model regions.[1] Ratios of simulated production to actual production are 1.0 in nearly all cases.[2]

The United States' food wheat production by the simulation model was approximately two percent greater than actual production (a ratio of 1.02). Simulated food wheat production by the United Kingdom and Italy was 10.6 and 3.1 percent under actual production (ratios of .894 and .969).

Over and under-production of feed grain involved the same three regions. Simulated feed grain production by the United States was 0.5 percent under base period production, while for the United Kingdom and Italy, it was over by 2.0 and 11.6 percent, respectively. The food wheat and feed grain simulation results for the United States indicate

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[1]Note that "actual Model I base period production" (Column 2) is not necessarily equal to "average total production" by a region during the base period (Column 1). For food wheat and feed grain, actual Model I production reflects only the needs of the model and is defined, for a given region, by the following relationship: Model I production equals Model I demand, plus exports to model regions, minus imports from model regions. For example, Model I base period relationships for French food wheat, in metric tons, are: model demand = 6,461,000 (Appendix Table 8, Col. 1); exports to model regions = 695,000 (Table 7, Col. 2); and imports from model regions = 219,000 (Table 7, Col. 2). Thus 6,461,000 + 695,000 - 219,000 = 6,937,000, the actual Model I food wheat production figure for France listed in Table 5, Column 2. Feed wheat production is constrained by upper and lower limits as set by the demand restraint and the minimum production restraint. Total and actual feed wheat production are the same (Columns 1 and 2) reflecting the assumption of no interregional trade in feed wheat.

[2]A ratio of simulated production to actual production of 1.0 means the simulated quantity and the actual quantity are equal. A ratio greater than 1.0 indicates over-production by the simulation model, and a ratio of less than 1.0 indicates under-production by the simulation model.

Table 5. Grain production, total, Model I actual, and Model I simulation, base period (1959/60-1961/62)

Commodity and Region	Total production for all uses (1)	Actual production for Model I regions (2)	Simulated production for Model I regions (3)
	--------1000 metric tons--------		
Food Wheat			
United States	32,255	17,272	17,651
Canada	9,522	6,951	6,951
United Kingdom	1,364	1,364	1,220
France	7,971	6,937	6,936
West Germany	2,684	1,572	1,572
Italy	7,610	7,610	7,375
Benelux	913	913	913
Feed Wheat			
United States	1,429	1,429	1,429
Canada	1,503	1,503	1,503
United Kingdom	1,576	1,576	1,576
France	2,739	2,739	2,739
West Germany	1,824	1,824	1,824
Italy	252	252	124
Benelux	529	529	529
Feed Grain[a]			
United States	134,822	128,052	127,396
Canada	11,719	10,587	10,587
United Kingdom	6,536	6,059	6,181
France	10,436	9,740	9,740
West Germany	5,950	5,678	5,678
Italy	4,658	4,596	5,129
Benelux	1,653	1,322	1,322

[a]Barley, oats, corn, sorghum

that food wheat was slightly more profitable than the actual levels of production imply. The opposite is true for Italy and the United Kingdom.

Feed wheat production by the simulation model equaled the upper limit as prescribed by the demand restraint in all regions except Italy. Italian feed wheat production was equal to the level of the minimum production restraint, implying that resources were more productive in feed grain and food wheat production.

In general, the operation of Model I in simulating base period production was encouraging. The results suggest that for the predetermined product prices and the fixed levels of the restraints, the coefficients utilized were representative of resource productivity in the base period.

Trade

The results of the transfer activities, representing trade between the regions, were not as consistent as were the production activities. Table 6 presents actual and simulated interregional grain trade between Model I regions. Many commodity transfers that occurred during the base period were not represented in the simulation solution. Some important transfers, involving substantial quantities, were eliminated in the simulation solution, for example, the United States' food wheat shipments to the Benelux countries and Canadian food wheat exports to West Germany.

In interpreting the results of the transfer activities, four points should be considered. One, the transfer costs utilized may not reflect the actual transfer charges. There is undoubtedly some error in the estimates of transfer costs, as some of the estimates were of necessity based on fragmentary information. However, errors in transfer costs should not be considered as solely responsible for the elimination of some transfer activities and the over or under-estimation of others.

A second point seems to be of greater importance, namely, the constant cost nature of the transfer activities in the model. Once a transfer activity is brought into the solution, shipment continues until export supply is exhausted or demand satisfied. Increasing transfer costs are not provided for.

Table 6. Grain trade, Model I actual and Model I simulation, base period (1959/60-1961/62)

Commodity and Region	Model I actual trade (1)	Model I simulated trade (2)
	--------1000 metric tons--------	
Food Wheat		
U.S. to U.K.	592	1,186
U.S. to France	70	--
U.S. to Germany	284	1,251
U.S. to Italy	663	--
U.S. to Benelux	645	--
Canada to U.S.	196	--
Canada to U.K.	2,452	2,141
Canada to France	149	--
Canada to Germany	932	--
Canada to Italy	191	1,088
Canada to Benelux	483	1,173
France to U.K.	138	--
France to Germany	511	475
Grance to Benelux	46	--
Feed Grain[a]		
U.S. to Canada	541	--
U.S. to U.K.	2,616	2,811
U.S. to France	32	--
U.S. to Germany	1,146	499
U.S. to Italy	260	--
U.S. to Benelux	3,425	3,778
Canada to U.S.	275	--
Canada to U.K.	365	--
Canada to Germany	43	166
Canada to Benelux	24	--
U.K. to Germany	104	--
U.K. to Italy	5	--
U.K. to Benelux	122	--
France to U.K.	184	--
France to Germany	236	863
France to Italy	268	--
France to Benelux	207	--

[a]Barley, oats, corn, sorghum

(--) Indicates zero

A third important consideration involves the operation of the world market for grains. Grain is not necessarily traded on the basis of minimum cost and comparative advantage. Bilateral agreements, preferential trading regulations, state trading, export subsidies and a host of other institutional arrangements influence the observed trading patterns. It was not possible to include all of these institutional arrangements in the model.

Finally, it is possible to rationalize some of the simulated transfer activities. Shipments from Canada and the United States to European ports involve approximately the same transfer costs. In addition, the practice of trans-shipment of U.S. and Canadian grains through Canadian ports makes allocation of exports by source difficult. Thus, the fact that simulated food wheat exports from the U.S. and Canada to Germany were only three percent greater than base period exports by these countries is reasonable and acceptable. Likewise, simulated Canadian food wheat exports to the Benelux countries exceeded actual exports by the United States and Canada by only four percent.

There are additional positive aspects about the results presented in Table 6. The simulated food wheat shipments from Canada to the United Kingdom and from France to West Germany are approximately equal to actual base period transfers. Also, simulated feed grain exports from the United States to the United Kingdom and the Benelux countries are fairly accurate.

One can also look at the operation of the transfer activities in terms of total trade between model regions. Because of the relationship between model demand, production, exports and imports (see footnote 1, this chapter), a solution that accurately simulates model production will also closely reproduce total interregional trade by the model regions.

Such is the case for Model I, especially for those regions that are primarily importers or exporters.

Table 7 presents total, actual model, and simulated model imports of good wheat and feed grain by Model I regions. In general, the imports of the major importers are accurately represented by the simulation solution. For the four major food wheat importers in the model (the United Kingdom, West Germany, Italy and the Benelux countries), the largest error involved Italy, where simulated imports exceeded actual imports by 27.5 percent; for West Germany and the Benelux countries, actual and simulated food wheat imports were equal; for the United Kingdom, simulated food wheat imports exceeded actual imports by five percent. Taking the EEC countries as a unit, we find that simulated food wheat imports were greater than actual imports by only four-tenths of one percent!

Essentially, the same results were obtained for feed grain imports (Table 7). For West Germany and the Benelux countries, actual and simulated feed grain imports were equal. Simulated feed grain imports by the United Kingdom were 11.2 percent below actual imports. Likewise, for the EEC as a whole, simulated feed grain imports were 9.6 percent below actual imports. The failure of the simulation solution to include feed grain imports by Italy and Canada is unfortunate. These two countries imported slightly over one million metric tons of feed grain during the base period.

Exports of food wheat and feed grain by Model I regions to other regions in the model are also presented in Table 7. In addition, Table 7 contains average total exports by the exporting regions in the model. Simulated food wheat exports by the United States and Canada are very close to actual exports during the base period. French food wheat exports in the simulation solution are 220,000 metric tons below actual exports

Table 7. Grain imports and exports by region, total, Model I actual, and Model I simulation, base period (1959/60-1961/62)

Commodity and Region	Total from all countries (1)	Model I actual from model regions (2)	Model I simulated from model regions (3)
	--------1000 metric tons--------		
IMPORTS:			
Food Wheat			
United States	196	196	--
United Kingdom	4,087	3,183	3,327
France	461	219	--
West Germany	2,647	1,726	1,726
Italy	1,162	853	1,088
Benelux	1,570	1,173	1,173
EEC	5,840	3,971	3,987
Feed Grain[a]			
United States	343	275	--
Canada	571	541	--
United Kingdom	4,766	3,164	2,811
France	357	32	--
West Germany	3,277	1,529	1,529
Italy	2,315	533	--
Benelux	4,508	3,778	3,778
EEC	10,457	5,872	5,307
EXPORTS:			
Food Wheat			
United States	17,149	2,254	2,437
Canada	8,968	4,403	4,402
France	1,707	695	475
Feed Grain[a]	12,052	8,018	7,088
Canada	1,187	707	166
France	1,571	895	863
United Kingdom	302	231	--

[a]Barley, oats, corn, sorghum

(--) Indicates zero

(31.7 percent). This result represents import substitution by France as food wheat imports were reduced to zero; hence, exports were reduced so that domestic demand could be satisfied. Consequently, net food wheat

exports (exports minus imports) by France were the same in the simulation solution as during the base period.

Regional feed grain exports are erratic in the case of Canada and the United Kingdom (Table 7). Simulated Canadian feed grain exports were only 166,000 metric tons as compared with 707,000 metric tons in the base period. This result represents import substitution similar to that described above for French food wheat. The elimination of feed grain exports from the United Kingdom can be partially explained by the fact that the United Kingdom's feed grain exports are almost entirely barley for brewing. Barley for brewing is higher priced than barley for feed, making the United Kingdom's feed grain export price higher relative to other feed grain exporters.

Resource Use--Base Period and 1970

The discussion of resource use in Model I will be concerned with the four variations of the model: base period simulation, 1970(1), 1970(2), and 1970(3). The base period simulation results provide the basis for comparison with the alternative models for 1970. It is assumed that resource use for grain production in the base period solution is representative of actual resource use during the base period. This assumption is based on the results of Model I in reproducing base period production. The three categories of resources will be discussed individually.

Land

Land use by the three grain producing activities in each region is presented in Table 8. In looking at these results, recall that a new set of coefficients was introduced into the 1970 models to represent increased yields per acre. Thus, although the same quantity of land may be used,

grain production increases.

Table 8. Resource use, Model I base period simulation and 1970, all grain[a]

Region and Model	Land hectares (1)	Labor man hrs. (2)	Capital U.S. $ (3)
	---------millions of units---------		
United States			
Base period	57.725	792.7	1,794.4
1970(1)	47.572	591.2	1,971.0
1970(2)	52.940	664.7	2,193.4
1970(3)	57.725	732.7	2,391.8
Canada			
Base period	14.727	109.8	385.5
1970(1)	14.727	97.4	439.8
1970(2)	14.727	98.5	438.6
1970(3)	14.727	100.8	436.2
United Kingdom			
Base period	2.820	111.4	233.8
1970(1)	2.820	64.8	265.5
1970(2)	2.820	64.9	265.7
1970(3)	2.820	64.4	263.2
France			
Base period	7.963	472.0	784.4
1970(1)	7.963	283.6	938.7
1970(2)	7.963	284.2	952.0
1970(3)	9.169	326.8	1,086.9
West Germany			
Base period	3.068	157.1	208.6
1970(1)	3.068	104.9	228.9
1970(2)	3.068	104.9	228.9
1970(3)	3.198	108.2	238.2
Italy			
Base period	6.329	822.7	681.1
1970(1)	6.285	501.3	870.0
1970(2)	6.329	502.7	876.5
1970(3)	6.789	535.7	940.8
Benelux			
Base period	.773	45.2	136.5
1970(1)	.773	31.6	145.3
1970(2)	.773	31.6	145.3
1970(3)	.798	32.3	150.1

[a]Food wheat, feed wheat, barley, oats, corn, and sorghum

For the United States, Canada and the United Kingdom, the quantity of land available was the same for all four models. Canada and the United Kingdom used all of the land available in each run of Model I presented in Table 8. Land use in the United States varied considerably between models. In Model I-1970(1), approximately 10.2 million hectares of land were transferred out of grain production at the minimum price fixed by the reservation activity; this represented a decrease of 17.6 percent below base period utilization.[3] As feed grain demand was increased, land use in the United States increased until it was back to the base period level in Model I-1970(3). The estimated land use pattern for the United States reflects its role as a residual supplier in the Model I solutions for 1970.

For France, West Germany, Italy and the Benelux countries, the quantity of land available was the same for the first three variations of Model I: base period simulation, 1970(1) and 1970(2). Except for Italy, all of the land available was used by the EEC regions in the first three variations of Model I. For Italy, Model I-1970(1) showed a decrease of only one percent below base period use.

The operation of Model I-1970(3) with available land equal to base period land use resulted in an infeasible solution.[4] This result provided important information because it indicated that the quantity of land available was insufficient to meet the product demand requirements. It was decided to place an upper limit, based on

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[3] 1 hectare = 2.47 acres

[4] The "short output" of the CDM 2 Linear Programming Routine indicates whether or not the problem has an optimal solution, no feasible solution, or an infinite solution. Irwin and Kiel, op. cit., p. 16.

historical land use, on the land available to the regions of the EEC. Model I-1970(3) was re-run and an optimal solution obtained. Substantial changes in land use occurred for France and Italy. France utilized approximately 1.2 million hectare (15 percent) more land for grain production than during the base period. Italy increased land use by seven percent over the base period. Minor increases were recorded for West Germany and the Benelux countries.

Labor

Labor utilization in Model I is presented in Column 2 of Table 8. The changes between the base period simulation results and the 1970 models are extremely interesting. The changes in quantity of labor used reflect changes in grain production and labor coefficients. The latter changes were introduced to represent increased labor efficiency.

For the United States, the maximum reduction in labor input occurred in Model I-1970(1). Converting the man hours to man years, approximately 84,000 less full time workers are utilized in Model I-1970(1) than in the base period.[5] This represents a decrease of 25.4 percent or roughly 2.5 percent per year. If we assume that a farm family averages 4.5 people and that no other family members are employed in grain production, approximately 378,000 people in the United States would be affected by the reduction in labor required for grain production.[6]

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[5] 1 man year equals 2400 man hours or 1 man working eight hours a day for 300 days.

[6] In 1959, the U.S. farm population was 16,592,000 and there were 3,703,894 farms or 4.48 people per farm. U.S.D.A., Agricultural Statistics, 1962, pp. 512 and 524.

Model I-1970(2) and 1970(3) showed an increase in labor input for the United States over the 1970(1) results. In the 1970(3) version of Model I, the reduction from the base period was only 7.6 percent or 25,000 full time workers. This reflects the substantial variations in United States' grain production in the 1970 models.

Labor utilization in Canada is essentially the same for the three models representing 1970. The 1970 models show an average reduction of approximately 4,800 full time workers below the base period level; this represents a 10.3 percent decrease. Since land use in Canada by the three 1970 models is the same, the small variations in labor input are a result of production shifts between food wheat, feed wheat and feed grain (see Table 9).

The number of full time workers released by 1970 for nonfarm and other farm employment in the United Kingdom averages 19,400. This represents a 41.7 percent decrease from the base period level of labor use. Considering the small percentage of the U.K. labor force employed in agriculture, a 41.7 percent decrease in labor used in the grain sector is important.

French labor use in 1970 varies with the amount of land utilized. Labor input in grain production in Model I-1970(1) and 1970(2) is estimated at 284 million hours or 39.8 percent below the base period level. Land use increased by 15 percent in Model I-1970(3); this was accompanied by a proportional labor increase of 15 percent. Nevertheless, French labor use under the assumptions of Model I-1970(3) is 60,500 full time workers less than during the base period.

Estimated 1970 labor utilization for grain production in West Germany, Italy, and the Benelux countries follows a pattern similar to that

for France. Model I-1970(1) and 1970(2) shows nearly a constant amount of labor being used by each region; 105, 502, and 31.6 million hours for West Germany, Italy and Benelux, respectively. The decreases from the base period are 33 percent for West Germany, 39 percent for Italy and 30 percent for the Benelux countries. As in the case of France, labor use in Model I-1970(3) increases for West Germany, Italy and Benelux, but by a much smaller percentage; the absolute levels of utilization under the assumptions of Model I-1970(3) remain below the base period.

For the EEC as a whole, the maximum decrease in the number of full time workers in grain production by 1970 is estimated at 239,900 or 38.5 percent below utilization during the base period. The minimum reduction is 164,100 workers or 26.3 percent. The latter result reflects the increased production of grain by the EEC regions under the assumptions of Model I-1970(3).

Capital

The utilization of capital in the various Model I solutions is presented in Column 3 of Table 8. Not much emphasis will be placed on these results. Capital coefficients and restraints were incorporated into the model to represent "variable" capital requirements. Variable capital was defined to include such items as machinery costs (fuel, oil, repairs), seed costs, fertilizer and insecticides. Finding representative data on variable capital requirements was extremely difficult. Consistent definitions of capital items are almost nonexistent. Because of the inadequate information available, it was decided not to change the capital coefficients for the 1970 models. The results can thus be interpreted as lower limits on the amount of variable capital used in 1970. Increased

capital input per metric ton of grain would further increase capital utilization.

One set of comparisons concerning capital utilization was made. Index numbers of total current farm operating expenses for European countries were published by the FAO in 1961.[7] The 1959 values of the index (1950-52 = 100) for the European countries in Model I are:

Belgium	137	Netherlands	170
France	166	Italy	159
West Germany	150	United Kingdom	135

These indexes were compared with the percentage increases in capital utilization for the corresponding regions as presented in Table 8. In no cases do the increases in variable capital used in grain production (for the ten-year period from the base period to 1970) exceed the increases in total current farm operating expenses presented above. This is true even though the FAO figures cover a shorter period. During the period from 1950 to 1960, total current farm operating expenses in the United States increased by 34 percent.[8] This too, is larger than the increases in capital utilization by the United States and Canada presented in Table 8. These rough comparisons provide additional support for the claim that the 1970 capital utilization estimates by Model I can be interpreted as lower limits.

Production in 1970

Estimates of regional grain production by four versions of Model I are presented in Table 9. The base period simulation results are the same

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[7] U.N.-FAO, Towards a Capital Intensive Agriculture. Part 1; General Review, Geneva, 1961, p. 23.

[8] U.S.D.A., Farm Income 1949-62, State Estimates (A Supplement to the Farm Income Situation for July 1963), pp. 43 and 63.

as those discussed in conjunction with Table 5. The results for 1970 are compared with the base period simulation solution because the model adjusts from the simulation results, not from the actual base period data. It is true that the economies involved adjust from the actual rather than the simulated situation. Hence, one might want to make some comparisons with the actual base period figures reported in earlier tables.

Table 9. Grain production, Model I base period simulation and 1970

Commodity and Region	Base period simulation (1)	1970(1) (2)	1970(2) (3)	1970(3) (4)
	--------1000 metric tons--------			
Food Wheat				
United States	17,651	16,050	16,050	16,050
Canada	6,951	7,166	6,023	4,773
United Kingdom	1,220	--	50	--
France	6,936	6,774	8,367	9,513
West Germany	1,572	3,475	3,475	3,475
Italy	7,375	8,340	7,841	7,994
Benelux	913	1,980	1,980	1,980
Feed Wheat				
United States	1,429	1,800	1,800	1,097
Canada	1,503	2,350	2,350	1,198
United Kingdom	1,576	2,100	2,100	1,482
France	2,739	4,250	4,250	3,905
West Germany	1,824	2,540	2,540	2,540
Italy	124	610	610	124
Benelux	529	820	820	820
Feed Grain[a]				
United States	127,396	145,300	165,183	184,121
Canada	10,587	12,256	13,756	16,909
United Kingdom	6,181	8,156	8,111	8,719
France	9,740	12,308	10,785	13,481
West Germany	5,678	4,104	4,104	4,498
Italy	5,129	7,539	8,485	10,607
Benelux	1,322	407	407	493

[a] Barley, oats, corn, sorghum

(--) Indicates zero

The 1970 production of food wheat by the United States in all three 1970 models is below the base period simulation output. The reduction represents a decrease of approximately 1.6 million metric tons or 9.1 percent. This result reflects the elimination of food wheat exports by the United States in the 1970 variations of Model I. The estimated level of production is equal to expected domestic demand as prescribed by the demand restraint.

