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STUDIES IN LONG-TERM ECONOMIC PROJECTIONS FOR THE WORLD ECONOMY

Aggregative Models

UNITED NATIONS

Department of Economic and Social Affairs

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FOREWORD

Economic projections have come to occupy a prominent place in national and international discussions on economic policy in recent years. This is largely because all over the world Governments are engaged in guiding the course of national economic activity. In many parts of the world, national planning has been employed as the primary instrument for achieving higher standards of living and modernized and well-diversified economies. Even in those countries where the major reliance for economic advance is placed on private enterprise, the concern for economic growth has become widespread. Given such a universal desire for rapid economic progress and freedom from disruptions and turbulences that often characterized the economies in the past, it is only natural that attention should be devoted to developing and refining techniques of economic projections as important aids to policy formulation.

Emphasizing the need and importance of economic projections, the Economic and Social Council at its twenty-eighth session requested the Secretary-General to undertake an evaluation of the existing techniques of long-term economic projections, their applicability to countries in different stages of development and the possibilities and limitations of these techniques.[1] A preliminary report containing such an evaluation was submitted to the Council at its thirtieth session.[2] Subsequently, through its resolution 777 (XXX), the Council requested the Secretary-General to intensify his activities in the field of economic and social projections; it also authorized him to convene meetings of experts from representative groups of national Governments as he deemed appropriate for the purpose of further evaluation of techniques of medium- and long-term projections, particularly in the economic field. Further impetus to the work of the United Nations on economic projections was provided by General Assembly resolution 1708 :: (XVI), which requested the Secretary-General to establish an Economic Projections and Programming Centre with regional centres in the regional economic commissions or institutes of economic development and planning.

In accordance with Economic and Social Council resolution 777 (XXX), the Secretary-General appointed a group of nine experts, who met at United Nations Headquarters from 18 to 29 June 1962.[3] The group was requested not only to assist in the evaluation of techniques of long-term economic projections but also to advise on a co-operative work programme for the Economic Projections and Programming Centre, which was established at Headquarters just prior to the meeting of the group of experts, and for the regional centres, which were soon expected to be (and since then have been) established.

The present volume is in the main a collection of studies prepared in connexion with the meeting of experts. Their purpose is to develop a framework for projections of world production and world trade to serve, *inter alia*, as a basis for estimating the external environment within which the developing countries may plan their programmes of economic development.

The first stage in the development of such projections is the formulation of a workable economic model for the world economy which focuses on the principal economic interrelationships among its constituent members. As in the *World Economic Survey*, published annually by the United Nations, the country members of the world economy have been divided into three broad categories, designated as is customary in United Nations documents, as the developed market economies, the centrally planned economies and the developing market economies. As a first approximation, it is assumed that the rates of growth in the developed market economies are determined essentially on the basis of internal considerations relating to manpower and capital formation. These considerations are also relevant in the centrally planned economies, though here they must be assessed in the framework of plan targets. The rates of growth of the developing market economies, however, are taken as a function not only of such internal variables but also of external variables relating to their foreign trade and the inflow of capital.

In order to use such a model for world economic projections, it is necessary to calculate the potential import demand and export supplies of the developed market economies as well as of their private capital flows, all as functions of their gross national product and other internal economic variables. Corresponding calculations on an appropriate basis are also needed, though the magnitudes involved in this case are much smaller, for the centrally planned economies. Official assistance may be taken as a policy parameter. These external variables, together with domestic development policies, then serve as a basis for estimating the potential export proceeds and import capacities of the developing market economies from which in turn their potential rates of imports of capital goods and therefore of their capital formation and of their gross national product may be projected.

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[1] Economic and Social Council resolution 741 (XXVIII).

[2] United Nations, "Evaluation of long-term economic projections" (document E/3379).

[3] *See* annex 1, *infra*.

These are the broad premises on which the studies contained in the following chapters are based. Chapters 1 and 2 dealing with the methods of projections in the developed market economies and the centrally planned economies, respectively, have been prepared by two members of the expert group, Professor E. S. Kirschen (Belgium) and Professor Józef Pajestka (Poland), in their capacity as consultants to the United Nations Secretariat. Chapter 3 which deals with the projection methodology for the developing market economies has been prepared by the Economic Projections and Programming Centre of the Bureau of General Economic Research and Policies. The unanimous report of the groups of experts is reproduced as annex 1.