Estimated Canadian food wheat production by the 1970 models is both above and below the base period level. Under the assumptions of Model I-1970(1) production increased by 3.1 percent. As feed grain demand was increased in Model I-1970(2) and 1970(3), Canadian food wheat production decreased. The decreases from the base period were 13.4 and 31.3 percent for Model I 1970(2) and 1970(3). The latter percentage represents a decrease of about 2.2 million metric tons.

For the United Kingdom, the pattern of food wheat production in the 1970 models is unrealistic. Output is zero or near zero in all 1970 variations of Model I. These results give little indication of what will happen by 1970. Certainly, the United Kingdom is not going to cease food wheat production. The close similarity of food wheat and feed grain prices in the United Kingdom seems to account for the large shift from food wheat to feed grain production. The United Kingdom food wheat price used in Model I-1970(1), 1970(2) and 1970(3) was only one percent above the feed grain price; for the other regions in Model I, food wheat prices ranged from 10 to 48 percent above feed grain prices. United Kingdom grain prices were changed substantially in Model I-1970(U.K.) to represent an expanded EEC; the results of this model are discussed in a later section.

Two of the four EEC regions have the same estimated food wheat production in all three 1970 versions of Model I: West Germany and Benelux.

West German production increased by about 1.9 million metric tons or 121 percent. Food wheat production by the Benelux countries in 1970 is estimated at more than one million metric tons above the base period. These results leave West Germany and the Benelux countries completely self-sufficient in food wheat by 1970 (see Table 10).

Food wheat production in France, under the assumptions of Model I-1970(1), is slightly below the base period level (2.3 percent). This result is associated with the movement to self-sufficiency by West Germany and the Benelux countries.[9] Model I-1970(2) and 1970(3) indicate large increases in French food wheat production. The maximum increase above the base period is 37.2 percent or approximately 2.6 million metric tons.

Food wheat production in Italy is different in each 1970 version of Model I. All three estimates are greater than simulated base period production. The maximum increase occurs in Model I-1970(1) where estimated production is about one million metric tons (13 percent) above simulated base period production.

Feed wheat production in Model I-1970(1) and 1970(2) is equal to the upper limit prescribed by the demand restraints. In Model I-1970(3) feed wheat production was equal to the level of the demand restraint in only two regions, West Germany and Benelux. French feed wheat production in Model I-1970(3) is between the limits (2.12 and 4.25 million metric tons) established by the minimum production and the demand restraints. For the four remaining regions (United States, Canada, United Kingdom and Italy), feed wheat production equaled the minimum production level. The results for the United States, Canada and the United Kingdom are associated

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[9] Discussion of the possibility of food wheat self-sufficiency by West Germany and the Benelux region is deferred until Chapter V.

with the movement of resources out of feed wheat production and into feed grain production. This movement is in response to the increased feed grain demand specified for Model I-1970(3). Resources previously used for feed wheat production in Italy are transferred to food wheat and feed grain by Model I-1970(3).

In most cases, changes in feed grain production as reported in Table 9, were opposite to those estimated for food wheat. Thus for the United States and Canada, feed grain production increases in each 1970 version of Model I. The sizeable increases in the United States, ranging from 17.9 million to 56.7 million metric tons, reflect increased domestic and foreign demand. Canadian feed grain production increases in Model I-1970(1) and 1970(2) are due entirely to estimated increases in domestic demand. The large increase estimated by Model I-1970(3), (about three million metric tons above 1970(2)), allows Canada to export more than 1.7 million metric tons of feed grain (Table 10).

United Kingdom feed grain production increased almost two million metric tons (32.0 percent) in Model I-1970(1) as compared with the base period simulation results. This large increase is primarily due to the elimination of United Kingdom food wheat production in Model I-1970(1). Feed grain production decreases slightly in Model I-1970(2) and then increases by about 600,000 metric tons in Model I-1970(3) as resources shift out of feed wheat production. Because of the zero or near zero level of food wheat production, estimated 1970 feed grain production is certainly above the level than can reasonably be expected. For a discussion of this problem see Chapter VI.

West Germany and the Benelux region show a similar pattern of feed grain production in the 1970 variations of Model I (Table 9). Estimated

production in both regions is reduced as resources are shifted out of feed grain production into the food wheat activity. Both regions exhibit a small increase in production under the assumptions of Model I-1970(3); this result reflects the increased utilization of land by West Germany and the Benelux countries (see Table 8).

French feed grain production is greater than during the base period in each of the 1970 models. The increases range from about 1.0 million to 3.7 million metric tons. The latter figure represents a 38.4 percent increase over the base period level of production. The large increase in land utilization by France in Model I-1970(3) is allocated to both food wheat and feed grain production, increasing the output of both commodities.

The level of feed grain production in Italy equals domestic demand in each 1970 variation of Model I. The maximum level of production (10,607,000 metric tons) is a little more than twice as large as the simulated base period level.

Trade in 1970

Directly related to the production levels presented in Table 9 are the estimates of imports and exports contained in Table 10. As in the case of production, the 1970 trade results of Model I will be compared with the base period simulation solution.

The import estimates in Table 10 contain some rather startling results. For food wheat, the most significant change is the almost complete elimination of imports by the EEC in 1970. The small quantity of food wheat imported by Italy in Model I-1970(2) and 1970(3) reflects a shift of resources to feed grain production to meet the increased demand for feed grains.

Table 10. Grain imports and exports by region, Model I base period simulation and 1970

Commodity and Region	Base period simulation (1)	1970(1) (2)	1970(2) (3)	1970(3) (4)
		--------1000 metric tons--------		
IMPORTS:				
Food Wheat				
United States	--	--	--	--
United Kingdom	3,327	4,860	4,810	4,860
France	--	--	--	--
West Germany	1,726	--	--	--
Italy	1,088	--	499	346
Benelux	1,173	--	--	--
EEC	3,987	--	499	346
Feed Grain[a]				
United States	--	--	--	--
Canada	--	--	--	--
United Kingdom	2,811	2,189	2,153	4,111
France	--	--	--	--
West Germany	1,529	4,958	5,701	7,758
Italy	--	--	--	--
Benelux	3,778	5,309	6,343	7,944
EEC	5,307	10,267	12,044	15,702
EXPORTS:				
Food Wheat				
United States	2,437	--	--	--
Canada	4,402	4,566	3,422	2,173
France	475	294	1,887	3,033
Feed Grain[a]				
United States	7,088	10,014	14,197	18,035
Canada	166	--	--	1,778
France	863	2,442	--	--
United Kingdom	--	--	--	--

[a]Barley, oats, corn, sorghum

(--) Indicates zero

Because of the low level of production in Model I-1970(1), 1970(2) and 1970(3), estimates of United Kingdom food wheat imports are quite large (about 45 percent above the simulated base period level).

The feed grain import estimates presented in Table 10 require very little interpretation. The three main importing regions, the United Kingdom, West Germany and Benelux, continue to import large quantities of feed grain in 1970. The important point to note is the large increase in feed grain imports by the EEC in response to changes in feed grain demand. Under the minimum assumptions of Model I-1970(1), imports of feed grain by the EEC are about twice as large as the simulated base period level. The 1970(2) and 1970(3) versions of Model I show even larger increases in feed grain imports by the EEC.

The Model I estimates of grain exports in 1970 follow logically from the production and import estimates previously discussed. Exports of food wheat by the United States are eliminated. At the same time, the United States' feed grain exports increase rapidly until Model I-1970(3), the United States exports over 18 million metric tons. In Model I-1970(2) conditions are such that the United States provides all the import requirements of the model regions.

Canada and France compete for the food wheat export market in the 1970 variations of Model I. Canada is the major exporter in Model I-1970(1). But as French food wheat production expanded in Model I-1970(2) and 1970(3), Canadian food wheat exports decreased and France filled the gap.

The appearance of feed grain exports by Canada in Model I-1970(3) is also associated with increased food wheat production and exports by France. Canada adjusted to the losses occurring in the food wheat export market by reducing food wheat production and increasing feed grain production to create an exportable surplus.

The pattern of French feed grain exports in 1970 is very interesting. Model I-1970(1) sets French feed grain exports at approximately 2.4 million

metric tons, while in Model I-1970(2) and 1970(3) French feed grain exports are zero. Two factors account for these results. First, the increased food wheat exports in Model I-1970(2) and 1970(3) require additional limited resource. Secondly, increased levels of domestic feed grain demand in Model I-1970(2) and 1970(3) put further pressure on French resources. The net result is that French feed grain production in Model I-1970(2) and 1970(3) is equal to domestic demand, and no exportable surplus is created.

Expanding the EEC to Include the United Kingdom

As indicated in the introduction to this chapter, United Kingdom grain prices in Model I-1970(1) were adjusted to represent an expanded EEC with the U.K. as a member. The new variation of Model I was identified as Model I-1970(U.K). Inclusion of the United Kingdom in the EEC changed relative and absolute grain prices in the U.K. considerably. United Kingdom grain prices used in Model I-1970(1) and Model I-1970(U.K.) in U.S. dollars per metric ton are:

	Food Wheat	Feed Wheat	Feed Grain	Food Wheat / Feed Grain
Model I-1970(1)	73.27	73.00	72.63	1.01
Model I-1970(U.K.)	96.25	89.88	81.71	1.18

The results of Model I-1970(U.K.) will be compared with the optimal solution of Model I-1970(1). The production response to the price changes in the United Kingdom is of importance. Food wheat production increased from zero in Model I-1970(1) to 4.86 million metric tons in Model I-1970 (U.K.). This result allows the U.K. to become self-sufficient in food wheat, a characteristic exhibited by the other major food wheat importers in Model I (West Germany and Benelux) when uniform EEC grain prices were introduced. Associated with the increase in food wheat production, U.K.

feed grain production fell from 8.156 million metric tons in Model I-1970(1) to 3.731 million metric tons in the model representing an expanded EEC.

The changes in grain production by the United Kingdom in Model I-1970(U.K.) altered labor and capital utilization. Land utilization remained unchanged, but the input of labor and capital increased by 5.1 and 6.9 percent over the level in Model I-1970(1). This result reflects a larger labor and capital input per metric ton of food wheat output. In addition, the results indicate that 1,400 less full-time workers will be available for other farm and nonfarm employment.

The price changes and the resulting production changes in the U.K. affect production, trade and resource utilization throughout the model, especially for the exporting regions. Only the major changes will be discussed. For the United States, feed grain production increased, permitting an increase of feed grain exports to the United Kingdom, amounting to 4.4 million metric tons. A small decrease (282,000 metric tons) in United States feed grain exports to West Germany was indicated by the solution to Model I-1970(U.K.). About 1.1 million hectares more land was utilized by the United States in Model I-1970(U.K.) than in Model I-1970(1). Corresponding increases were indicated for labor and capital.

The major repercussions from including the United Kingdom in the EEC were felt by Canada. Food wheat shipments from Canada to the United Kingdom fell from 4.57 millon metric tons in Model I-1970(1) to zero in Model I-1970(U.K.). Land, labor and capital were transferred out of Canadian grain production at the minimum prices fixed by the reservation

activities.[10] Canadian food wheat production fell to 2.6 million metric tons, the expected level of domestic demand.

Relatively smaller changes were made in French production, trade and resource use. Food wheat production fell (294,000 metric tons), and feed grain production increased (282,000 metric tons). The French production shifts were in response to the United Kingdom's movement to food wheat self-sufficiency. French food wheat shipments to the United Kingdom were eliminated, and feed grain shipments to West Germany increased slightly (276,000 metric tons).

General Implications of Model I

A number of general implications are suggested by the results of Model I. It appears that, except for the importation of quality wheats for blending purposes, the EEC will be self-sufficient in food wheat by 1970. The quality hard wheat required for blending will come primarily from the United States and Canada. There is even some possibility that the EEC will achieve self-sufficiency in durum wheat, as EEC durum producers are granted special protection under the grain regulations adopted in December 1964.

Secondly, it is evident that the import demand for feed grains will be considerably larger by 1970 and that the United States will benefit by increased exports. A doubling of base period feed grain exports by the United States appears entirely possible. The role of France in providing feed grains to the EEC depends on what assumptions are made about France's

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[10] Resource use for grain production by Canada in Model I-1970(1) and 1970(U.K.) is as follows (millions of units):

	1970(1)	1970(U.K.)
Land (hectares)	14.73	11.16
Labor (man hours)	97.4	76.0
Capital (U.S. dollars)	439.8	331.0

domestic demand for feed grain. In Model I-1970(1) an exportable surplus existed. But when different feeding ratios were postulated and domestic demand requirements increased, France ceased exporting feed grain and produced only for domestic requirements.

Thirdly, under the assumptions about increased labor efficiency, Model I indicates that about 35 percent less labor will be required for grain production in the EEC by 1970 than during the base period. If the current high level of industrial employment continues, the absorption of surplus agricultural labor in the EEC should be easier than in the United States during the past decade. Pockets of unemployment will certainly occur, especially in the poorer areas of southern Italy.

Fourth, expansion of the EEC to include the United Kingdom would affect Canada more severely than the other exporting countries in Model I. The loss of the United Kingdom's wheat import market left Canada with about 3.57 million hectares of idle land. Increased domestic demand for feed grain and/or substantial feed grain exports as indicated by Model I-1970(3) would lessen Canada's adjustment problem.

A more detailed discussion of the economic and political implications of Model I and Model II is presented in Chapter VI.

CHAPTER V

QUANTITATIVE RESULTS: MODEL II

The general development of Model II was presented in Chapter III. Recall that Model II is a minimizing model. The objective function minimizes gross expenditures by the EEC for food wheat, feed wheat and feed grain. Regional specification is different from Model I. Model II omits the United Kingdom but adds Australia and Argentina. Each EEC region in the model has a production activity for each commodity. Minimum levels of production are specified for each commodity and producing region. Food wheat and feed grain are traded interregionally; feed wheat is not traded. The non-EEC regions in the model supply food wheat and feed grain to the EEC regions at a fixed price. An upper limit is placed on the quantity of exports available in the non-EEC regions. Finally, demand restraints specify the quantity of each commodity required for domestic use by the EEC regions.

The format for presenting the results of Model II is similar to that used for Model I. Initially, a summary of the characteristics of the various forms of Model II will be presented. Next, base period simulation results will be compared with actual base period data. Finally, the 1970 versions of Model II will be compared with each other and with the simulated base period results. The chapter concludes with a general comparison of Models I and II.

Variations of Model II

Four variations of Model II were utilized:

1. Base period simulation
2. 1970(1)
3. 1970(2)
4. 1970(3)

Model II-base period simulation was the model used to reproduce the relationships existing during the base period (1959/60-1961/62). Product prices in the objective function were wholesale prices for the production activities and c.i.f. prices for the importing activities. All prices were selected to represent prices existing at the four regional centers. Hence, c.i.f. prices were adjusted to represent movement from the ports of entry to the regional centers. Production coefficients were the same as those used in Model I-base period simulation. Land availability was estimated as the actual quantity used for base period production. Demand reflected base period domestic disappearance. Minimum production was equal to average production during the base period. Export supplies (import availabilities) were based on average exports to EEC members during the base period.

Model II-1970(1) was based on a set of technical and institutional relationships expected to exist in 1970 (roughly a period from 1969 to 1971). Product prices for the production activities were set equal to the expected regional target prices under the EEC uniform price regulations. Import prices were adjusted according to the standard quality differentials adopted by the EEC. Land and labor coefficients were adjusted to reflect increased efficiency. Land availability was unchanged. Demand and minimum production levels were derived from estimates published by the EEC. Export supplies were adjusted on the basis of projected net exports established by the FAO.

Model II-1970(2) differs from 1970(1) in two respects. One, an upper limit, based on historical utilization, was placed on land availability for the EEC regions. Two, feed grain demand for each EEC region was based on a feed-grain-to-meat-consumption ratio equal to the base period ratio.

Model II-1970(3) is different from Model II-1970(2) in two respects. One, feed grain demand for each EEC region is changed to represent a 25 percent increase in the base period feed-grain-to-meat-consumption ratio. Two, the upper limit on the supply of United States' feed grain was increased from 9.3 to 16.8 million metric tons.

Base Period Simulation

As in the case of Model I, production for export to non-model countries and imports from non-model countries are not included in the simulated or actual base period data. Tables 11 and 12 present total regional base period production and trade in order to illustrate the proportion of total production and trade covered by Model II. It follows that results for 1970 also pertain only to the regions of the model.

Production

The simulated base period production levels of Model II are almost identical to actual grain production during the base period (Table 11).[1] Two factors are responsible for the results in Table 11. One, the levels of the minimum production restraints were equal to average model production during the base period. Two, the quantity of land available for

[1] "Actual" production for a given region in Model II equals average base period production (Column 2, Table 11), minus average base period exports to non-model countries, (minus feed wheat production in the case of food wheat).

grain production was estimated as the actual amount used for base period production. Thus the restraints of the model insured that simulated and actual production would be identical. The two cases (feed grain in Benelux and West Germany) where simulated production exceeds actual production are due to a slight over-estimation of base period land use by the two regions.

Table 11. Grain production, total, Model II actual, and Model II simulation, base period (1959/60-1961/62)

	Total production for all uses (1)	Actual production for Model II regions (2)	Simulated production for Model II regions (3)
	--------1000 metric tons--------		
Food Wheat			
Benelux	913	825	825
France	7,971	6,784	6,784
West Germany	2,684	1,997	1,997
Italy	7,610	7,376	7,376
EEC	19,178	16,982	16,982
Feed Wheat			
Benelux	529	529	529
France	2,739	2,739	2,739
West Germany	1,824	1,824	1,824
Italy	252	252	252
EEC	5,344	5,344	5,344
Feed Grain[a]			
Benelux	1,653	1,480	1,481
France	10,436	9,591	9,591
West Germany	5,950	5,754	5,759
Italy	4,658	4,655	4,655
EEC	22,697	21,480	21,486

[a]Barley, oats, corn

Trade

The simulation of trade flows between the regions of Model II was not any better than in the case of Model I. Essentially the same reasons

apply as were suggested for Model I (see page 51 Chapter IV). In Model II, there are no transfer costs as such, but the availability of a limited quantity of imports at a fixed price has the same effect. The other arguments, pertaining to institutional arrangements and errors in measurement, are unchanged.

The results of the various forms of Model II contained transfer activities that were not in the solution, but that could come into the solution without changing the value of the objective function. That is, the Delta (J)'s (Z_j-C_j, or simplex criteria) were zero, but the activity was not "in" the solution. Such a condition indicates that alternative optimal solutions exist. Investigation of the activities involved led to the conclusion that although alternative levels for commodity transfers between pairs of regions exist, total exports by a given region would be subject to only minor changes. In addition, total imports by the EEC regions would not change because of the action of the demand restraints and the land restraint. The land restraint fixes the amount of total production by the three production activities in each region, and the demand restraint fixes the amount of consumption. Thus, total imports for the deficit regions equals the difference between production and demand. Since the results are presented in terms of total exports and imports by the regions of the model, it was decided that the solutions obtained were adequate for this study.[2]

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[2]The reasons for the occurrence of alternative optimal solutions are connected with the special nature of the restraints used. Discussion of the transfer activities involved will help illustrate the relationships. In Model II-base period simulation, four transfer activities were not in the solution but had zero Delta (J)'s: (1) food wheat from Canada to Benelux; (2) food wheat from Canada to France; (3) food wheat from the

continued next page

Trade flows, in terms of total trade between model regions, are presented in Table 12. (Table 12, Column 1 also contains gross imports and exports by the model regions). The simulated food wheat and feed grain imports presented in Table 12 are very close to actual imports by the model regions. For the model regions that do not export grain (Benelux, West Germany and Italy during the base period), simulated and actual imports should be equal if simulated production is equal to actual production. The differences existing in Table 12 reflect the manner in

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Footnote 2 (continued) -- United States to France; and (4) food wheat from Argentina to West Germany. For the United States and Argentina, total exports were at the limit prescribed by the export supply restraint (i.e., the restraints were binding). Canada exported 87,800 metric tons of food wheat less than the upper limit. Thus at most, Canadian food wheat exports could increase by 87,800 tons, while total exports by other regions were falling by a like amount. This is a small amount when compared to total exports of about 5.0 million metric tons.

In Model II-1970(1) and 1970(2) the same two transfer activities were not in the solution but had zero Delta (J)'s: food wheat from France to Benelux, and food wheat from Argentina to West Germany. To understand the France to Benelux activity, it is necessary to understand that food wheat exports by France and Italy to Benelux (or West Germany) have the same delivery price under the proposed EEC regulations ($104.95 per metric ton for Benelux, and $106.25 per metric ton for West Germany). Thus the program is unable to distinguish between food wheat exports from France or Italy in the 1970 versions of Model II. The amount of exports by France and Italy is equal to the difference between production and domestic consumption. Whether it is exported to Benelux or West Germany is immaterial, total exports will be the same. This claim is supported by the results of Model II-1970(3) in which France exported all of its food wheat surplus to West Germany, and Italy exported its surplus to Benelux. The solution to Model II-1970(3) also showed two transfer activities not in the solution but with Delta (J)'s equal zero; they were food wheat from France to Benelux and from Italy to West Germany. These activities could enter the solution but total exports by France and Italy would remain the same. Likewise, as explained above, total imports by West Germany and the Benelux region would remain the same. The Argentine transfer activity is similar to the Canadian situation; the maximum change would be only 270,300 metric tons.

To investigate the validity of the above statements, the prices of the four transfer activities not in the solution of the base period simulation model but with zero Delta (J)'s were lowered (one at a time),

continued next page

which actual and simulated imports were determined.[3]

Model II also performed well in simulating total exports during the base period (Table 12). The upper limits on export supply were set equal to average exports to the EEC during the base period. Simulated exports are equal to the upper limits (actual) in all but two cases, Canadian food wheat exports and Australian feed grain exports.

In general, Model II was highly successful in reproducing base period conditions. This success was primarily due to the nature of the activities and restraints used in the model. The general outcome of the base period simulation model could be predicted in advance. Having the simulated results correspond closely with actual production and trade is an important advantage. As expected 1970 conditions are introduced into the model, the changes resulting represent movement from the actual as well as from the simulated base period conditions.

Footnote 2 (continued) -- and the model was re-run yielding four new optimal solutions. The effect of lowering the prices was to bring the excluded activities into the solution. The results support the above reasoning; total exports and imports by the model regions remained the same, but trade between individual pairs of regions changed as the new activities came into the solution. Since the trade results of Model II are presented in terms of total regional exports and imports, the initial optimal solutions were judged as accurate.

[3]The "actual" regional imports listed in Table 12 are based on imports from Model II regions as reported in EEC and FAO publications. The simulated import estimates reflect the identity: imports equal demand, minus production, plus exports (ignoring changes in stocks). Actual and simulated imports in Table 12 would be equal if actual imports were calculated on the basis of the above identity. Feed grain imports by the Benelux region and West Germany would be an exception because simulated feed grain production was not equal to actual production (Table 11).

Table 12. Grain imports and exports by region, total, Model II actual, and Model II simulation, base period (1959/60-1961/62)

Commodity and Region	Total from all countries (1)	Model II actual from model regions (2)	Model II simulated from model regions (3)
	--------1000 metric tons--------		
IMPORTS:			
Food Wheat			
Benelux	1,570	1,348	1,435
France	461	291	271
West Germany	2,647	2,230	1,804
Italy	1,162	1,162	1,416
EEC	5,840	5,031	4,926
Feed Grain[a]			
Benelux	4,508	4,708	4,770
France	357	38	18
West Germany	3,277	2,055	2,078
Italy	2,315	1,800	1,746
EEC	10,457	8,601	8,512
EXPORTS:			
Food Wheat			
United States	17,149	1,661	1,661
Canada	8,968	1,754	1,666
Argentina	2,156	660	660
Australia	4,813	417	417
France	1,707	521	521
Feed Grain[a]			
United States	12,052	4,862	4,862
Canada	1,187	70	70
Argentina	3,335	2,461	2,461
Australia	986	500	393
France	1,571	727	727

[a]Barley, oats, corn, sorghum

Resource Use-Base Period and 1970

Land

As explained in Chapter III, resource use in Model II is tied to the quantity of land made available for grain production. In the base period model and in Model II-1970(1) the amount of land utilized (and

available because of the equality in the restraints) by each region was the same (Table 13). The quantity available was equal to estimated base period utilization.

Table 13. Resource use, Model II base period simulation and 1970, all grain[a]

Region and Model	Land hectares (1)	Labor man hrs. (2)	Capital U.S. $ (3)
	--------millions of units--------		
Benelux			
Base period	.7985	46.1	141.4
1970(1)	.7985	28.0	152.3
1970(2)	.823	28.7	157.0
1970(3)	.823	28.7	157.0
France			
Base period	7.8395	464.7	772.3
1970(1)	7.8395	279.4	928.5
1970(2)	9.027	321.0	1,054.7
1970(3)	9.027	321.0	1,054.7
West Germany			
Base period	3.2260	166.7	219.8
1970(1)	3.2260	100.4	237.5
1970(2)	3.296	102.2	242.5
1970(3)	3.296	102.2	242.5
Italy			
Base period	6.2175	808.2	670.2
1970(1)	6.2175	498.6	860.2
1970(2)	6.670	532.3	923.3
1970(3)	6.670	532.3	923.3

[a]Food wheat, feed wheat, barley, oats, and corn

Model II-1970(2) was run with the base period quantity of land available, but an infeasible solution was obtained. The supply of grain from the production and import activities was not sufficient to meet the predetermined level of demand. The availability of land was changed to represent a maximum based on historical utilization; Model II-1970(2) was re-run and an optimal solution obtained. The quantity of land used in

Model II-1970(2) is equal to the maximum specified (Table 13). The largest increase occurred in France where approximately 1.2 million hectares of 15.1 percent more land was utilized in Model II-1970(2) than during the base period. A 450,000 hectare increase (7.3 percent) is indicated for Italy. Smaller increases are estimated for the Benelux region and West Germany.

The first run of Model II-1970(3) contained only one change from Model II-1970(2); feed grain demand for each EEC region was adjusted to represent a 25 percent increase in the base period feed-grain-to-meat-consumption ratio. An infeasible solution was obtained for this version of Model II-1970(3). The infeasible solution indicated that production and imports of feed grain were not enough to meet the increased feed grain demand; this result occurred even though EEC land availability was at a maximum. With feed grain supplies exhausted, Canada and the United States still exported no food wheat to the EEC. This illustrates the startling reduction in food wheat imports by the EEC and the possible shortage of feed grain supplies.

Based on the results of Model I, which illustrated the tremendous potential for feed grain production and export by the United States, the supply of U.S. feed grain exports in Model II-1970(3) was increased from 9.3 to 16.8 million metric tons. This change made it possible to obtain an optimal solution for Model II-1970(3).

Labor

Labor utilization in Model II (Table 13), follows a pattern similar to Model I (Table 8). Labor utilization by Model II in 1970 is below the base period level in all regions. For the EEC as a whole, Model II-1970(1) shows a decrease of 241,300 full time workers (39 percent)

from the base period level. Because of the increased land use, the decrease estimated by Model II-1970(2) and 1970(3) is not as large: 208,900 full time workers or 33.8 percent.

Capital

In input of capital in Model II (Table 13) is similar to the results of Model I (Table 8). The comments in Chapter IV concerning capital use and capital coefficients also apply to Model II. The figures presented for 1970 do not contain the influence of increased capital input per unit of output and hence, represent lower limits for the production levels involved. For the EEC as a whole, capital use for grain production in Model II-1970(2) and 1970(3) is estimated at approximately 2.4 billion U.S. dollars, or 31.8 percent above the base period level.

Production in 1970

Estimated grain production in 1970 by the regions in Model II is presented in Table 14. Food wheat production by Model II-1970(1), 1970(2) and 1970(3) is the same. Estimated increases from the base period are 11.3, 19.5, 7.0 and 25.5 percent for the Benelux region, France, West Germany and Italy, respectively.

Feed wheat production by the 1970 variations of Model II is equal to the minimum level prescribed by the production restraint. For the EEC as a whole, an excess demand (demand minus production) for feed wheat of 2.1 million metric tons is created for 1970. Three things might occur: one, wheat identified as food wheat in the model could be used for feed wheat; two, feed grain could be substituted for feed wheat; finally, feed wheat could be imported (not provided for in this model). Because of the surplus of food wheat in the model, food wheat will probably be denatured

Table 14. Grain production, Model II base period simulation and 1970

Commodity and Region	Base period simulation (1)	1970(1) (2)	1970(2) (3)	1970(3) (4)
	--------1000 metric tons--------			
Food Wheat				
Benelux	825	918	918	918
France	6,784	8,104	8,104	8,104
West Germany	1,997	2,137	2,137	2,137
Italy	7,376	9,254	9,254	9,254
EEC	16,982	20,413	20,413	20,413
Feed Wheat				
Benelux	529	585	585	585
France	2,739	3,272	3,272	3,272
West Germany	1,824	1,952	1,952	1,952
Italy	252	317	317	317
EEC	5,344	6,126	6,126	6,126
Feed Grain[a]				
Benelux	1,481	1,560	1,645	1,645
France	9,591	11,619	15,027	15,027
West Germany	5,759	6,257	6,470	6,470
Italy	4,655	6,321	7,889	7,889
EEC	21,486	25,757	31,031	31,031

[a]Barley, oats, corn and used for feeding.

The important production estimates for Model II involve feed grain output in 1970 (Table 14). All four regions respond to the increased demand with larger production. The changes from the base period reported for Model II-1970(1) reflect changes in the production coefficients and minor changes in land use.[4] The increases in feed grain

[4]Resource use by class of commodity (food wheat, feed wheat or feed grain) can be estimated from the model results. Thus for Model II, land use in feed grain production is as follows (thousand hectares):

continued next page

production from Model II-1970(1) to Model II-1970(2) and 1970(3) reflect increased land availability and use. The additional land specified for the latter two models is all used in feed grain production.

Consequently, the maximum feed grain production increases are estimated under the assumptions of Model II-1970(2) and 1970(3). Estimated increases from the base period are 11.1, 56.7, 12.3, and 69.5 percent for the Benelux region, France, West Germany and Italy, respectively. For the EEC as a whole, the maximum increase is about 9.5 million metric tons or 44.4 percent; the minimum increase (Model II-1970(1) is about 4.3 million metric tons or 19.9 percent.

Trade in 1970

Total trade between model regions, as estimated by the 1970 versions of Model II, is presented in Table 15. For two regions in Model II, France and Italy, food wheat imports are eliminated in 1970. Italy switches from a net importer of about 1.4 million metric tons in the base period to a net exporter of nearly 600,000 metric tons in 1970. Benelux and West Germany import the same quantities of food wheat in all 1970 versions of Model II. Benelux imports about 200,000 metric tons (14.6 percent) less in 1970 than estimated by the base period simulation Model. West German food wheat imports in 1970 are practically the same as estimated for the base period. Total EEC food wheat imports in 1970 are below the estimated base period level by 1.8 million metric tons (37.2 percent).

Footnote 4 (continued) --

	Base Period	1970(1)	1970(2), 1970(3)
Benelux	446.1	446.1	470.6
France	4,047.6	4,048.1	5,235.6
West Germany	2,057.8	2,057.8	2,127.8
Italy	1,826.8	1,826.7	2,279.9

Table 15. Grain imports and exports by region, Model II base period simulation and 1970

Commodity and Region	Base period simulation (1)	1970(1) (2)	1970(2) (3)	1970(3) (4)
	--------1000 metric tons--------			
IMPORTS:				
Food Wheat				
Benelux	1,435	1,225	1,225	1,225
France	271	--	--	--
West Germany	1,804	1,867	1,867	1,867
Italy	1,416	--	--	--
EEC	4,926	3,092	3,092	3,092
Feed Grain[a]				
Benelux	4,670	5,330	6,536	8,581
France	18	--	--	--
West Germany	2,078	3,599	4,193	6,859
Italy	1,746	3,089	2,702	5,350
EEC	8,512	12,018	13,431	20,790
EXPORTS:				
Food Wheat				
United States	1,661	--	--	--
Canada	1,666	--	--	--
Argentina	660	354	354	354
Australia	417	590	590	590
France	521	1,551	1,551	1,551
Italy	--	597	597	597
Feed Grain[a]				
United States	4,862	8,515	7,439	16,811
Canada	70	--	--	--
Argentina	2,461	1,757	1,757	1,757
Australia	393	--	--	684
France	727	1,746	4,235	1,537

[a]Barley, oats, corn, sorghum

(--) Indicates zero

Feed grain imports by the three importing regions of the EEC, Benelux, West Germany and Italy, are greater in all 1970 versions of Model II than in the base period simulation Model. Imports of feed grain by the Benelux region and West Germany exceed the simulated base period

level by 14.1 and 73.2 percent in Model II-1970(1). Additional increases are estimated by Model II-1970(2) and 1970(3). Model II-1970(3) indicates that the Benelux countries will import about twice as much feed grain as during the base period. For West Germany, Model II-1970(3) predicts more than a three-fold increase in feed grain imports above the base period level.

Italian feed grain imports in Model II-1970(2) fell (387,000 metric tons, 12.5 percent) below estimates by Model II-1970(1). This result is associated with the large increase in Italian feed grain production under the assumptions of Model II-1970(2) (Table 14). The increase in land available allowed Italian feed grain production to expand more than the increase in demand, thereby reducing imports. With production the same in Model II-1970(3) as in 1970(2) Italian feed grain imports increased substantially in the former model in order to satisfy the increased level of demand.

Maximum EEC feed grain imports as estimated by Model II-1970(3) are about 12.3 million metric tons (244 percent) above the simulated base period level; the minimum increase (Model II-1970(1)) is 3.5 million metric tons (41.2 percent).

Estimated food wheat exports by the exporting regions in Model II are the same in all 1970 variations of the model (Table 15). Food wheat exports by the United States and Canada to the EEC are eliminated in the 1970 models. Of the non-EEC members, Australia is the only one to export all of its food wheat export supply in 1970 (590,000 metric tons).[5]

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[5]Exporting "all of its food wheat export supply" means that the estimated quantity of food wheat available for export in 1970 by Australia to the EEC was exhausted. This is the quantity fixed by the upper limit of Australia's export availability restraint.

Argentina exported 270,000 metric tons of food wheat less than the upper limit fixed for Model II-1970(1), 1970(2) and 1970(3). The major increases were recorded by France and Italy. French food wheat exports in 1970 are about three times as large as during the base period. Italy changes from a net importer to a net exporter of food wheat. Of the estimated total EEC food wheat import requirements in 1970 (3.092 million metric tons), 70 percent is provided by the EEC members France and Italy.

Feed grain exports in 1970, as estimated by Model II (Table 15), reflect changes in production and demand. Model II-1970(1) estimates United States' feed grain exports to the EEC at approximately 8.5 million metric tons, 75.1 percent above the simulated base period level. But in Model II-1970(2) where EEC land use expands, United States' exports decline by about 1.1 million metric tons, (12.6 percent). The latter result occurs, even though EEC feed grain demand is 4.2 million metric tons greater in Model II-1970(2) than in Model II-1970(1). Since EEC feed grain production does not increase in Model-II 1970(3), United States exports equal the upper limit for that model, 16.8 million metric tons.

Argentina feed grain exports to the EEC are the same in all 1970 variations of Model II (Table 15). The quantity exported is equal to the upper limit set by the export supply restraint. The decline from the base period reflects the expected increase in domestic demand for feed grain in Argentina by 1970.

Feed grain exports by Australia are eliminated in Model II-1970(1) and 1970(2). In Model II-1970(3) the increase in EEC demand for feed grain is such that Australia exports 684,000 metric tons to the EEC. Increasing the export supplies of either the United States or Argentina or both in Model II-1970(3) would reduce or eliminate exports by Australia.

The quantity of French feed grain exports to other EEC regions increases rapidly under the assumptions of Model II-1970(1) and 1970(2). Model II-1970(1) estimates French feed grain exports at about 1 million metric tons greater than during the base period. Slightly over 4.2 million metric tons of feed grain exports from France are estimated by Model II-1970(2). This represents a six-fold increase above the simulated base period level of feed grain exports. Two factors are associated with this rapid increase: one, the large production response by France to the increased availability of land in Model II-1970(2); and two, the substitution, by EEC feed grain importers, of imports from the United States with imports from France in Model II-1970(2).

Model II-1970(3) shows French feed grain exports falling considerably below the level estimated by Model II-1970(2). The increased demand for feed grain specified for Model II-1970(3) forces France to retain more feed grain for domestic feeding purposes. Consequently, less feed grain is available for export by France. This pattern corresponds with the results of Model I, except that feed grain exports by France were eliminated entirely in Model I-1970(3).

Model I and Model II compared

The results of the various forms of Model I and Model II show similarities and differences that need to be discussed. In general, there seem to be more similarities between the two models than there are important differences. The result of the base period simulation versions of Model I and Model II are quite similar for those activities that can be compared. Because of the nature and the level of the restraints used, Model II appeared to do a better job in reproducing base period production and trade.

Estimates of grain production in 1970 by Model II were less erratic than those made by Model I. This result is due to the minimum production restraints placed on all grain producing activities in Model II. Thus, a zero level of production, as estimated by Model I-1970(1) and 1970(3) (United Kingdom food wheat production), could not occur in Model II.

Model I predicted food wheat self-sufficiency for the Benelux region and West Germany in 1970. Model II predicts a considerably different situation with Benelux and West Germany importing about the same quantity of food wheat as during the base period. The latter result seems more likely to occur.[6]

The production responses to changes in land availability were similar in Model I and Model II. In general, both models predicted greater feed grain production as land availability was increased.

The trends in estimated imports of feed grain by the EEC are similar in Model I and Model II. A maximum expected increase of three times the simulated base period level is predicted by Model I, whereas Model II suggests a maximum increase of two and one-half times the simulated base period level. Estimated EEC feed grain imports by Model II exceed those by Model I primarily because Model II contains two additional suppliers, Argentina and Australia. In addition, France tends to export more feed

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[6]It should be noted that due to changes in relative prices, food wheat production is likely to increase relative to feed grain, especially in the Netherlands. Results of the 1964 harvest support this expectation and lend credibility to the direction of the shift estimated by Model I. For the Netherlands, total grain production increased by 200,000 metric tons over 1963 despite a reduction of 12 percent in the harvested acreage of feed grains. The increase was due almost entirely to the record wheat crop of 718,000 metric tons, 35 percent above 1963, and 19 percent above the previous high in 1962.

USDA, The 1965 Western Europe Agricultural Situation (ERS- Foreign 114), p. 46.

grain in Model II than in Model I.

Predicted exports of food wheat by the three regions (United States, Canada and France) for which comparison can be made, show the same pattern. Food wheat exports by the United States were eliminated in all 1970 versions of Model I and Model II. Canadian food wheat exports to the EEC were eliminated in Model II; in Model I the maximum was less than 500,00 metric tons. Recall that Canadian food wheat exports to the European regions in Model I were eliminated when the EEC was expanded to include the United Kingdom.

Feed grain exports were more evenly distributed in Model II than in Model I. The upper limits on export supply specified for Model II helped prevent the erratic feed grain export pattern estimated by Model I. The United States was not allowed to supply all the feed grain import requirements of the model as in as in Model I-1970(2).

Resource use in total grain production (food wheat, feed wheat and feed grain) by the EEC regions in Model I corresponds closely with resource use in Model II.[7] For example, the estimated maximum reduction of full time workers in the EEC by Model I was 38.5 percent (239,900) workers); in Model II the maximum reduction was estimated at 39 percent (241, 300 full time workers).