The models presented here are intended primarily for illustrative purposes rather than to serve as a definite basis for projections. Since the models for the three major groups of countries were prepared independently, they are not fully consistent with one another either as regards the classification of countries or as regards the quantitative estimates. These discrepancies do not, however, affect the usefulness of the report as a framework for analysis of the problem of projections of long-term economic growth for the world economy.

The methodological approach discussed in this volume has served as the basis for estimating the trade needs of the developing countries in order to achieve the acceleration in economic growth implicit in the United Nations Development Decade objectives. Estimates of such trade needs were presented to the United Nations Conference on Trade and Development and are reproduced in the *World Economic Survey, 1963*.[4]

The economic models represented in this volume are doubtless of an aggregative character. They need to be constantly revised and improved in the light of new knowledge and to suit the changing circumstances of a growing world economy. Attention has particularly to be devoted to prepare more detailed sectoral models. Work on such problems has been initiated in the Economic Projections and Programming Centre at United Nations Headquarters and in the regional centres. The work programme of the Centre, contained in annex 2, provides details of the projects on which work has already started or is expected to start in the near future. The work programme has been designed to intensify and co-ordinate the work of the United Nations in the field of projections and planning, in accordance with General Assembly resolution 1708 II (XVI) and Economic and Social Council resolution 924 (XXXIV). The work programme has been endorsed by the Economic and Social Council in its resolution 979 (XXXVI).

This report is the first in a series to be published by the Economic Projections and Programming Centre of the Bureau of General Economic Research and Policies. It is hoped that this publication will serve to spur further thinking on the vital issue of international economic progress, and will thus contribute to the aims of the United Nations Development Decade.

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[4] United Nations, *World Economic Survey, 1963, I. Trade and Development: Trends, Needs and Policies* (Sales No.: 64.II.C.1), chapter 3.

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Part I

STUDIES BY CONSULTANTS SUBMITTED TO THE COMMITTEE OF EXPERTS ON LONG-TERM ECONOMIC PROJECTIONS (1962)

Chapter 1

A PROJECTION MODEL FOR THE DEVELOPED MARKET ECONOMIES *

E. S. KIRSCHEN **

Introduction

BASIC ASSUMPTIONS

1. In this study the world is divided into three zones: zone A, the developed market economies; zone B, the centrally planned economies; and zone C, the underdeveloped economies.

2. The following definition of zone A excludes, among other countries, Venezuela, Spain, Portugal, Greece and Turkey. This zone is subdivided into four areas.

* The grouping of countries and the data used in this chapter are those of the author and do not necessarily correspond to those in chapter 3 prepared by the United Nations Secretariat. The style and terminology have been slightly edited to conform to United Nations usage.

** Professor, University of Brussels, Belgium. The author wishes to acknowledge the very valuable assistance he has received on economic matters from Mr. H. Glejser. Mrs. C. Dupres-Reichert helped with the fixed capital problems, while statistical information was collected by Mr. X. H. Panhuys on imports, exports, aid and capital movements and by Miss N. Schmitz on demography and the stock of capital.

Table 1-1. Real national income and population of zone A

Area and country	*Number of countries in area*	*Real national income (billions of dollars)*	*Population (millions)*	*Real income per capita (dollars)*
A-1. North America and Oceania:				
Australia, Canada, New Zealand, United States	4	398	199.7	1,990
A-2. European Economic Community (as constituted at present):				
Belgium, France, Germany (Federal Republic), Italy, Luxembourg, Netherlands	6	151	165.6	914
A-3. Others, western Europe:				
Austria, Denmark, Finland, Iceland, Ireland, Norway, United Kingdom, Sweden, Switzerland	9	97	86.3	1,122
A-4. Others, non-European:				
Israel, Japan, South Africa	3	45	107.0	425
TOTAL, ZONE A	22	691	558.6	1,238

SOURCE: Data on real national income were obtained from J. P. Delahaut and E. S. Kirschen, " Les revenus nationaux du monde non communiste ", Département d'économie appliquée, Université libre de Bruxelles, *Cahiers économiques de Bruxelles*, No. 10, April 1961, p. 165. Other figures are given by P. N. Rosenstein-Rodan, " International Aid for Under-developed Countries ", *Review of Economics and Statistics* (Cambridge), May 1961.