[7]Only the EEC regions can be compared as there are no production activities for the non-EEC regions in Model II.

CHAPTER VI

ECONOMIC AND POLITICAL IMPLICATIONS

EEC Regions

The results presented in the previous two chapters suggest a number of changes that may occur with the introduction of uniform grain prices in the EEC. The purpose of this chapter is to present and evaluate some of the aggregate aspects of the results. Political as well as economic considerations will be discussed. In general, the EEC will be considered as a unit vis-à-vis other regions in the models.

EEC - Wheat

The results of both Model I and Model II show 1970 EEC food wheat production substantially above the base period level. The increases range from 3.43 million to 5.93 million metric tons (20.2 and 34.8 percent, respectively). For a rough comparison, the increase in total EEC wheat production from 1951-53 to 1961-63 was 26.8 percent.[1]

The increases in production change the degree of food wheat self-sufficiency in the EEC.[2] Using model production and demand (i.e., excluding trade with non-model countries) the EEC was about 81 percent

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[1]Computed from data in U.S.D.A., The Grain-Livestock Economy of the European Economic Community: A Compendium of Basic Statistics (Statistical Bulletin No. 351), p. 29. The hazard of making percentage comparisons computed from different bases should be recognized. The respective bases for the above calculations, in millions of metric tons, were 17.0 (1959/60-1961/62) and 20.2 (1951-53).

[2]The degree of self-sufficiency is defined as the ratio of domestic production to domestic demand (consumption). It is usually quoted as a percentage.

self-sufficient in food wheat during the base period. For 1970, Model II estimates food wheat self-sufficiency at 95.6 percent. Estimates by Model I range from 101.5 to 113.3 percent.

Although previous studies have not separated food wheat production from feed wheat production, estimates of the degree of EEC self-sufficiency for all wheat do exist. In order to make valid comparisons between the results of this study and studies involving all wheat, adjustments have to be made. By assuming that the ratio of total production to model production existing during the base period remains unchanged (i.e., the quantity of production for trade with non-model regions changes by the same proportion as model production), it is possible to expand the model estimates of production to represent total EEC wheat production.[3] First, food wheat production was adjusted and then feed wheat production was added to yield the following estimates of total EEC wheat production in 1970 (million metric tons):

Model I-1970(1)	31.381
Model I-1970(2)	32.613
Model I-1970(3)	33.244
Model II (all 1970 versions)	31.266

Using the 1970 level of wheat consumption estimated by the EEC (30.17 million metric tons), it was possible to compute expected self-sufficiency based on the above production figures.[4] The estimates obtained range from

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[3]The ratios utilized for food wheat were 1.126 for Model I and 1.129 for Model II. These ratios were computed from data in Tables 5 and 11. The adjustment ratio for feed wheat is 1.0, reflecting the assumption of no trade in feed wheat.

[4]EEC, Le marché commun des produits agricoles-Perspectives "1970", p. 93.

103.6 percent to 110.2 percent.

The EEC study, using their own production estimates, predicted 1970 wheat self-sufficiency at 100 percent.[5] The same estimate is arrived at under both income assumptions used by the EEC. It is evident that the EEC's wheat production estimate is slightly lower than the adjusted estimates of Model I and Model II presented above.

The FAO, using a procedure similar to the EEC's, predicted EEC wheat surpluses (production minus consumption) of 2.6 and 2.4 million metric tons, depending upon the income assumption employed.[6] The FAO figures yield EEC wheat self-sufficiency estimates of 108 and 109 percent.

All of the above estimates of EEC wheat self-sufficiency represent substantial changes from the base period (1959/60-1961/62) when the EEC was 89.6 percent self-sufficient in all wheat, and had net imports averaging 2.9 million metric tons per year.[7]

The results of this study tend to support the FAO estimates. It seems quite clear that wheat self-sufficiency by the EEC will be attained by 1970. Data for the 1964 calendar year indicates that the changes predicted are already occurring. EEC wheat production is reported at about 29.0 million metric tons, 18.8 percent above the 1959-61 average.[8] (The weather in 1964 was good but not exceptional.) Thus, production in 1964 is only about one million metric tons below the predicted 1970 level of consumption. Although 1964 consumption figures are not available, it is

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[5] EEC, Ibid.

[6] FAO, "Agricultural Commodities--Projections for 1970," FAO Commodity Review 1962, Special Supplement, p. A-51.

[7] U.S.D.A., op. cit., p. 12, computed from Table 3.01

[8] U.S.D.A., The 1965 Western Europe Agricultural Situation (ERS-Foreign 114), p. 73.

obvious that production may already equal or exceed total consumption.

The results of this study, as well as the FAO projections, suggest the possibility of EEC soft wheat surpluses by 1970. This possibility has been recognized by European officials.[9] As early as 1961 the FAO convened a conference in Rome to discuss the possible utilization of commodity surpluses expected to occur in Western Europe.[10] More recently, a symposium on agricultural trade was held in Amsterdam.[11] The disposal of European and American surpluses was one of the principal topics discussed. Upon returning from the Amsterdam meeting Professor L. W. Witt reported, "Common market technicians suggest that future excess production of certain commodities will be dealt with in this order: subsidized export; internal diversion to lower scale uses; production control; and commodity grants and loans."[12]

France has already initiated a limited program of concessional wheat sales. It is generally expected that France will have to increase this program. The amount of increase in concessional sales depends on how completely France (and Italy) replaces the United States and Canada as suppliers to the EEC. The results of this study indicate that France

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[9]EEC, L'aide alimentaire de la C.E.E. aux pays en voie de development-problèmes posés et possibilités réelles (Série: Agriculture, No. 14), Brussels, July 1963.

[10]For a general review of problems and programs concerning food surpluses see, U.N., Food Aid and Other Forms of Utilization of Agricultural Surpluses (FAO Commodity Policy Studies No. 15), Rome, 1964.

[11]Proceedings, The American Symposium on Agricultural Trade (Amsterdam, The Netherlands, November 11-15, 1963, Amsterdam: Food and Agriculture Center for European-American Trade).

[12]L. W. Witt, "Trip Report" (Department of Agricultural Economics, Michigan State University, December 1963), p. 2. (Mimeographed.)

and Italy can capture a major part of the EEC soft wheat import market. The elimination of the United States and Canada as suppliers of wheat to the EEC would certainly reduce the pressure for concessional sales by France. Another alternative open to France is the possibility of denaturing wheat for domestic feeding, export within the EEC, and/or export to non-EEC countries.[13]

However, the EEC will probably continue to import certain quality wheats for blending purposes. Elmer Learn, reporting on an EEC study, indicates that EEC quality wheat needs in 1970 will require imports of 1.5 to 2.0 million metric tons.[14] Other factors, such as inadequate transportation and storage facilities, might temporarily prevent France and Italy from capturing the entire EEC soft wheat market.

Consequently, the most likely situation for 1970 is one in which the EEC has gross soft wheat exports of 3.0 to 3.5 million metric tons, but continues to import 1.0 to 1.5 million metric tons of quality hard wheat and durum wheat.

EEC - Feed Grain

Model I and Model II estimates of 1970 feed grain production by the EEC vary from 23.8 million to 31.0 million metric tons. These results represent a range in increases from the base period of 2.45 to 9.55 million metric tons. Corresponding to the wide range of production estimates,

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[13]For a comprehensive review of the costs of alternative outlets for French grain, see: U.S.D.A., Foreign Agricultural Service, Outlets for French Grain (prepared by L. Schertz and R. Cannon, Draft Rev. 1, March 21, 1965).

[14]Elmer Learn, "Long-Term Effects of Common Market Grain Policies," Foreign Agricultural Trade of the United States (January 1963), p. 17.

the expected degree of feed grain self-sufficiency varies from 61.7 percent to 77.1 percent. The estimates of self-sufficiency are difficult to interpret because they represent different levels of consumption as well as different levels of production. Thus, the same expected level of production (Model II-1970(2) and 1970(3)) could yield different self-sufficiency estimates depending on the assumed level of demand. Nevertheless, these results can be compared with base period levels of feed grain self-sufficiency of 81.1 percent for Model I and 73.7 percent for Model II.

As in the case of wheat, it is desirable to expand the model results to represent total EEC feed grain production. Again, it is assumed that the ratio of total production to model production existing during the base period remains unchanged.[15] Using this assumption the following estimates of total EEC feed grain production in 1970 were obtained (million metric tons):

Model I		Model II	
1970(1)	25.917	1970(1)	27.217
1970(2)	25.303	1970(2)	32.790
1970(3)	30.940	1970(3)	32.790

These results represent increases from the base period ranging from 11.5 to 44.5 percent.

The EEC study mentioned previously estimated total EEC coarse grain (barley, oats, corn, rye, sorghums and millets) production in 1970 at 33.25 million metric tons.[16] This figure can be used only for rough

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[15]The ratios utilized for feed grain were 1.064 for Model I and 1.0567 for Model II. These ratios were computed from data in Tables 5 and 11.

[16]EEC, Le marché commun des produits agricoles-Perspectives "1970", p. 93.

comparison since the results of Model I and Model II pertain only to EEC production of barley, oats, and corn.

As in the case of wheat, the 1964 production figures indicate that the predicted changes are starting to occur. EEC feed grain production (barley, oats, other) for 1964 is reported at 25.484 million metric tons or 9.1 percent above the 1959-1961 average.[17]

The fairly wide range of predicted EEC feed grain production is the result of several factors. Important among these are changes in resource efficiency, changes in resource availability (land), and changes in the level of demand.

The changes in land and labor coefficients to represent 1970 resource requirements were the same in Model I and Model II. Model II-1970(1) provides a good measure of the feed grain production response to changes in production coefficients. Model II-1970(1) employed almost exactly the same amount of land in feed grain production as Model II-base period simulation (see Chapter V, page 82). Hence, the 4.27 million metric ton increase in EEC feed grain production was due entirely to changes in yields per hectare as fixed by the land coefficient. Model I-1970(1) predicts EEC feed grain production at 3.02 million metric tons above the base period simulation level. This result reflects increased land and labor efficiency, but is also influenced by a reduction in the amount of land devoted to feed grain production.

Increases in land availability and use increased expected EEC feed grain production by about 5.3 million metric tons in both Model I and Model II. This figure is about one-fourth of the base period level

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[17] U.S.D.A., The 1965 Western Europe Agricultural Situation, p. 73.

of EEC feed grain production. If the level of land use and production estimated by Model I-1970(3) was attained under the demand assumptions of Model I-1970(1), expected EEC feed grain self-sufficiency would increase from 75.7 percent to 90.4 percent, and expected imports would fall from 10.3 million to 5.5 million metric tons. Applying Model II-1970(3) EEC feed grain production to Model II-1970(1) demand, yields similar results: self-sufficiency increasing from 71.5 percent to 86.1 percent, and imports falling from 12.0 million to 6.7 million metric tons. These results illustrate the significance of changes in land use within the EEC. The occurrence of a special set of circumstances (attainment of the expected yield increases, utilization of the maximum amount of land, and demand equal to the level assumed for Model I-1970(1) or Model II-1970(1)) could alter the optimistic predictions about the level of feed grain imports by the EEC.

The level of feed grain demand also influences the expected level of production by the EEC, as well as the quantity of imports. Both Model I and Model II show significant changes in production and imports as the level of feed grain demand and other associated factors are varied.

As was stressed earlier, the level of feed grain demand is directly associated with the level of meat production and consumption. Three levels of feed grain demand were postulated for this study: one based on FAO and EEC projections; a second based on a feed-grain-to-meat-consumption ratio equal to the base period ratio; and a third based on a 25 percent increase in the base period feed-grain-to-meat-consumption ratio. Thus, in estimating the 1970 level of feed grain demand, expected meat consumption becomes a crucial element. The estimates of meat consumption used in this study were based on population projections and

expected responses to income changes (via income elasticities of demand), with relative prices assumed constant. To meet the estimated high levels of meat consumption, significant changes in the livestock industry of the EEC will have to occur.

During the base period, red meat production in the EEC was highly dependent on a milk cow-veal production operation. Feeding of beef, as in the United States, was not widely practiced. By looking at the average number of livestock by class during the base period in the EEC and in the United States, one can see the differences in structure (Table 16). (The human populations in 1960 were approximately the same, 169 million in the EEC, 181 million in the United States.) Milk cows equaled 48.7 percent of total cattle in the EEC while in the United States they represented 20.6 percent of the total cattle population.

Table 16 also indicates that the EEC horse, mule and donkey population during the base period was larger than in the United States. The EEC population of equines fell rapidly during the 1950's (from 6.6 million in 1950 to 4.3 million in 1960) and will continue to fall during the 1960's. A further reduction in the number of these animals will allow for the maintenance of additional meat and/or dairy animals.

It is not likely that milk consumption in the EEC will increase as rapidly as meat consumption. The figures in Table 17 show that 1960/61 per capita consumption of milk in all EEC countries, except Italy, was near the level in the United States. The figures further indicate that, except for France, per capita meat consumption (all meat, beef and veal) by the remaining EEC countries was considerably lower relative to the United States than milk consumption. Projections by the EEC suggest that by 1970 EEC per capita consumption of all meat will increase by 36.7 percent over the 1957/58-1959/60 level (high income assumption); per capita

Table 16. Livestock numbers by class of livestock, EEC and the United States, average 1959-1961

	United States (1)	EEC (2)
	--------1000 head--------	
Cattle (total)	95,625	48,509
Milk Cows	19,667	23,640
Cattle less than 1 yr. old	25,710	9,452
Cattle greater than 2 yrs. old	45,828	21,170
Hogs	57,505	33,581
Sheep and goats	32,914	21,803
Horses, mules, donkeys	3,139[a]	4,186
Chickens	372,354	317,458

[a]Average 1959-1960

Source: U.S.D.A., Agricultural Statistics, 1962; EEC, Statistique Agricole, No. 4, 1963

consumption of beef and veal is expected to increase by 40.7 percent; and per capita milk consumption for the same time period and under the same income assumption is expected to increase by only seven percent.[18]

Consequently, the structure of the EEC livestock industry will have to change substantially if the expected level of demand for meat is to be met. Increases in meat imports might fill some of the needs. But until cheaper methods of preserving and transporting red meats are developed, large increases in imports are unlikely. Likewise, importation of live animals will increase, but the total quantity will not be large. Substantial quantities of poultry can be imported as was evident prior to the "chicken war" of 1963.

[18]EEC, Le marché commun des produits agricoles-Perspectives "1970", pp. 150, 152, 153

Table 17. Consumption per capita, all meat, beef and veal, and milk, 1960/61

	All meat (1)	Beef and veal (2)	Milk (liquid) (3)
	--------kilograms per capita per year--------		
United States	83.9	33.0	130.2
Canada	77.6	33.8	188.8
United Kingdom	67.9	22.0	147.4
Belgium--Luxembourg	55.6	20.4	100.6
France	74.5	31.6	105.4
West Germany	57.0	19.2	109.3
Italy	28.6	13.4	63.6
Netherlands	46.6	18.7	120.6
Canada ÷ U.S.	.925	1.024	1.450
U.K. ÷ U.S.	.809	.667	1.132
Bel-Lux ÷ U.S.	.663	.618	.773
France ÷ U.S.	.888	.958	.810
W. Germany ÷ U.S.	.679	.582	.839
Italy ÷ U.S.	.341	.406	.488
Netherlands ÷ U.S.	.555	.567	.926

Source: OECD, Food Consumption in the O.E.C.D. Countries, Paris, November, 1963.

The European preference for lean red meat suggests that intensive beef feeding similar to that in the United states will not occur. Thus, the first change in EEC red meat production will probably be a feeding to heavier weights of dairy type animals. Also, the eventual development of specialized beef feeding operations seems likely, especially in France, Italy and West Germany.

All of the above factors influence the expected level of EEC feed grain demand, production and imports. If the supply of meat does not increase sufficiently to fill the expected level of demand, meat prices are likely to rise, and the quantity demanded will be less than projected. Such a combination of events would tend to reduce the level of feed grain demand and the potential imports from non-EEC countries. On the other hand, if meat production and consumption reaches the expected levels, the 1970 estimates of feed grain demand used in this study should be fairly accurate.

Developments in the livestock industry also influence the distribution of resources, especially land, between the livestock section and the grain sector. As livestock production increases, land devoted to permanent pasture is likely to increase. This would put pressure on the amount of land available for grain production, since the increases in available land specified for Model I and Model II are generally expected to come out of pasture land. It does not seem likely that the area devoted to grain and the area devoted to pasture can increase simultaneously. The final distribution of land will, of course, influence EEC grain production and hence, the level of imports from non-EEC countries.

The possible increases in gross feed grain imports by the EEC, estimated by Model I and Model II, have already been presented. They range from an increase of 39.7 percent to a three-fold increase over the base period level of feed grain imports. Again, the assumed level of demand is of critical importance to non-EEC suppliers. At the higher levels of demand assumed for Model I-1970(3), and Model II-1970(3), France retained more feed grain for domestic use and was left with little or no exportable surplus. Under these conditions imports from non-EEC regions rose rapidly.

EEC--Resource Use

Estimated changes in resource use by the regions of the EEC were similar in Model I and Model II. Changes in the utilization of land have been considered in previous sections of this chapter and in Chapters IV and V.

The reduction in the number of workers employed in grain production could create problems of adjustment within the EEC. The ability of the EEC to adjust depends to a large extent on the level of employment in the industrial sector as well as labor requirements in other sectors of agriculture. The experience of the 1950's supports this claim. During the period 1950 to 1960 the number of permanent agricultural workers in the EEC declined by four million (16.4 to 12.4 million, or 24.4 percent.) Yet by 1960 the overall unemployment rate ranged from only 4.0 percent in Italy, down to 0.9 percent in West Germany. The adjustment is even more impressive when one realizes that as late as 1954, unemployment was 8.7 percent in Italy, 5.2 percent in West Germany, 5.0 percent in Belgium and about 1.7 percent in France and the Netherlands.[19] These figures imply that absorption of surplus agricultural labor created only minor problems during the 1950's.

This study estimates the maximum reduction in full time workers employed in grain production in the EEC at about 241,300 workers, or 39.0 percent below the base period level of utilization. The minimum estimated reduction is 164,100 full time workers or 26.3 percent. If industrial expansion continues at near the rate experienced during the 1950's, the surplus labor from grain production should be absorbed with little difficulty.

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[19]OECD, Manpower Statistics, 1960-1962, Paris, 1963

Trade Creation, Trade Diversion, and the Cost of Protection

Chapter III reviewed aspects of the theory of economic integration relevant to this study. Three concepts, derived from the theory, were defined to measure the overall effect of the EEC grain policy. To review: trade creation was defined as an increase in the value of commodities purchased from low-cost producers (non-EEC regions); trade diversion occurs when there is an increase in the value of commodities purchased from high cost, protected EEC members (France and Italy), and/or a reduction in the value of commodities purchased from low-cost producers (non-EEC regions); negative production effect (cost of protection) was defined as an increase in the total value of production by EEC countries minus the cost of providing the increased quantity with imports from low-cost, non-EEC regions. The latter measure assumes that the supply of imports from non-EEC regions is perfectly elastic and hence, should be interpreted as an upper limit on the increased cost of protection. Empirical estimates of the above concepts were developed from the results of Model II.

Estimates of trade creation and trade diversion were combined to yield estimates of the net effect of expected EEC grain policy. The estimates were computed from the results of the food wheat and feed grain production and trade activities. Feed wheat was omitted because it is not traded. The measurement of trade diversion was separated into two components, A and B. A equals the reduction in the value of commodities purchased from non-EEC regions. B equals the increase in the value of commodities purchased from EEC members. The elements of the various measures are easily recognized. Trade creation represents the increased purchase of feed grain from non-EEC regions in the model. Trade diversion A is an estimate of the reduction in the value of food wheat purchased from non-EEC

regions. Trade diversion B is the combined effect of changes in food wheat and feed grain trade within the EEC. The results for the various 1970 versions of Model II are as follows ($1,000):

	1970(1)	1970(2)	1970(3)
Trade Creation	145,771	74,076	713,408
Trade Diversion			
A	275,605	275,605	275,194
B	290,345	507,239	272,987
Net	-420,179	-708,768	165,227

The net estimates equal trade diversion A plus B, minus trade creation.

Two of the models estimated trade diversion greater than trade creation. In Model II-1970(3) trade creation was greater than the combined trade diversion effects. In order for the net effects of EEC grain policy to be positive, events similar to those postulated for Model II-1970(3) must occur. Otherwise the net effect is likely to be negative, as indicated by Model II-1970(1) and 1970(2).

Two estimates of the cost of protection (negative production effect) incurred by the EEC as a result of the proposed grain policies were calculated. The first, based on the results of Model II-1970(1), yielded an estimate of 261.8 million dollars. The second was derived from the results of Model II-1970(2) and 1970(3), and yielded an estimate of 369.8 million dollars. These figures are not exhorbitant when compared with the cost of certain commodity programs in the United States.[20] It should

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[20] In 1962 the cost of U.S. acreage diversion and price-support payments for feed grain and wheat equaled 868.1 million dollars. U.S. Congress, Joint Committee Print, Subsidy and Subsidy-Effect Programs of the U.S. Government, 89th Cong., 1st Sess., Joint Committee Print (Washington:U.S. Government Printing Office, 1965), p. 34.

be remembered that the estimates for the EEC involve only the cost of replacing a given increase in the quantity of domestic production with an equal quantity of imports. Additional charges, due to export subsidies, market intervention, and administration, would have to be considered in order to obtain an estimate of the total cost to the EEC of the grain program.

Non-EEC Regions

The results of Model I and Model II contain important information about the possible influence of EEC grain policies on the non-EEC regions in the models. Model I provides the most information because production activities were specified for each non-EEC region in the model (United States, Canada and the United Kingdom). Model II is less informative because it treated the non-EEC regions (United States, Canada, Argentina and Australia) as outside suppliers with a fixed quantity of each commodity available for export.

Non-EEC--Wheat

The movement ot self-sufficiency by the EEC virtually eliminated food wheat exports by non-EEC regions. The United States exported no food wheat in any of the 1970 versions of Model I or Model II. If United States' production remains at the base period level and domestic consumption reaches the expected 1970 level, the elimination of exports to the EEC and the United Kingdom leaves about 1.2 million metric tons of food wheat for the United States to dispose of under P.L. 480 type programs. To avoid this surplus within the framework and assumptions of Model I, the United States would have to remove 571,000 hectares of land from wheat production. Since the results of Model I-1970(1) and 1970(2) (closed model, no commodity

surpluses) indicate 10.2 million and 4.8 million hectares of unused land in the United States, the potential addition to food wheat surpluses could be substantially greater than 1.2 million metric tons. Only in Model I-1970(3) does the United States utilize the same quantity of land for grain production as during the base period.

Canada faces some of the same problems as the United States with respect to food wheat production and export. In Model I-1970(1), 1970(2) and 1970(3), Canada utilizes the same quantity of land for grain production as during the base period, but food wheat production and exports decline in two of the three models (exports, in Model I-1970(3) are about one-half the simulated base period level). In Model I-1970(U.K.), with the United Kingdom as a member of the EEC, Canadian food wheat shipments are eliminated and 3.6 hectares of land remain unused.

In a study on Canada and the EEC, Sol Sinclair contends that Canadian bread wheat (Manitoba Northern) exports to the EEC are not in danger of being replaced by domestic (EEC) production or by competing exporters. He states:

> Canadian bread wheat is almost in the class of a monopoly product on the world market, due to its quality as a blender with other wheats in the flour grist. ...Canadian wheat has an advantage over all other imported varieties for this purpose and therefore should constitute a larger proportion of wheat imports. . . . it is reasonable to expect that Canadian bread wheat exports to the Community will be maintained, at least at pre-C.A.P. [Common Agricultural Policy] levels.[21]

Sinclair predicts a similar situation for durum wheat exports. Consequently, Sinclair expects total Canadian wheat exports to the EEC to

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[21] Sol Sinclair, Common Agricultural Policy of the EEC and Its Implications for Canada's Exports (Canadian Trade Committee, Report R-7, revised June 30,1964), pp. 128, 129, 130

continue at about 1.75 million metric tons. Whether or not Sinclair's prediction comes true depends almost entirely upon the uniqueness of Canadian wheat and new developments in the milling industry.

As mentioned previously, EEC experts acknowledge the need for continued imports of durum wheat and quality hard wheat. It is expected that these imports will come primarily from Canada and the United States. Contrary to Sinclair's claim, it would appear that U.S. Dark Northern Spring wheat is a good substitute for Canadian Manitoba Northern wheat.[22] Likewise, U.S. durum and Canadian durum wheat have similar properties. These wheats are grown in adjacent areas with similar climates and soil types (Saskatchewan, Manitoba, Montana, North and South Dakota, and Minnesota). Rather than a question of quality, Canada's advantage seems to be in its ability to have large quantities ready for export, whereas the United States' export supply of quality hard wheat and durum wheat is relatively small and varies from year to year.

A further point involves the possible expansion of hard wheat and durum wheat production in the EEC. There is little doubt that the EEC grain policy is designed to encourage durum wheat production. The basic target price at Duisburg is $125.00 per metric ton versus $106.25 per metric ton for soft wheat. In addition, the price schedule adopted by the Council in December 1964 introduces a "minimum price guaranteed to the grower" of $145.00 per metric ton.[23] This price will be supported by subsidies to the growers as provided for in an earlier Council decision.

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[22]EEC, Problemés relatifs à la qualité du blé, de la farine et du pain dans les pays de la C.E.E. (Série: Agriculture, No. 7), Brussels, 1962. The results of this study (page 24) indicate that Dark Northern Spring and Manitoba wheat have similar properties.

[23]Hans G. Hirsch, "The Uniform Grain Price in the European Economic Community," Foreign Agricultural Trade of the United States (February 1965), p. 8.

A $145.00 producer price for durum wheat should increase production in France and Italy, the two areas where durum wheat is already produced. The production of quality hard wheat in the EEC is questionable because current varieties are not suited for the climate in the wheat growing areas. Nevertheless, it is unlikely that EEC imports of quality hard wheat and durum wheat in 1970 will exceed 1.5 million metric tons. Furthermore, these imports will come from the United States as well as Canada. Hence, Sinclair's predictions for Canada seem somewhat over-optimistic.

The estimates of United Kingdom food wheat production and trade, derived from Model I, should be interpreted with caution. The zero or near zero levels of production cause the estimated levels of food wheat imports to be too high. A study done at Oxford University and published by the U.S.D.A., contains estimates of United Kingdom food wheat production in 1975 that range from 0.99 to 1.06 million long tons.[24] Assuming that the United Kingdom produces about 1.0 million metric tons of food wheat in 1970, the import estimates of Model I (Table 10) would have to be reduced by 1.0 million tons leaving an import requirement of about 3.8 million metric tons. Introducing this assumption into Model I would cause a number of adjustments. Some of the obvious changes are: one, exports of food wheat to the United Kingdom from Canada and/or France would be reduced; two, feed grain production in the United Kingdom would be below the estimated level (Table 9); and three, feed grain imports by the United Kingdom would increase (probably originating from the United States). Additional adjustments are difficult to predict.

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[24]U.S.D.A., United Kingdom Projected Level of Demand, Supply, and Imports of Farm Products in 1965 and 1975 (ERS-Foreign-19), p. 129. A long ton equals 2,240.0 pounds; a metric ton equals 2,204.6 pounds.

Model II yielded a limited amount of information about expected food wheat exports by Argentina and Australia to the EEC. The results are adequately described in Chapter V (Table 15) and future discussion seems unwarranted.

Non-EEC--Feed Grain

Estimated feed grain exports by non-EEC regions in Model I and Model II indicate the possibility for considerable expansion, especially by the United States. Although expansion of production within the EEC is likely to be sizeable, the expected high levels of feed grain demand result in further expansion of import requirements.

The United States, with its tremendous potential for increasing feed grain production, seems to be in a favorable position to take advantage of increased feed grain requirements by the EEC and the United Kingdom. The growing importance of corn and grain sorghums as livestock feed is an added advantage for the United States. Table 18 indicates that between 1950/51 and 1960/61 EEC corn consumption nearly tripled; sorghum and millet, and barley consumption doubled; while consumption of oats fell about 800,000 metric tons. Similar changes are indicated for the United Kingdom.

Canada and Australian feed grain exports have consisted primarily of barley and oats. Maintaining current levels of barley exports seems likely, but exports of oats will probably diminish. There is some possibility that Canada will be a net importer of feed grain as it currently imports substantial quantities of corn and grain sorghums from the United States.[25]

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[25]A total coarse grain deficit of 2.0 to 2.3 million metric tons is predicted for Canada in 1970. FAO, "Agricultural Commodities--Projections for 1970," FAO Commodity Review 1962, Special Supplement, p. A-51. The United States exported an average of 515,000 metric tons of corn and grain sorghums to Canada during the period 1959/60-1961/62.

Table 18. Production, imports, and total consumption of feed grains, EEC and United Kingdom, 1950/51 and 1960/61

	Production (1)	Imports (2)	Total consumption (3)
	--------1000 metric tons--------		
EEC			
Barley			
1950/51	3,845	963	4,757
1960/61	9,861	1,906	9,998
Oats			
1950/51	7,358	377	7,727
1960/61	6,227	743	6,931
Corn			
1950/51	2,360	1,547	3,810
1960/61	6,690	4,532	10,568
Sorghum & millet			
1950/51	4	587	(591)
1960/61	18	1,269	(1,287)
United Kingdom			
Barley			
1950/51	1,738	775	2,972
1960/61	4,309	965	5,060
Oats			
1950/51	2,735	73	2,848
1960/61	2,091	48	2,132
Corn, sorghum			
1950/51	--	1,295	1,244
1960/61	--	3,494	3,531

( ) Parentheses indicate estimates. No consumption figures available for sorghum and millet, so total consumption assumed to equal production plus imports; implies no change in stocks and no exports.

(--) Indicates zero

Sources: FAO, Production Yearbook; FAO, World Grain Trade Statistics; FAO, Food Balance Sheets; OECD, Food Consumption in the O.E.C.D. Countries (November 1963).

Argentina is the only other country that exports substantial quantities of corn and grain sorghums to the EEC and the United Kingdom.[26] The ability of Argentina to increase exports of these grains depends largely

[26]Average Argentine corn and sorghum exports during the base period were: 2.04 million metric tons to the EEC and 312,000 metric tons to the United Kingdom.

on changes in domestic utilization. If Argentine livestock production increases, additional quantities of feed grain will be required and the exportable surplus may reduce. This is exactly the situation predicted by the FAO.[27]

Consequently, it seems clear that the United States will be the main beneficiary of any increase in the import demand for corn and grain sorghums.[28]

The optimistic future for United States feed grain exports to the EEC is relevant to the current proposal for guaranteed access. This proposal, as enunciated by the U.S. officials, has as its goal the assurance by the EEC (and other importing governments) of continuing access to their markets for wheat and feed grain.[29] If an agreement is reached that does not allow for substantial expansion of feed grain exports, the United States might unwittingly lose a portion of the market.

Non-EEC--Value of Exports

In order to obtain an indication of the overall effect on non-EEC exporters of the changing trade patterns predicted by Model I and Model II, estimates of total revenue from the export of food wheat and feed grain to

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[27]FAO, loc. cit. For Argentina and Uruguay, average net coarse grain exports for 1957-59 were 3.1 million metric tons. Projected net exports in 1970 range from 2.4 million metric tons (low income assumption) to 1.8 million metric tons (high income assumption).

[28]James Wilton Graves, "Western European Demand for United States Feed Grains" (unpublished Ph.D. dissertation, Dept. of Agricultural Economics, Michigan State University, 1964). Graves reached a similar conclusion concerning the future of U.S. feed grain exports to Western Europe.

[29]At the conference in Amsterdam, Secretary of Agriculture, Freeman discussed the idea of guaranteed access. Proceedings, The European-American Symposium on Agricultural Trade, pp. 358-359.

the EEC were computed (Table 19). Exports were valued at estimated producer prices, hence the results represent gross revenue at the producer level.[30] The important advantage of using value estimates is that food wheat and feed grain can be aggregated. Only the high and low 1970 results for each model are presented in Table 19.

The most revealing result found in Table 19 is that, even with the elimination of food wheat exports, gross revenue to United States producers from exports to the EEC is greater than the base period level in all 1970 versions of Model I and Model II. The lowest value (Model II-1970(2)) is only $100,000 above the base period level. But, gross revenue equal to more than twice the base period level is possible under the assumptions of Model II-1970(3) (703.0 million dollars).

Australia is the only other country where gross revenue to producers from exports to the EEC in 1970 exceeded the base period level. This occurred in only one model, Model II-1970(3), where estimated revenue is 69.1 million dollars versus 49.6 million dollars versus 49.6 million

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[30] Assumed producer prices, dollars per metric ton are:

	Food Wheat	Feed Grain
United States		
Base period	65.28	41.67
1970	46.00	41.82
Canada		
Base period	65.00	50.20
1970	65.00	44.00
Argentina		
Base period	55.00	37.00
1970	55.00	37.00
Australia		
Base period	63.00	46.70
1970	63.00	46.70

during the base period. For the remaining non-EEC regions, Table 19 shows gross revenue in 1970 below the base period level.

The results for the United States are somewhat more optimistic than generally voiced by U.S. officials or reported in previous studies.[31] Secretary of Agriculture, Orville Freeman, commenting on the Mansholt price proposal of November 1963, stated, "...our preliminary projections indicate ... that it would result in a substantial decrease of the current markets for grain for anyone outside the Community."[32] This is representative of the beliefs generally expressed by U.S. officials.

The studies by the U.S.D.A., Learn, Krause, and Coppock are based on different assumptions about future relationships and consequently yield different results. As pointed out by this study, one of the key factors is the future development of the EEC livestock industry and its effect on feed grain demand. However, the alternative assumptions employed in this study, resulted in the United States being at worst, equally well off as during the base period.

The value of United States' wheat and feed grain exports to the EEC since the introduction of common grain regulations tends to support the more optimistic results of this study. Table 20 indicates that in 1964 the value of wheat and feed grain exports increased by about 75

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[31] See, U.S.D.A., Impact of Common Market Proposals on Competitive Status of U.S. Bread and Feed Grains in the EEC Area (FAS M-123), October 1961; Elmer W. Learn, op. cit., pp. 5-22; Lawrence B. Krause, "The European Economic Community and American Agriculture," in Factors Affecting the United States Balance of Payments (Washington, D.C., Joint Economic Committee, 1962), pp. 105-133; John O. Coppock, North Atlantic Policy-The Agricultural Gap, 1963.

[32] Proceedings, The European-American Symposium on Agricultural Trade, pp. 357-358.

Table 19. Value of exports to the EEC by non-EEC regions in Model I and Model II, base period and 1970

	Base period (1)	1970 High (2)	1970 Low (3)
	---------millions of U.S. $---------		
Model I			
United States	311.0	582.3	327.2
Canada	117.5	100.7	--
Model II			
United States	311.0	703.0	311.1
Canada	117.5	--	--
Argentina	127.4	84.5	84.5
Australia	49.6	69.1	37.2

(--) Indicates zero

million dollars over the 1959-61 average; this occurred in spite of a 43 million dollar reduction in the value of wheat and wheat flour exports. The figures in Table 20 clearly indicate downward trend in the value of wheat and flour exports, and the offsetting increase in feed grain exports.

Table 20. The value of United States' exports to the EEC, average 1956-58 and 1959-61, annual 1962, 1963 and 1964

	Wheat and wheat flour (1)	Feed grains[a] (2)	Sum. (3)
	--------millions of U.S. $----------		
1956-58	120.7	141.6	262.3
1959-61	107.8	208.6	316.4
1962	64.3	317.6	381.9
1963	72.8	276.2	349.0
1964	64.8	326.5	391.3

[a]Barley, oats, corn, and grain sorghums; excluding products

Sources: U.S.D.A., The 1965 Western Europe Agricultural Situation (ERS-Foreign 114), p. 76; U.S.D.A., Foreign Agricultural Trade of the United States (March-April 1965), p. 69.

Summary of Chapter VI

To summarize, this chapter has considered some of the aggregate relationships associated with EEC grain policy. It seems certain that the EEC will be self-sufficient in soft wheat by 1970 and will have a surplus to dispose of on the world market through concessional sales or by denaturing. EEC feed grain production will increase substantially, but changes in the livestock industry will cause the feed grain deficit to be larger than during the base period. The United States will benefit from the increased demand for feed grain. Gross revenue from the export of wheat and feed grain by the United States to the EEC is expected to be greater in 1970 than during the base period. Resource use in all model regions will be characterized by continued substitution of capital for labor. Some idling of land may occur in the United States and Canada.

CHAPTER VII

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

Summary

Problem

The development of the European Economic Community, since its inception in 1957, has led to numerous changes in agricultural policy. Important among these changes was the adoption in 1962 of common regulations governing the pricing and trading of cereals. These regulations replaced the individual policies of the member states. The initial regulations called for a system of uniform grain prices to be in operation on or before 1970. These prices were adopted in December 1964 for implementation in July 1967.

The introduction of uniform grain pricing and trading regulations is expected to change production, trade and resource use within the EEC. Because of the importance of grain as an input in livestock production, the new grain regulations are also expected to affect the livestock industry. In addition, changes within the EEC will cause production and trading patterns of major grain exporters to change.

Method

This study measured some of the possible changes in production, trade and resource use resulting from the EEC's grain policy. Two basic linear programming models were used for the analysis. The models were designed to utilize policy variables (prices and import levies), additional economic relationships, and technical production relationships to yield estimates of regional production and resource use as well as

estimates of interregional trade. Three commodity classifications were specified for each model: (1) food wheat; (2) feed wheat; and (3) feed grain (barley, oats, corn and grain sorghums). Model I included the countries of the EEC, United States, Canada and the United Kingdom. These countries were grouped into seven regions. Model II, consisting of eight regions, omitted the United Kingdom but added Argentina and Australia.

Model I is a maximization model. Each region in the model produced the three commodities listed above. Minimum levels of production were specified for feed wheat. Food wheat and feed grain were traded between certain regions of the model; feed wheat was not traded. Reservation activities for each region fixed minimum prices for the constrained resources; land, labor and capital. Demand restraints specified the quantity of each commodity required for domestic use by a given region. Thus, the objective function maximizes revenue from production and trade by all regions, net of transfer costs, and subject to minimum prices on the constrained resources.

Model II is a minimization model. It was formulated after experience with Model I had been obtained. The objective function minimizes gross expenditure by the EEC for food wheat, feed wheat and feed grain. Each EEC region had a production activity for each commodity. Minimum levels of production were specified for each commodity and producing region. Food wheat and feed grain were traded interregionally; feed wheat was not traded. The non-EEC regions in the model supplied food wheat and feed grain to the EEC regions at a fixed price. An upper limit was placed on the quantity of exports available in the non-EEC regions. Finally, demand restraints specified the quantity of each commodity required for

domestic use by the EEC regions.

Several variations of each model were utilized. Each model was initially specified with prices, coefficients, restraints, etc., representing average conditions during the base period (1959/60-1961/62). After the base period solutions were obtained, prices, production coefficients, and the various restraints were changed to represent expected 1970 conditions. Three 1970 variations were specified for each model. The 1970 models differed as to the level of feed grain demand and the availability of land for grain production. In addition, Model I was utilized to give estimates for an expanded EEC with the United Kingdom as a member.

Results

In general, the results will be summarized by first reviewing changes in production, trade and resource use for the EEC as a unit, and then discussing the same items for the non-EEC regions in the models. Detailed results for the individual regions are presented in Chapters IV and V.

Production of wheat (food and feed) and feed grain in the EEC is expected to increase substantially by 1970. The changes in wheat production are expected to increase EEC self-sufficiency from 89.6 percent in the base period to somewhere between 103.6 and 110.2 percent in 1970, depending on the assumptions.