3. Zone B, the centrally planned economies, is composed of:

(*a*) The Union of Soviet Socialist Republics;

(*b*) European countries: Bulgaria, Czechoslovakia, Eastern Germany, Hungary, Poland, Romania and Yugoslavia;

(*c*) Asian countries: mainland China, Mongolia, North Korea and North Viet-Nam.

4. Zone C, the under-developed economies, consists of 124 countries with a population of 1,266.8 million. This zone has a real income of $250 billion [1] and a real income per capita of $204, only one-sixth of that of zone A. The eight largest units, which account for more than one-half of the total real income, are: India ($47.2 billion), Indonesia ($16.4 billion), Brazil ($14.0 billion), Spain ($13.4 billion), Mexico ($11.9 billion), Turkey ($11.1 billion), Pakistan ($8.7 billion) and the Philippines ($7.5 billion). Of these eight countries, four are situated in Asia, one in the Middle East, one in Europe and two in Latin America.

5. Provisionally, the base year is 1957. However, it would be better, at a later stage, to use the eleven-year period, 1950-1960, centred on 1955. During this period, post-war reconstruction had been completed almost everywhere, wars were small and depressions moderate. Thus, it presents as ideal a starting point as is likely to be found.

6. The assumptions for the projections are the usual ones:

(*a*) No major war;

(*b*) No deep economic depression;

(*c*) The Common Market will be worked out at least as rapidly as was specified in the Rome Treaty;

(*d*) The Western economies will continue to be mainly submitted to the laws of the market, although Governments will become increasingly conscious of their responsibility towards economic expansion and will begin to take action to this effect;

(*e*) The terminal years will be " normal " or " average ".

7. The terminal years suggested here are 1970, 1975 and 1980 (the year 1965 will be too close to the end of the work). It may be assumed that present techniques for both production and government will be modified until 1970 in a way that can already be predicted, while by 1975 and 1980 some new techniques will have been invented and effectively used; these inventions will more than compensate for the disappearance of some raw materials in present industrial areas.

Method and plan

8. This study is meant to allow a first discussion of a number of growth problems at both world and zone levels. The statistical calculations are by no means complete; occasionally the model is no more than a sketch. Nevertheless, it is hoped that the various symbols can be replaced by actual figures.

9. In the first section of the study, the objective is to arrive at the simplest possible model for zone A, showing a projection of total production, the rate of growth of the economy, potential import demands, potential export supplies, private capital flow to zone C and public aid to zone C. In order to achieve this simple model, it is necessary to aggregate, among other things, all zone A countries as if they had only one government and all imports and exports as if common methods of projection could be applied to, for example, imports of coffee and imports of tin. These simplifying assumptions will be removed in the second section, at the cost of making the model much more cumbersome.

10. Both sections of the study, however, have the same aim: to clarify the most likely, or the least unlikely, course of events and to guide the choices that must be made by those responsible for economic policy decisions in the twenty-two countries of zone A. From the great number of possible models, those selected must fulfil three conditions: (*a*) they must be coherent from the economic point of view; (*b*) they must be based on the available statistical or policy information; and (*c*) they must be soluble, at a reasonable cost, by modern computers.

A Six-equation model

General outline

11. The simplest method of projection consists of extrapolating the past trends of some economic magnitudes, such as the population or the gross national product. In many cases, however, projections are based on the use of models, i.e., systems of simultaneous equations. These equations link either:

(*a*) Macro-economic variables, assumed to represent the essential features of a national economy: the capital, the gross national product, the main components of demand;

(*b*) Branch variables, relating to the output or input of branches of activity, or possibly to the main components of either, such as exports of the branches or value added by them; or

(*c*) Variables relating to smaller parts of the variables mentioned above, such as food consumption and investment in machinery. The magnitudes will not appear in the model given in this study.