Expected EEC feed grain production in 1970 ranges from 2.45 to 9.55 million metric tons above the base period level. (These results exclude production for export to non-model regions.) Despite possible increases in production, the expected EEC feed grain deficit in 1970 is greater than during the base period. The predicted 1970 deficit ranges from 7.8 to 19.3

million metric tons; this represents increases from 18.0 to 315.5 percent above the base period deficit.

The wheat production figures imply that the EEC will have a sizeable soft wheat surplus in 1970. Because of the need to import quality hard wheat and durum wheat, the most likely situation is one in which the EEC has gross soft exports of 3.0 to 3.5 million metric tons, but continues to import 1.0 to 1.5 million tons of quality hard wheat and durum wheat. The quantity of the soft wheat surplus depends in part on the extent to which EEC producers divert food wheat to feed wheat (denaturing) for use within the EEC.

As indicated above, the EEC feed grain deficit in 1970 is expected to be greater than during the base period. This result depends on a number of assumptions about the livestock industry, resource efficiency and use in grain production, and grain price relationships. A rearrangement of the assumptions so that the highest yields and maximum land use occurred in conjunction with the minimum levels of demand could reduce the expected feed grain deficit to a level about equal to the base period deficit. This special set of circumstances is not likely to occur.

The trends during the 1960's including 1964, tend to support the changes in EEC production and trade estimated for 1970 by this study. EEC wheat production in 1964 was 18.8 percent above the 1959-61 average. Feed grain production increased by 9.1 percent. Comparing the 1963 trade reports with the 1959-61 average, one finds that the value of wheat imports from non-EEC sources decreased by 67.0 million dollars (19.6 percent), and the value of feed grain imports from non-EEC sources increased by 215.5 million dollars (43.9 percent).

Changes in resource use between the base period and 1970 reflected

changes in production coefficients, the quantity of production, and the availability of resources.

Land use in Model I by the EEC regions was generally at the limit prescribed by the land restraint. Two levels of land availability were specified for the EEC regions in the 1970 versions of Model I. The first was based on average land use for grain production during the base period, and the second was an upper limit based on historical utilization. For the EEC as a whole, the latter figure was 10.0 percent above the former, with the major increase being in France (15.1 percent).

Land availability and use were equal in Model II by definition, since the land restraint for each EEC region was specified with an equality. As in the case of Model I, two levels of land use were specified. The maximum was 9.6 percent above the base period average.

Labor utilization in grain production in the EEC is expected to decrease substantially by 1970. The decrease is primarily due to changes in labor efficiency. This study estimated the maximum reduction in full time workers at about 241,300 workers, or 39.0 percent below the base period level of utilization. The minimum estimated reduction is 164,000 full time workers or 26.3 percent. These figures are slightly above the percentage reduction in permanent agricultural workers in the EEC from 1950 to 1960 (24.4 percent).

The estimates of capital utilization in 1970 derived from Model I and Model II are rough, but they can be interpreted as lower limits on expected variable capital use in grain production in the EEC. Model I and Model II yield estimated increases ranging from 20.6 to 33.4 percent above the base period level of variable capital utilization. These estimates are less than the increase in current operating expenses for all EEC

agriculture during the period 1950-52 to 1959 (57 percent). The changes in capital utilization reflect the continued substitution of capital for labor in the EEC.

Jacob Viner's concepts of trade creation and trade diversion were adapted to provide an estimate of the overall effects of the EEC's uniform grain regulations. In addition, Balassa's concept of negative production effects was adapted to yield an estimate of the increased cost of protection implicit in the EEC's grain policy. The results of Model II provided the basis for these estimates. In two out of the three 1970 versions of Model II, trade diversion was greater than trade creation. In Model II-1970(3) trade creation exceeded trade diversion primarily because of the large increase in EEC imports of feed grain from non-EEC regions. The estimates of the additional protection ranged from 261.8 million to 369.8 million U.S. dollars. These estimates should be interpreted with caution as they are contingent upon a number of assumptions. In addition, alternative estimates of trade creation, trade diversion, and the cost of protection could be obtained, depending on the preferences (definitions) of the researcher.

Numerous changes in production, trade and resource use in the non-EEC regions were derived from the results of the various forms of Model I and Model II. Only the major changes will be indicated.

Model I estimates of food wheat production in Canada and the United States reflect the role of these countries as residual suppliers to the EEC and the United Kingdom. As exports are reduced or eliminated, the quantity of production approaches the level of domestic demand. Thus, U.S. food wheat production in 1970 is estimated at 1.6 million metric tons below the simulated base period level. Expected Canadian food wheat

production in 1970 varies from 4.8 to 7.2 million metric tons, depending on the level of exports. (These production figures are for model requirements and exclude production for export to non-model regions.)

Feed grain production in the non-EEC regions of Model I varies with the level of domestic demand and the demand for exports. In general, the United States and Canada exhibited a steady increase in feed grain production in all 1970 versions of Model I. Estimated 1970 production in the United States for model requirements ranges from 145.3 to 184.1 million metric tons. Predicted feed grain production in Canada ranges from 12.3 to 16.9 million metric tons.

In general, food wheat exports of the non-EEC regions in the study are less in 1970 than during the base period. The one exception is Australia. In the 1970 versions of Model II, Australia exports 173,000 metric tons more of food wheat than during the base period. Food wheat exports from the United States are eliminated in all 1970 versions of Model I and Model II. Canadian food wheat exports to the EEC and the United Kingdom vary over a wide range. The maximum estimate for 1970 is approximately equal to the base period level of 4.4 million metric tons. In the model utilized to simulate an expanded EEC with the United Kingdom as a member, no food wheat was exported by Canada. Likewise, in the 1970 versions of Model II, exports of food wheat from Canada to the EEC were eliminated. Because of the need for hard wheat for mixing purposes, Canada and the United States are expected to export from 1.0 to 1.5 million metric tons of quality hard wheat and durum wheat to the EEC in 1970.

The United States is the major non-EEC feed grain exporter in Model I. Model I indicates that 1970 U.S. feed grain exports to the EEC and the United Kingdom could be as much as 10.0 million metric tons above

the base period level; the minimum expected increase is about 2.0 million metric tons. Canada exports feed grain in Model I only when the maximum assumed level of feed grain demand is introduced.

Feed grain exports in Model II are all designated for consumption in the EEC. In general, feed grain exports in 1970 by the non-EEC regions in Model II are divided between the United States and Argentina. The increases in United States' exports are similar to those estimated by Model I. Argentine feed grain exports in 1970 are constrained by the upper limit of the export supply restraint. Model II clearly illustrates the relationship between French feed grain production, export and demand, and EEC imports from non-EEC regions. In one version of Model II, France is able to export over 4.2 million metric tons of feed grain; U.S. feed grain exports to the EEC are at a minimum. In a subsequent version of the model, with a higher level of feed grain demand specified, France produces the same quantity of feed grain but retains a larger quantity for domestic use and has an exportable surplus of only 1.5 million metric tons; in this model U.S. exports expand rapidly. A similar pattern is illustrated by Model I, except that when a higher level of demand is specified, France ceases to export feed grain.

Resource use by the non-EEC regions in Model I is responsive to changes in production and trade as well as changes in the production coefficients.

Land availability for the non-EEC regions in Model I (U.S., Canada and the U.K.) was equal to average base period utilization in all versions of the model. Major fluctuations in land use were estimated for the United States. In one 1970 version of Model I, approximately 10.2 million hectares of land were transferred out of grain production at the minimum price

fixed by the reservation activity. As feed grain demand was increased, land use in the United States increased until in another variation of the model it was back to the base period level.

Canada used all the land available, except in the model utilized to represent an expanded EEC with the United Kingdom as a member. The loss of the United Kingdom's import market left Canada with about 3.57 million hectares of idle land.

The United Kingdom used all the land available in each version of Model I.

Labor utilization in the non-EEC regions of Model I fell in all 1970 variations of the model. In the United States, the decreases from the base period ranged from 7.6 to 25.4 percent. For Canada and the United Kingdom the average decrease was about 10.3 and 41.7 percent, respectively.

Capital utilization for grain production in the non-EEC regions of Model I is expected to be substantially greater in 1970 than during the base period. This result reflects the further substitution of capital for labor in these regions. Expected increases in the United States range from 9.8 to 33.3 percent. For Canada and the United Kingdom, the average increase is estimated at about 13.6 and 13.1 percent, respectively. It should be remembered that these estimates are lower limits since variable capital coefficients were not adjusted to allow for increased capital utilization per unit of output.

In order to measure the overall effect of EEC grain regulation on non-EEC suppliers, gross revenue from the export of food wheat and feed grain to the EEC was estimated. Most non-EEC regions in the model are expected to have less revenue in 1970 than during the base period.

The United States was the only region in which expected revenue in all 1970 models was greater than during the base period. The possible increases range from $100,000 to more than twice the base period level of $311.0 million dollars. The value of the United States' wheat and feed grain exports to the EEC since the introduction of common grain regulations tends to support the above estimates. In 1964, the value of wheat and feed grain exports was about 75 million dollars above the 1959-61 average; this occurred in spite of a 43 million dollar reduction in the value of wheat and wheat flour exports. The results of this study indicate a continuation in these trends.

Recommendations

During the progress of this study, it became obvious that there were several ancillary areas of research that warranted further investigation.

Information on grain pricing, both within the EEC and internationally, was of major importance to this study. Unfortunately the information desired was not always available. In the international sphere, a thorough study of world market grain prices would be valuable. How are world market grain prices established, what do they represent? Given the varied institutional arrangements of exporters and importers, are the current world market grain prices realistic? Are they artifically depressed as EEC authorities, especially the French, claim? Or are they about equal to production costs plus handling expenses as claimed by the United States and Canada? Related to the question of international pricing is the recently revived discussion of international commodity agreements. It would appear that thorough knowledge of commodity pricing is a prerequisite to serious discussion of commodity agreements.

Further information about grain pricing and handling charges within the EEC is required. Estimates of regional prices used in this study were based on fragmentary information. Knowledge of regional prices would be valuable in future analysis of the production and trade effects of the EEC's common agricultural policy. Related to the question of grain pricing and handling costs is the question of the availability of physical facilities for the movement of large quantities of grain from the surplus areas in France to the deficit areas of the Community.[1]

The results of this study clearly indicate the importance of the livestock industry in determining levels of feed grain demand, production and trade. The structure of the EEC livestock industry is likely to change rapidly during the next ten years. Investigation of alternative forms of organization suitable to EEC conditions would be extremely valuable. Detailed knowledge of possible forms of livestock organization would permit more accurate estimates of the demand for feed grains and roughage. A study of alternative forms of organization would require additional information about basic input-output relationships in the livestock sector.[2]

In addition to the above areas of research there are a number of specific recommendations that would improve the models utilized in this study.

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[1] A recently released study by the EEC contains new information about regional grain pricing and handling costs within the EEC.

EEC, Analyse des facteurs qui influent sur l'orientation de l'offre regionale de céréales et de produits transformés dérivés des céréales (Série: Agriculture No. 17), Brussels, 1965.

[2] Progress is being made in this area also, as the U.S.D.A. has negotiated contracts for studies of grain-livestock relationships in France, Italy, and the low countries (West Germany and the Benelux countries).

As additional data becomes available, it would be desirable to divide the regions specified for this study into smaller, more economically uniform areas. Conditions within the regions used in this study vary considerably. Increasing the number of regions would allow for finer distinctions between grain producing areas in a given country. Such an expansion of the study would require detailed information about regional production coefficients, prices and transfer costs.

During the discussion of quality hard wheat and durum wheat exports by the United States and Canada, the idea occurred that minimum export levels could be specified for these countries. Another possibility would be to specify additional activities for the production and trade of quality hard wheat and durum wheat.

Finally, the introduction of additional restraints and/or activities to simulate special institutional arrangements would be desirable. As was indicated in Chapter IV, the transfer activities were not very successful in reproducing base period trading patterns between individual regions. It was suggested that one important reason for this situation was the existence of bilateral agreements, preferential trading regulations, state trading, and etc. Incorporation of additional institutional arrangements into the model should make the trading patterns more realistic.

Conclusions

The major conclusions of this study are as follows:

1. By 1970, the EEC will have an export surplus of soft wheat ranging from 3.0 to 3.5 million metric tons. The exact quantity of this surplus will depend on (a) the distribution of acreage between wheat production and feed grain production, (b) the specific relations of c.i.f. prices and levies for wheat and coarse grains, and (c) the extent to which

soft wheat is denatured for livestock feeding within the EEC. The EEC is expected to import from 1.0 to 1.5 million metric tons of quality hard wheat and durum wheat for blending purposes and for use in manufacturing vermicelli, spaghetti, macaroni and similar products.

2. Feed grain production in the EEC will continue to increase during the sixties. The maximum projected level for 1970 is 44.5 percent above the base period quantity of 22.7 million metric tons. Despite substantial increases in production, the EEC feed grain deficit in 1970 is expected to be greater than during the base period. This result occurs because of the rapid increase in feed grain consumption associated with the expected increase in meat production.

3. Resource use in grain production in the EEC will be subject to additional changes during the sixties. The utilization of land for grain production could increase by as much as ten percent. Labor utilization will decrease from 26.3 to 39.0 percent, depending on the assumptions specified. The substitution of capital for labor will continue, with the lower limit on variable capital use in grain production about 20.6 percent above the 1959-61 average.

4. By 1970, the United States' exports of wheat to the EEC probably will be eliminated, except for relatively small quantities of quality hard wheat and durum wheat. Prospects for increasing feed grain exports to the EEC and the United Kingdom are very good. A maximum potential increase of two and one-fourth times the base period level of feed grain exports is possible. Even with the elimination of wheat exports, all of the models utilized in the study predicted that gross revenue from U.S. grain exports to the EEC would be greater in 1970 than during the base period.

5. Canadian wheat exports to the EEC and the United Kingdom are likely to diminish during the sixties. This study indicated rather

clearly the risks associated with Canada's role as a residual supplier of wheat. It is estimated that expansion of the EEC to include the United Kingdom will virtually eliminate Canadian wheat exports to this area. Reduction of wheat exports could leave Canada with as much as 3.57 million hectares of surplus grain land.

6. Argentina will be able to export substantial quantities of feed grain to the EEC and the United Kingdom in 1970. The exact quantity of exports will depend to a large extent on how much feed grain Argentina retains for use in its livestock industry.

7. Australia will continue to be a relatively minor supplier of wheat and feed grain to the EEC and the United Kingdom. Australia's role will depend in part on the availability of subsidies to compensate for its locational disadvantage with respect to European markets.

8. Data for recent years, including 1964, tend to support many of the changes in production and trade estimated by this study. EEC wheat production in 1964 is reported at about 18.8 percent above the 1959-61 average. In 1964, feed grain production in the EEC exceeded the 1959-61 average by 2.14 million metric tons. Changes in EEC imports also correspond to the predicted pattern. The value of EEC wheat and flour imports from non-EEC sources in 1963 was 19.6 percent below the base period average. For the same period, the value of EEC feed grain imports from non-EEC sources increased by 43.9 percent. For the United States, 1964 figures indicate that the value of wheat and feed grain exports to the EEC increased by about 75 million dollars over the 1959-61 average; this occurred in spite of a 45 million dollar reduction in the value of wheat and wheat flour exports to the same countries.

9. The application of linear programming in the analysis of aggregate economic policy problems involving production location and trade appears to be quite promising. The advantage of the approach used in this study is that it allows for the incorporation of institutionally controlled variables and technical production relationships into models that yield internally consistent estimates of production and trade. In addition, the models provide estimates of future production, trade and resource use as alternative assumptions about institutional and technical relationships are specified. This type of analysis is extremely useful in studying problems of economic policy in which several alternatives exist.

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APPENDIX I

WEIGHTS, MEASURES AND ABBREVIATIONS

Weights

1 short ton = 2,000.0 pounds
1 long ton = 2,240.0 pounds
1 metric ton (m. ton) = 2,204.622 pounds

1000 kilograms or kilo = 1 metric ton
10 quintals = 1 metric ton

1 bushel (bu) wheat = 60 pounds
1 bushel corn = 56 pounds
1 bushel oats (U.S.) = 32 pounds
1 bushel barley = 48 pounds
1 bushel sorghums = 56 pounds

1 metric ton of wheat = 36.7437 bushels of wheat
1 metric ton of corn = 39.36825 bushels of corn
1 metric ton of oats (U.S.) = 68.8944 bushels of oats (U.S.)
1 metric ton of barley = 45.9296 bushels of barley
1 metric ton of sorghums = 39.36825 bushels of sorghums

1 bushel oats (Canada) = 34 pounds
1 metric ton of oats (Canada) = 64.8418 bushels of oats (Canada)

Square Measures

1 hectare (ha) = 2.47 acres
1 acre = 0.4047 hectare

Abbreviations

Benelux
: Belgium, Luxembourg and the Netherlands

ECE
: Economic Commission for Europe, an agency of the United Nations.

EEC
: European Economic Community. Also known as the Common Market, the Community and the Six. Member countries are Belgium, the Netherlands, Luxembourg, France, West Germany and Italy.

EFTA

European Free Trade Association, also called the Outer Seven. Member countries are Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the United Kingdom.

ERS

Economic Research Service, a branch of the U.S. Dept. of Agriculture.

FAO

The Food and Agricultural Organization, a specialized agency of the United Nations.

FAS

Foreign Agricultural Service, a branch of the U.S. Dept. of Agriculture.

OECD

Organization for Economic Cooperation and Development, formerly the OEEC, see OEEC.

OEEC

Organization for European Economic Cooperation. Member countries were Austria, Belgium, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, the United Kingdom, and after 1959, Spain. Yugoslavia was represented by an observer. The United States and Canada were associate members. The OEEC was succeeded in September 1961 by the OECD, with the members listed above, but with the United States and Canada as full members.

USDA

United States Department of Agriculture

c.i.f.

cost, insurance and freight. A term denoting that a given figure includes, in addition to the value of the merchandise shipped, the insurance paid on it and the carrier's charges.

ha

hectare, see measures

bu

bushel, see weights

APPENDIX II

MATHEMATICAL SPECIFICATION OF THE MODELS, BASIC DATA AND COEFFICIENT DERIVATION

Basic Data Sources

All of the data used in this study were taken or estimated from secondary sources. Since the study involved several countries, most of the basic data was obtained from the publications of international organizations such as the FAO and the OECD (formerly OEEC). In addition, publications by the EEC and the USDA contained useful information. In some cases it was possible to make comparisons between various sources. In general, the source with consistent time period and item definitions for each country in the study was selected. Numerous miscellaneous publications were used to obtain specific information about individual countries, especially with respect to input-output relationships.

Formal Models

Chapter III discussed the formulation of the basic models utilized in this study. Each model was discussed in general, indicating the regional and commodity specification, the nature of the objective function, the coefficients and the restraints utilized. In addition, the introductory sections of Chapters Four and Five presented the various forms of the two basic models (Model I and Model II). This section of the appendix will present the basic models in algebraic form.

Model I

Basic definitions:

1. Let the subscript i (i=1,2,3), stand for the i-th commodity:

i=1 stands for food wheat;
i=2 stands for feed wheat; and
i=3 stands for feed grain.

2. Let the subscript j (j=1,2,...,7), stand for the j-th region:

j=1 stands for the United States;
j=2 stands for Canada;
j=3 stands for the United Kingdom;
j=4 stands for France;
j=5 stands for West Germany;
j=6 stands for Italy; and
j=7 stands for the Benelux region.

3. Let the subscript k (k=1,2,...,7), also represent the regions listed above. When j and k appear together, they represent a transfer between two regions, j≠k.

4. Let the subscript h (h=4,5,6), stand for the h-th resource. The subscript h ranges from 4 to 6 in order to avoid confusion with the commodity subscript i (i=1,2,3):

h=4 stands for land;
h=5 stands for labor; and
h=6 stands for variable capital.

The objective function of Model I is as follows:

$$\text{Max } f(x) = \sum_{ij} p_{ij}x_{ij} - \sum_{ijk} t_{ijk}x_{ijk} + \sum_{hj} r_{hj}x_{hj} \cdot \qquad \text{(I-A)}$$

Where,

p_{ij} = the producer price of the i-th commodity in the j-th region;

x_{ij} = the level of the i-th production activity in the j-th region;

t_{ijk} = the transfer cost of moving the i-th commodity (i=1 or 3) between the j-th region and the k-th region;

x_{ijk} = the level of the i-th commodity transfer (i=1 or 3) between the j-th region and the k-th region;

Note: Not all pairs of regions j,k have transfer activities. See Table 2, page 35 for Model I transfer activities by region and commodity. Also, i=1 or 3 reflects the assumption of no trade in feed wheat; that is, $x_{2jk} = 0.0$ by assumption.

r_{hj} = the reservation price of the h-th resource in the j-th region; and

x_{hj} = the level of the h-th reservation activity in the j-th region.

Each production and reservation activity in Model I is subject to regional restraints on the quantities of resources available. There are twenty-one regional resource restraints, one for each region j and each resource h. Thus, for a given h and a given j, the general form of the resource restraints is,

$$\sum_i a_{hij}x_{ij} + a_{hj}x_{hj} \leq R_{hj} \quad . \tag{I-B}$$

Where,

a_{hij} = the quantity of the h-th resource required to produce one unit of the i-th commodity in the j-th region;

a_{hj} = 1.0; the coefficient that transfers one unit of the h-th resource to the h-th reservation activity in the j-th region;

R_{hj} = the quantity of the h-th resource available for grain production in the j-th region; and

x_{ij} and x_{hj} defined above.

Each region in Model I is subject to regional demand restraints for food wheat, feed wheat and feed grain. There are twenty-one demand restraints, one for each region j and each commodity i. By commodity, they are:

(1) seven regional food wheat and seven regional feed grain demand restraints (i=1 or 3), one for each j, of the form,

$$a_{ij}x_{ij} + \sum_k a_{ijk}x_{ijk} = D_{ij} \text{ ; and} \tag{I-C}$$

(2) seven regional feed wheat demand restraints, one for each j, of the form,

$$a_{2j}x_{2j} \leq D_{2j} \quad . \tag{I-D}$$

Where,

a_{ij} = 1.0; thus $a_{ij}x_{ij}$ equals the total production of the i-th commodity in the j-th region;

a_{ijk} = +1.0; +1.0 is the coefficient that allows region j to import commodity i from region k; and -1.0 is the coefficient that allows region j to export commodity i to region k;

D_{ij} = the regional demand requirement for the i-th commodity in the j-th region; and

x_{ij} and x_{ijk} defined above.

Each region in Model I is subject to a minimum feed wheat production restraint. There are seven minimum feed wheat restraints, one for each region j, of the form,

$$a_{2j}x_{2j} \geq P_{2j} \cdot \qquad \text{(I-E)}$$

Where,

a_{ij} = 1.0;

x_{2j} = the level of the feed wheat production activity in the j-th region; and

P_{2j} = the minimum quantity of feed wheat production specified for the j-th region.

In addition, nine import balance equations were specified for Model I in order to sum the quantity of imports of food wheat (i=1) or feed grain (i=3) by a particular region k (k=3,4,5,6, or 7 when i=1, and k=3,5,6, or 7 when i=3). Their general form is,

$$\sum_j a_{ijk}x_{ijk} \leq M_{ik} \cdot \qquad \text{(I-F)}$$

Where,

a_{ijk} = -1.0;
x_{ijk} defined above; and
M_{ik} = 0.0; thus the level of the slack activity indicates the quantity of commodity i imported by region k.

Thus, Model I consists of the equations I-A through I-F, plus the final restraint, general to all linear programming problems, that all x_{ij}, x_{ijk} and x_{hj} must be greater than or equal to zero.

Five variations of Model I were utilized. For a description of the features of each variation, see Chapter IV.

Model II

Basic definitions:

1. Let the subscript i (i=1,2,3), stand for the i-th commodity:

   i=1 stands for food wheat;
   i=2 stands for feed wheat; and
   i=3 stands for feed grain.

2. Let the subscript j (j=1,2,...,8), stand for the j-th region:

   j=1 stands for the United States;
   j=2 stands for Canada;
   j=3 stands for Argentina;
   j=4 stands for Australia;
   j=5 stands for the Benelux region;
   j=6 stands for France;
   j=7 stands for West Germany; and
   j=8 stands for Italy.

   Note: The United Kingdom is omitted from Model II, but Argentina and Australia are added.

3. Let the subscript k (k=5,6,7,8), stand for the EEC regions in Model II:

   k=5 stands for the Benelux region;
   k=6 stands for France;
   k=7 stands for West Germany; and
   k=8 stands for Italy.

When j and k appear together, they represent a transfer between two regions. They may appear as jk or kj, depending on the equation. When they appear together, the second subscript represents the importing region.

4. Let the subscript h (h=4,5,6), stand for the h-th resource:

   h=4 stands for land;
   h=5 stands for labor; and
   h=6 stands for variable capital.

The objective function of Model II is as follows:

$$\text{Min } f(x) = \sum_{ik} w_{ik} x_{ik} + \sum_{ijk} m_{ijk} x_{ijk} \cdot \qquad \text{(II-A)}$$

Where,

w_{ik} = the wholesale price of the i-th commodity in the k-th region;

x_{ik} = the level of the i-th production activity in the k-th region;

m_{ijk} = the import price of the i-th commodity (i=1 or 3) from the j-th region delivered to the k-th regional center; and

x_{ijk} = the level of the i-th commodity transfer (i=1 or 3) from the j-th region to the k-th region.

Note: i=1 or 3 indicates that food wheat and feed grain are traded interregionally; feed wheat is not traded. Also, as in the case of Model I, not all pairs of regions j,k have transfer activities. See Appendix Table 5 for Model II import activities by region and commodity.

Each production activity in Model II is subject to regional restraints on the quantity of land available for grain production. In addition, each EEC region has an equation that permits the measurement of complementary labor and variable capital associated with the fixed quantity of land. Thus, there are:

(1) four regional land restraints, one for each k, of the form,

$$\sum_{i} a_{4ik} x_{ik} = R_{4k} \text{ ; and} \qquad \text{(II-B)}$$

(2) four regional labor equations and four regional variable capital equations (h=5 or 6), one for each k, of the form,

$$\sum_{i} a_{hik} x_{ik} \geq R_{hk} \cdot \qquad \text{(II-C)}$$

Where,

a_{hik} = the quantity of the h-th resource required to produce one unit of the i-th commodity in the k-th region;

R_{4k} = the quantity of land available for grain production in the k-th region;

R_{5k} = R_{6k} = 0.0; thus, the level of the surplus activities indicates the quantity of labor and variable capital used in conjunction with the fixed quantity of land available to each region k; and

x_{ik} defined above.

Each EEC region in Model II is subject to demand restraints for food wheat, feed wheat and feed grain. There are twelve demand restraints, one for each region k and commodity i. By commodity, they are:

(1) four regional food wheat and four regional feed grain demand restraints (i=1 or 3), one for each k, of the form,

$$a_{ik}x_{ik} + \sum_j a_{ijk}x_{ijk} = D_{ik} \text{ ; and} \qquad \text{(II-D)}$$

(2) four regional feed wheat demand restraints, one for each k, of the form,

$$a_{2k}x_{2k} \leq D_{2k} \cdot \qquad \text{(II-E)}$$

Where,

a_{ik} = 1.0; thus, $a_{ik}x_{ik}$ equals the total production of the i-th commodity in the k-th region;

a_{ijk} = +1.0; the coefficient that allows region k to import commodity i from region j;

D_{ik} = the regional demand requirement for the i-th commodity in the k-th region; and

x_{ik} and x_{ijk} defined above.

Each EEC region in Model II is subject to minimum production restraints for food wheat, feed wheat and feed grain. There are twelve minimum production restraints, one for each region k and commodity i. Thus, for a given i and a given k, the restraints take the following form,

$$a_{ik}x_{ik} \geq P_{ik} \cdot \qquad \text{(II-F)}$$

Where,

P_{ik} = the minimum quantity of production of the i-th commodity specified for the k-th region; and

a_{ik} and x_{ik} defined above.

Each non-EEC region in Model II has equations specifying the amount of food wheat or feed grain available for export to the EEC. There are eight export supply equations, one for each non-EEC exporting region j (j=1,2,3, or 4) and commodity i (i=1 or 3). Thus, for a given i and a given j, the equations take the following form,

$$\sum_k a_{ijk} x_{ijk} \leq S_{ij} \cdot \qquad \text{(II-G)}$$

Where,

S_{ij} = the quantity of the i-th commodity available for export to the EEC by the j-th region; and

a_{ijk} and x_{ijk} defined above.

The exporting regions of the EEC (France and Italy) are subject to balance equations that allocate production to domestic use or to export to other EEC regions. There are three balance equations, French food wheat, French feed grain and Italian food wheat. Thus, for a given k and a given i (k=6 or 8 when i=1, and k=6 when i=3), the equations take the following form,

$$-a_{ik} x_{ik} + D_{ik} + \sum_j a_{ikj} x_{ikj} = 0.0 \ , \qquad \text{(II-H)}$$

where the elements of the equation are defined above. Note the order of the subscripts k and j indicating export from k to j. Not all regions j receive imports from France and Italy.

Thus, Model II consists of the equations II-A through II-H, plus the final restraint that all x_{ik} and x_{ijk} must be greater than or equal to zero.

Four variations of Model II were utilized. For a description of each variation, see Chapter V.

Basic Data and Coefficient Derivation

This section of the appendix contains all the basic data and coefficients used in the various forms of Model I and Model II. The tables are organized according to the function of the data in the models; i.e., objective function, coefficients, or restraints.

Objective Function

Appendix Table I contains the base period and 1970 producer prices used in Model I. In general, the base period producer prices were based on average 1959/60-1961/62 prices received by farmers as reported in the annual issues of the FAO Production Yearbook. Comparisons with EEC, USDA and other official government publications were made where possible. Where hard wheat and soft wheat quotations existed, the soft wheat price was selected. Otherwise, the all wheat category was utilized. The Benelux food wheat price is a weighted average of Belgium-Luxembourg and Netherlands prices. The observed base period prices were weighted by base period production. Base period feed grain prices are based on a simple average of the feed grains produced in a given region (barley, oats, corn and/or grain sorghum). Feed wheat prices were set at 10% above feed grain prices, reflecting the differential in feeding value between a metric ton of wheat and a metric ton of feed grain.

The 1970 prices in Appendix Table 1 reflect expected 1970 policies and conditions. The prices for the United States are based on a continuation of the current (1964-65) domestic wheat-feed grain programs. The 1970 prices for the United Kingdom are the same as the base period prices, except for the prices used in the model representing an expanded EEC with the U.K. as a member. The 1970 prices for the EEC region are based on the target prices at Duisburg announced in December 1964 (see Table 1,

Appendix Table 1. Model I producer prices, base period and 1970

Time Period and Region	Food Wheat (1)	Feed Wheat (2)	Feed Grain (3)	Food wheat / Feed grain[c] (4)
	--------U.S. dollars per metric ton--------			
BASE PERIOD				
United States	65.28	45.84	41.67	1.57
Canada	65.00	55.22	50.20	1.29
United Kingdom	73.27	73.00	72.63	1.01
France	77.94	73.26	66.60	1.17
West Germany	107.67	95.83	87.12	1.24
Italy	107.32	78.31	71.19	1.51
Benelux	88.01	82.97	75.43	1.17
1970				
United States	46.00	46.00	41.82	1.10
Canada	65.00	48.40	44.00	1.48
United Kingdom[a]	73.27	73.00	72.63	1.01
United Kingdom[b]	96.25	89.88	81.71	1.18
France	91.13	85.10	77.36	1.18
West Germany	99.88	90.04	81.85	1.22
Italy	97.95	89.15	81.05	1.21
Benelux	98.65	89.73	81.57	1.21
1970 ÷ BASE PERIOD				
United States	.70	1.00	1.00	
Canada	1.00	.88	.88	
United Kingdom[a]	1.00	1.00	1.00	
United Kingdom[b]	1.31	1.23	1.13	
France	1.17	1.16	1.16	
West Germany	.93	.94	.94	
Italy	.91	1.14	1.14	
Benelux	1.12	1.08	1.08	

[a]Prices used in Model I - 1970(1), 1970(2), and 1970(3).

[b]Prices used in Model I - 1970(U.K.).

[c]Column (1) divided by Column (3).

page 23). The basic target prices were adjusted by deducting transportation and handling costs from the other EEC regional centers to Duisburg.[1] Estimated regional intervention prices provided a check on the derived producer prices.

[1]Regional centers are presented in Chapter III, page 32.

Appendix Table 2 contains the transfer costs for food wheat and feed grain used in the objective function of Model I. The figures represent the cost of moving a particular commodity from one regional producing area to the regional center of another region in the model. Transfer costs for the base period and the 1970 versions of Model I were assumed to be the same. The estimates were computed from data published by the USDA, International Wheat Council and the Great Plains Wheat Association.[2]

The reservation prices on land, labor and variable capital used in the objective function of Model I are presented in Appendix Table 3. Reservation prices for the base period and the 1970 versions of Model I were assumed to be the same. The reservation prices for land are estimates of the annual rental value of land used in grain production. Various sources and methods were used to estimate the reservation price of land. The figure for the United States was based on a method utilized by Heady and Egbert.[3] It equals the per hectare value of grain land times the sum of the tax rate and the average Federal Land Bank interest rate on new loans.[4] The rental value of land in the United Kingdom was

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[2]R.C. Haldeman, Potential Effects of St. Lawrence Seaway on Costs of Transporting Grain (U.S. Dept. of Agriculture, Marketing Research Report No. 319, 1959); International Wheat Council, World Wheat Statistics (London: published annually); Robert H. Clarke and Richard J. Goodman, Grain Marketing in the E.E.C.: France-Germany (Rotterdam: Great Plains Wheat, Inc., September 1963, mimeographed); E.P. Reid, "Statutory Grain Rates," Royal Commission on Transportation [Canada], Volume III (July 1962), pp. 367-407.

[3]Alvin C. Egbert and Earl O. Heady, Regional Adjustments in Grain Production--A Linear Programming Analysis (U.S. Dept. of Agriculture, Technical Bulletin No. 1241, June 1961), p. 21.

[4]The per hectare value of grain land and the tax rate was developed from data in, U.S.D.A., Farm Costs and Returns, Commercial Farms by Type, Size, and Location (Agriculture Information Bulletin No. 230, Rev. August 1963); the interest rate was obtained from, U.S.D.A., Agricultural Statistics, 1962, Table 709, p. 588.

Appendix Table 2. Model I transfer costs, food wheat and feed grain

Source: / Destination:	United States (1)	Canada (2)	France (3)	United Kingdom (4)
	--------U.S. dollars per metric ton--------			
Food Wheat				
Benelux	16.91	17.84	7.23	-
France	24.58	21.65	-	-
West Germany	16.09	19.14	5.89	-
Italy	16.86	17.63	-	-
United Kingdom	17.66	19.40	8.93	-
United States	-	12.13	-	-
Feed Grain				
United States	-	10.19	-	-
Canada	11.24	-	-	-
Benelux	17.17	21.98	8.90	6.32
France	22.09	-	-	-
West Germany	20.17	23.58	7.25	7.92
Italy	18.69	-	8.50	11.50
United Kingdom	18.51	23.90	11.00	-

(-) Indicates that no transfer activities were specified for the regions and commodities represented by the column and row headings.

developed from costs and returns data for mixed farms published by the University of Nottingham.[5] The reservation price on land specified for Canada was based on the typical rental arrangements in the Prairie Provinces as reported by the Canadian Department of Agriculture.[6] The reservation prices on land for the EEC regions are approximately equal to a one-fifth share arrangement on the total per hectare value of grain production.

The reservation prices for labor in Appendix Table 3 represent the average base period wage of a permanent agricultural worker. The estimates

[5] University of Nottingham, Farming in the East Midlands (Dept. of Agricultural Economics, F.R. No. 149, February 1963).

[6] Canada Department of Agriculture, Farm Rental, Operating and Transfer Arrangements in the Prairie Provinces (Economics Division Publication 956, June 1963).

were derived from data published by the United Nations and the U.S.D.A.[7] The reservation price on variable capital was set at 4 1/2 percent for all regions in Model I.

The wholesale prices used in the objective function of Model II are presented in Appendix Table 4. The base period prices were obtained from EEC sources.[8] The Benelux food wheat price was based on a weighted

Appendix Table 3. Model I reservation prices on limited resources

Region	Land U.S. $/ha. (1)	Labor U.S. $/hr. (2)	Variable capital U.S. $ (3)
United States	17.99	0.97	0.045
Canada	14.33	0.76	0.045
United Kingdom	12.11	0.64	0.045
France	38.00	0.43	0.045
West Germany	55.00	0.47	0.045
Italy	36.00	0.36	0.045
Benelux	58.00	0.55	0.045

average of Belgium-Luxembourg and Netherlands prices similar to the procedure used for Model I. The feed grain prices represent a simple average of the barley, oats and corn prices. Feed wheat was priced at 10 percent above the feed grain price. The 1970 wholesale prices were derived from the uniform target prices set by the Council of Ministers in December 1964. They represent expected wholesale prices at the various EEC regional centers specified for Model I and Model II (Rotterdam, Duisburg, Paris, and Milan).

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[7] United Nations, FAO/ECE, Prices of Agricultural Products and Fertilizers in Europe, 1961/62, Annex p. 56; FAO, Production Yearbook, 1963, p. 395; and U.S.D.A., Agricultural Statistics, 1962, p. 528.

[8] EEC, Prix Agricoles (No. 1A, 1963 and No. 6, 1964).

Appendix Table 4. Model II base period wholesale prices and expected 1970 wholesale prices

Commodity and Region	Base period[a] (1)	1970 (2)	1970 ÷ base period (3)
	--------U.S. $/metric ton--------		
Food Wheat			
Benelux	96.62	104.95	1.09
France	93.84	101.25	1.08
West Germany	115.50	106.25	.92
Italy	108.13	97.95	.91
Feed Wheat			
Benelux	82.78	98.60	1.19
France	83.69	94.53	1.13
West Germany	109.90	100.03	.91
Italy	82.81	89.15	1.08
Feed Grain			
Benelux	75.25	89.64	1.19
France	76.03	85.94	1.13
West Germany	99.91	90.94	.91
Italy	75.28	81.05	1.08
Food Wheat ÷ Feed Grain			
Benelux	1.28	1.17	
France	1.23	1.18	
West Germany	1.16	1.17	
Italy	1.44	1.21	

[a]Average 1959/60-1961/62

Import prices used in the objective function of Model II are presented in Appendix Table 5. These prices represent the price of the commodity delivered to the four EEC regional centers. The average base period prices were established by two methods, depending on the availability of data. If c.i.f. prices were available, they were adjusted for movement from the ports of entry to the regional centers. If c.i.f. prices were not available, export prices of the exporting countries were adjusted for subsidies and then increased by the amount of the transportation and handling charges from the exporting country to the importing

Appendix Table 5. Model II import prices at regional centers, base period and 1970

Commodity and Exporter: / Importers:	Benelux (1)	France (2)	West Germany (3)	Italy (4)
	--------U.S. dollars per metric ton--------			
BASE PERIOD[a]				
Food Wheat				
United States[b]	70.63	74.44	71.93	75.00
Canada[c]	75.92	79.73	77.22	79.00
Argentina	69.75	73.98	71.05	73.50
Australia	65.50	69.31	69.66	69.00
France	62.41	-	63.41	-
Feed Grain				
United States	61.73	65.65	63.73	64.25
Canada	62.18	-	63.78	-
Argentina	60.42	64.67	61.94	63.67
Australia	65.14	-	66.64	65.75
France	64.98	-	63.33	64.58
1970[d]				
Food Wheat				
United States[b]	61.63	65.44	62.93	66.00
Canada[c]	63.92	67.73	65.22	67.00
Argentina	60.75	64.98	62.05	64.50
Australia	59.75	63.56	63.91	63.25
France	104.95	-	106.25	-
Italy	104.95	-	106.25	-
Feed Grain				
United States	61.73	65.65	63.73	64.25
Canada	63.43	-	65.03	-
Argentina	59.17	63.42	60.69	62.42
Australia	64.39	-	65.89	65.00
France	89.64	-	90.94	81.05

[a]Average 1959/60-1961/62

[b]U.S. No. 2 hard red winter, Gulf ports

[c]No. 2 Manitoba northern, St. Lawrence

[d]1969-1971; 1970 prices adjusted for quality differences on the basis of EEC quality standards.

(-)Indicates that no importing activities were specified for the regions and commodities represented by the column and row headings.

regional center. The base period import prices were adjusted on the basis of the EEC quality differentials presented in Appendix Table 6 to yield estimates of 1970 prices for imports from non-EEC regions (Appendix Table 5). For example, $70.63 - $9.00 = $61.63 is the estimated 1970 Benelux import price of food wheat from the United States. The import prices for imports from the non-EEC regions in Model II represent the net cost to the Community. For the EEC as a whole, the value of the variable levy is considered as a transfer from the consumers to the Agricultural Guidance and Guarantee Fund. The 1970 prices for trade between EEC regions reflect the changes introduced by the uniform grain prices. That is, intra-community levies and subsidies on grain trade are eliminated.

Coefficients

Appendix Table 7 contains the production coefficients used in Model I and Model II. Recall that only the EEC regions have production activities in Model II. The base period land coefficients were computed from harvested area and production data for the 1959/60-1961/62 period, as reported in the annual issues of the FAO Production Yearbook. The 1970 land coefficients were computed from EEC and FAO yield projections.[9]

The base period labor coefficients presented in Appendix Table 7 are based on labor requirements for actual crop work. This includes the following activities: soil preparation, planting, spraying, harvesting and delivery. In general, overhead labor requirements were excluded.

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[9] EEC, Le marché commun des produits agricoles, Perspectives "1970"; FAO, "Agricultural Commodities--Projections for 1970," FAO Commodity Review 1962, Special Supplement.

Appendix Table 6. EEC standard quality differentials used in 1970 versions of Model II

Type of grain	Deduct from c.i.f. price	Add to c.i.f. price
	------U.S. dollar per metric ton------	
Food Wheat (soft wheat)		
U.S. No. 2 Hard red winter	9.00	--
Canadian Manitoba No. 2	12.00	--
Argentina - all types	9.00	--
Australia, f a q	5.75	--
Feed Grain		
United States[a]	--	--
Canada, Feed barley I & II[b]	--	1.25
Argentina, Plata corn[c]	1.25	--
Australia, Beecher barley	.75	--

[a]No quality differential on U.S. barley, Federal II, Western I & II, Yellow corn I-III, White corn I-III

[b]No. 1 feed barley price used in base period simulation model for imports of feed grain from Canada

[c]Corn c.i.f. price used in base period simulation model for imports of feed grain from Argentina.

(--) Indicates zero

Source: EEC Commission Regulation No. 70 published in Journal Officiel des Communautes Europeennes, 28 Juillet 1962, pp. 1865/62-1867/62.

The data utilized to compute the labor coefficients were obtained from numerous sources, including official government publications, farm management handbooks, previous research studies, and personal correspondence.[10]

[10]Publications utilized include the following: U.S.D.A., Changes in Farm Production and Efficiency, A Summary Report 1963 (Statistical Bulletin No. 233, July 1963); University of Bristol, Farm Management Handbook, 1962 (Dept. of Economics, March 1962); C.P. Hirsch, "Labour Requirements and Availability in British Agriculture," The Farm Economist, IX No. 11 (1961), pp. 518-525; France, Ministère de l'Agriculture, La Planification Interregionale Dans L'Agriculture (Four Volumes, including Annexes; Paris: Societe D'Etudes Pour le Developpement Economique et Social, Mars 1964); Hans Volzke, "Zucherrubenbau-Betrieb mit 35 ha in Sudhannover," Landtechnik, 18 No. 20 (October 1963), pp. 668-673; R. Zapf and E. Sinzinger, "Die Auswirkung veranderter Preis-Kosten-Verhaltrrisse

continued on next page

The 1970 labor coefficients for regions other than the United States and Canada, were based on changes in per hectare labor use in the United States between the period 1950/51-1952/53 and 1959/60-1961/62. During this ten year period labor use per hectare decreased by 63.64 percent in wheat production and 57.16 percent in feed grain production. The ratios of change (0.6364 and 0.5716) were applied to the base period man hour per hectare requirements for the United Kingdom, France, West Germany, Italy and the Benelux region. The resulting figures were multiplied by the estimated 1970 yields (hectares per metric ton) to yield estimates of 1970 labor requirements in man hours per metric ton. For the United States and Canada, 1970 labor requirements were based on estimates computed by Joachim Elterich.[11] Elterich predicted that labor requirements for wheat, rye, oats and barley would decrease (under moderate technological advance) from 4.5 hours per acre in 1959 to 4.0 hours per acre in 1970-75.[12] Applying the ratio of change implicit in Elterich's

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Footnote 10 continued -- auf Organisation and Rentabilitat landwirtsch aftlicher Betriebe in bayerischen Losslehmgebieten," Berichte uber Landwirtschaft, XLI No. 4 (December 1963), pp. 643-692; K.D. Porter and B.J. McBain, Final Report-Oil Seeds and Wheat 1961-1963, A Cost of Production Study on 104 Farms (Publication No. 175, Dept. of Agriculture, Province of Alberta, 1964); S.W. Garland and L.M. Johnson, Crop Production Requirements in Manitoba-machinery, labor and material (Canada Dept. of Agriculture, Economics Division, December 1963); M.Ragush, Changes in Farm Organization, Medium Productivity Soils, Brown Soil Zone, 1961 (Canada Dept. of Agriculture, Economics Division, Saskatoon, Saskatchewan, September 1962).

[11] Joachim Gustav Elterich, "Labor Use for Michigan Agriculture 1959 with Projections for 1970-75" (unpublished Ph.D. dissertation, Dept. of Agricultural Economics, Michigan State University, 1964).

[12] Ibid., Table 3.2, p. 61.

Appendix Table 7. Production coefficients, Model I and Model II, base period and 1970[a]

Commodity and Region	Land ha./m.ton (1)	Labor hrs./m.ton (2)	Variable capital U.S. $/m.ton (3)
BASE PERIOD:			
Wheat (food and feed)			
United States	.62162	4.5412	19.33
Canada	.89216	6.0159	23.83
United Kingdom	.27947	11.04465	27.04
France	.39817	22.6957	43.80
West Germany	.30573	19.6478	21.95
Italy	.57553	74.8189	63.29
Benelux	.26030	17.5669	43.84
Feed Grain			
United States	.36001	5.5420	11.19
Canada	.67854	5.5643	17.38
United Kingdom	.32983	13.0349	25.59
France	.42201	25.9178	37.03
West Germany	.35753	15.9101	23.61
Italy	.39242	51.01395	40.26
Benelux	.30111	15.0555	55.41
1970:			
Wheat (food and feed)			
United States	.4673	3.0	19.33
Canada	.7813	4.7	23.83
United Kingdom	.2550	6.4	27.04
France	.3333	12.1	43.80
West Germany	.2857	11.7	21.95
Italy	.4587	37.9	63.29
Benelux	.2346	10.1	43.84
Feed Grain			
United States	.2700	3.7	11.19
Canada	.5950	4.3	17.38
United Kingdom	.2801	6.3	25.59
France	.3484	12.2	37.03
West Germany	.3289	8.4	23.61
Italy	.2890	21.5	40.26
Benelux	.2860	8.2	55.41

[a]Model I includes all the regions. Model II contains production activities for France, West Germany, Italy, and the Benelux region.

estimates (0.8889) to United States and Canadian base period per hectare labor requirements and then multiplying by estimated 1970 yields, yielded

the 1970 labor coefficients for the United States and Canada contained in Appendix Table 7.

The variable capital coefficients in Appendix Table 7 represent the current operating costs of wheat and feed grain production other than land and labor costs. Non-labor costs associated with land preparation, planting, spraying, harvesting, hauling and machinery use were included in variable capital. As in the case of labor requirements, the basic data on variable capital utilization were obtained from numerous technical bulletins and reports.[13] Base period and 1970 variable capital coefficients were assumed to be the same. For the reasons supporting this assumption, see Chapter IV, page 61.

Restraints

The different types of restraints specified for Model I and Model II are discussed in detail in Chapter III. The tables in this section

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[13]Principal sources were: U.S.D.A., Farm Costs and Returns, Commercial Farms by Type, Size and Location (Agriculture Information Bulletin No. 230, rev. August 1963); H.D. McRorie et. al., 1960 Saskatchewan Farm Business Summary of 42 Farm Management Clubs, 382 Club Members (Regina: Saskatchewan, Extension Report No. 3); Canada Department of Agriculture, Economics Division Costs of Production in Agriculture, 1962 (Prepared by I.F. Furniss, Ottawa, May 1963, mimeographed); I.F. Furniss, "Effects of Agricultural Technology on Per Acre Costs of Producing Wheat at 64 Test Locations in the Prairie Provinces," Canadian Journal of Agricultural Economics, VIII No. 1 (1960), pp. 69-81; M.M. Sandilands, "Costs and Returns from Wheat and Barley, 1961 Harvest," Farm Management Notes, No. 29 (Spring 1963), pp. 40-41; France, Ministère de l'Agriculture, loc, cit.; Landbouw-Economisch Instituut, Kosten en Opbrengsten per Bedrijf en per Produkt in de Noordelijke en Zuidwestelijke Akkerbouwgebieden, Voorcalculatie 1961/62 (Den Haag: Landbouw-Economisch Instituut, Rapport No. 379); Volzke, loc. cit.; Zapf and Sinzinger, loc. cit.

of the appendix contain the predetermined levels of the various restraints; that is, the elements entered in the "Right Hand Side" or "First B" section of the program.

Appendix Tables 8 and 9 contain the demand estimates specified for Model I and Model II. Detailed discussion of the derivation of the predetermined levels of demand was presented in Chapter III.

Appendix Table 8. Demand, Model I base period and 1970

Commodity and Region	Base period (1)	1970(1) and 1970(U.K.) (2)	1970(2) (3)	1970(3) (4)
		--------1000 metric tons--------		
Food Wheat				
United States	15,214.0	16,050.0	16,050.0	16,050.0
Canada	2,549.3	2,600.0	2,600.0	2,600.0
United Kingdom	4,546.5	4,860.0	4,860.0	4,860.0
France	6,461.4	6,480.0	6,480.0	6,480.0
West Germany	3,298.1	3,475.0	3,475.0	3,475.0
Italy	8,463.5	8,340.0	8,340.0	8,340.0
Benelux	2,086.0	1,980.0	1,980.0	1,980.0
Food Wheat				
United States	1,429.3	1,800.0	1,800.0	1,800.0
Canada	1,503.0	2,350.0	2,350.0	2,350.0
United Kingdom	1,576.3	2,100.0	2,100.0	2,100.0
France	2,739.0	4,250.0	4,250.0	4,250.0
West Germany	1,824.3	2,540.0	2,540.0	2,540.0
Italy	252.3	610.0	610.0	610.0
Benelux	529.3	820.0	820.0	820.0
Feed Grain[a]				
United States	120,308.4	135,286.8	150,987.1	166,085.8
Canada	10,421.3	12,255.5	13,756.2	15,131.8
United Kingdom	8,991.7	10,345.0	10,264.1	12,830.1
France	8,876.3	9,866.0	10,784.7	13,480.9
West Germany	7,206.8	9,062.6	9,804.9	12,256.1
Italy	5,128.5	7,538.9	8,485.2	10,606.5
Benelux	5,099.9	5,716.5	6,750.0	8,437.5

[a]Barley, oats, corn, sorghum

Appendix Table 9. Demand, Model II base period and 1970

Commodity and Region	Base period (1)	1970(1) (2)	1970(2) (3)	1970(3) (4)
	--------1000 metric tons--------			
Food Wheat				
Benelux	2,259.9	2,143.0	2,143.0	2,143.0
France	6,533.6	6,552.5	6,552.5	6,552.5
West Germany	3,800.5	4,003.8	4,003.8	4,003.8
Italy	8,791.5	8,657.0	8,657.0	8,657.0
EEC	21,385.5	21,356.3	21,356.3	21,356.3
Feed Wheat				
Benelux	529.3	820.0	820.0	820.0
France	2,739.0	4,250.0	4,250.0	4,250.0
West Germany	1,824.3	2,540.0	2,540.0	2,540.0
Italy	252.3	610.0	610.0	610.0
EEC	5,344.9	8,220.0	8,220.0	8,220.0
Feed Grain[a]				
Benelux	6,151.7	6,889.9	8,180.9	10,226.1
France	8,882.6	9,873.0	10,792.4	13,490.5
West Germany	7,837.3	9,855.4	10,662.7	13,328.4
Italy	6,401.3	9,409.9	10,591.0	13,238.8
EEC	29,272.9	36,028.2	40,227.0	50,283.8

[a]Barley, oats, corn, sorghum

Further discussion does not seem warranted. Note that the feed grain demand estimates in Appendix Table 8 are the same as those presented in Table 3, page 39. Recall that the levels of demand specified are for model requirement only and do not include imports from non-model countries. This fact explains the differences between EEC demand levels in Model I and those in Model II. The United Kingdom was eliminated from Model II, but Argentina and Australia were added. The net effect was an increase in Model II levels of demand.

The levels of the resource restraints specified for the various forms of Model I are presented in Appendix Table 10. In general, the

base period levels of availability were established by multiplying the production coefficients (Appendix Table 7) times the actual production for Model I regions (Table 5). Utilization by commodity was then summed for each region to yield an estimate of total utilization for grain production. Total utilization and availability were assumed to be the same; hence, the base period figures in Appendix Table 10 represent utilization as well as availability. Since the objective of the base period simulation model was to reproduce base period conditions, this assumption seemed reasonable and workable.

Appendix Table 10. Resources available for grain production,[a] Model I base period and 1970

Model and Region	Land hectare (1)	Labor man hours (2)	Variable capital U.S. $ (3)
	--------thousands of units--------		
Base period			
United States	57,725.5	794,589.0	1,794,395.0
Canada	14,727.0	109,771.5	385,473.5
United Kingdom	2,820.5	111,448.5	234,545.5
France	7,963.0	472,021.5	784,444.5
West Germany	3,068.5	157,069.5	208,609.0
Italy	6,329.0	822,706.5	682,638.5
Benelux	774.0	45,236.0	136,466.0
1970(1), 1970(U.K.), 1970(2)			
United States	57,725.5	791,100.0	4,132,700.0
Canada	14,726.5	116,300.0	589,800.0
United Kingdom	2,820.1	70,800.0	299,000.0
France	7,962.7	291,500.0	1,046,400.0
West Germany	3,068.4	125,700.0	253,600.0
Italy	6,328.5	829,900.0	1,385,900.0
Benelux	773.4	33,300.0	182,700.0
1970(3)			
United States	57,725.5	791,100.0	4,132,700.0
Canada	14,726.5	116,300.0	589,800.0
United Kingdom	2,820.1	70,800.0	299,000.0
France	9,169.0	335,600.0	1,204,900.0
West Germany	3,198.0	131,000.0	264,300.0
Italy	6,789.0	890,300.0	1,486,800.0
Benelux	798.0	34,000.0	188,500.0

[a]Food wheat, feed wheat, and feed grain

Resource availability for Model I in 1970 is based on the availability of land. Land availability for grain production in the United States, Canada and the United Kingdom was set equal to base period utilization for all 1970 versions of Model I. Two levels of land availability were specified for the EEC regions in 1970: one based on base period utilization and a second based on maximum historical utilization. The latter estimate was established as follows: (1) a ratio of base period land use for Model I requirements to average base period harvested grain area for all purposes was calculated for each EEC region (this ratio indicated the proportion of total grain area in a given region devoted to production for model requirements); (2) the maximum harvested area for each EEC region was selected from historical data (except for France, the maximum figures were selected from the period 1950-1964; France's maximum was based on an average of 1924-26 harvested grain area); and (3) the product of the ratio and the historical maximum yielded the estimates of 1970 land availability utilized in Model I-1970(3).

Given the 1970 availability of land for Model I requirements, the 1970 availability of labor and variable capital was derived as follows: (1) the quantity of land available for each region was divided by the smallest land coefficient (wheat or feed grain) to yield an estimate of the maximum amount of grain that could be produced from the given land area; and (2) the derived production figures were multiplied by the largest labor and variable capital coefficient (wheat or feed grain) for each region to yield the 1970 estimates of the labor and capital availability presented in Appendix Table 10. This procedure guaranteed that adequate quantities of labor and variable capital were available for grain production. Labor and capital not used in grain production was

was transferred to the reservation activities.

Appendix Table 11 contains the levels of the land restraints used in Model II. The method used to establish the availability of land for Model II was the same as described above for Model I. Availabilities of labor and variable capital were not required for Model II as the restraints were set at greater than or equal to zero (see pages 42-43 and 155).

Appendix Table 11. Land available for grain production,[a] Model II base period and 1970

Region	Base period and 1970(1) (1)	1970(2) and 1970(3) (2)
	--------1000 hectare--------	
Benelux	798.5	823.0
France	7,839.5	9,027.0
West Germany	3,226.0	3,296.0
Italy	6,217.5	6,670.0

[a]Food wheat, feed wheat, and feed grain

Minimum production levels for feed wheat production in Model I are presented in Appendix Table 12. These figures are equal to the minimum production year of the three year base period, 1959/60-1961/62.

Appendix Table 12. Model I, minimum production levels for feed wheat, base period and 1970

Region	Minimum production 1000 m. tons
United States	1,097
Canada	1,198
United Kingdom	1,482
France	2,119
West Germany	1,690
Italy	124
Benelux	470

Minimum production levels for Model II are presented in Appendix Table 13. The minimum production levels for the base period are equal to average production for the period 1959/60-1961/62. Setting the minimum equal to the average, forced the base period simulation model to reproduce base period quantities of production. This was a desirable feature as is explained in Chapter V, page 80. The minimum production levels for 1970 are equal to projected EEC yields times base period land

Appendix Table 13. Minimum production levels, Model II base period and 1970

Commodity and Region	Base period[a] (1)	1970 (2)
	--------1000 metric tons--------	
Food Wheat		
Benelux	824.7	917.8
France	6,784.1	8,103.6
West Germany	1,996.7	2,136.8
Italy	7,376.0	9,254.3
EEC	16,981.5	20,412.5
Feed Wheat		
Benelux	529.3	584.5
France	2,739.0	3,271.8
West Germany	1,824.3	1,952.0
Italy	252.3	316.5
EEC	5,344.9	6,124.8
Feed Grain[b]		
Benelux	1,479.7	1,559.6
France	9,590.7	11,616.0
West Germany	5,754.3	6,254.2
Italy	4,655.3	6,320.7
EEC	21,480.0	25,750.5

[a] Average 1959/60-1961/62

[b] Barley, oats, corn

utilization.[14]

The quantity of food wheat and feed grain available for export to the EEC by the non-EEC regions in Model II is presented in Appendix Table 14. The base period levels are equal to average exports to the

Appendix 14. Export availabilities, Model II base period and 1970

Country and Commodity	Base period[a] (1)	1970 (2)
	--------1000 metric tons--------	
United States		
Food Wheat	1,661.3	2,535.2
Feed Grain[b]	4,862.3	9,311.3[d]
Canada		
Food Wheat	1,754.0	1,922.0
Feed Grain[c]	69.6	--
Argentina		
Food Wheat	659.5	624.5
Feed Grain[b]	2,460.8	1,757.0
Australia		
Food Wheat	417.0	589.6
Feed Grain[c]	500.3	736.4

[a]Average 1959/60-1961/62

[b]Barley, oats, corn, sorghum

[c]Barley, oats

[d]For Model II-1970(3) the quantity available was increased to 16,811,300 metric tons.

(--) Indicates zero

[14]EEC, Le marché commun des produits agricoles, Perspectives "1970", pp. 194-198.

EEC during the period 1959/60-1961/62. The 1970 figures are based on projected export surpluses of wheat and coarse grains (exports minus imports) established by the FAO.[15] The percentage increases implicit in the FAO figures were converted to a 1960 base and then applied to the base period averages contained in Appendix Table 14, Column 1. This procedure resulted in the 1970 estimates of export availabilities presented in Column 2 of the same table.

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[15] FAO, "Agricultural Commodities--Projections for 1970," FAO Commodity Review 1962, Special Supplement, pp. A-51, A-52.