12. A possible approach to a projection of the economy of zone A might have been to construct a model for each of the twenty-two countries — or possibly models for groups of these countries. Although this would have permitted the use of all the information available at the country level, it would have created considerable difficulties in describing the zone as a whole. First, the variables representing export and import projections between the individual countries would have been particularly troublesome because the forecasts have not, so far, been co-ordinated. Secondly, the combination of national models using different variables would have

[1] See source for table 1-1.

raised problems of algebra too complicated for even the modern computers. In order to avoid these difficulties, the whole of zone A has been treated as if it were a single economy. The variables of such a model may be called " megisto-economic ", indicating that they refer to economies larger than the national ones, which are referred to as macro-variables.

13. At first sight, this method appears to increase the over-simplification of issues that results from the use of magnitudes meant to represent the whole or a large part of a national economy. Zone A countries differ in available factors of production (manpower, capital), in natural environment, in institutional organization and in degree of dependency upon foreign trade. All these formidable problems have been ignored in this study, with the hope that the picture of zone A as a whole will remain meaningful.

14. On the other hand, the well-known statistical advantage of aggregation is of benefit. It is possible to forecast with more accuracy the income or expenditures of a nation than those of a single individual. Thus, it is easier to project the income and other macro-economic variables of a group of nations that are homogeneous, to a certain degree, than those of individual countries.

15. The first stage of the study is the setting up of a model consisting of six equations (four functions and two identities), linking:

(*a*) Four megisto-variables internal to zone A: its gross domestic product (Y), its fixed capital (k), its gross investment (V) and its net saving (S);

(*b*) Two megisto-variables concerning trade between zones A and C: the imports (M) and exports (X) of zone A.

These equations will be described in turn in this section of the study (paragraphs 19-78). The number of variables appears to be the absolute minimum required; although consumption does not appear explicitly in the model, it can be obtained as a residue.

16. As stated in paragraph 10 above, the main purpose of the model is to show the effect of some important decisions to be taken by those responsible for economic policy in zone A. Six policy variables appear in the model. Two of these — the acceleration of technical progress and the additional saving — are internal to zone A, although they affect the possibility of zone A helping zone C. The other four refer primarily to relations between zones A and C, although they also exert an influence on the rate of development of zone A. These variables are public gifts, public loans, " refusal to import ", which means the aggravation or reduction of obstacles to the import into zone A of goods produced in zone C, and the terms of trade of zone A towards zone C, that is, the ratio of the price index of goods and services exported to zone C to that of goods and services imported from zone C.

17. Lastly, it is necessary to take account of eight exogenous variables, representing phenomena that influence the economy of zone A and/or its relations with zone C. These are phenomena that cannot be controlled, or that can be controlled to a limited extent only, by economic policy, although they might belong to other spheres of policy. Two of these variables are demographic: the quantity of labour and the number of households. Two are technical: the average life of capital and the ratio of the replacement value of capital to its depreciated value. Three are social and political: the value added, the investment and the depreciation in branches of activity, such as agriculture, housing services and government services, for which economic considerations often play a secondary role. The last of these eight variables is the mere passage of time, which takes into account many other factors submitted to a more or less regular evolution.

18. In the following pages, the present stage of thinking on each function or identity is summarized. Then, in order to open a discussion, a formula, which might be applied to zone A as a whole, is suggested. The final pages of this section present the model resulting from the combination of the six equations and propose methods of solving this model, i.e., expressing each of the endogenous or dependent variables as a function of the policy variables, the exogenous variables and a few constants derived from the observation of past performances.

The production function

19. This type of function relates gross domestic product or a similar flow of a country or a group of countries to a small number of factors meant to determine it. The first decision to be made is whether the production function should cover the whole of the economy or should exclude some branches that are considered exogenous.

20. The first solution was adopted in the Netherlands projection for 1970,[2] in a study by the Economist Intelligence Unit,[3] in I. Svennilson's forecast,[4] in the Knowles report,[5] in the energy forecast of the Organisation for European Economic Co-operation (OEEC) [6] and in Sandee's unofficial projection of the Netherlands economy in the symposium by the Association scientifique européenne pour la prévision économique à moyen et à long terme (ASEPELT).[7]

21. However, numerous production functions apply to only a part of the economy. Thus, the classical study

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[2] Central Planning Bureau, *Een verkenning der economische toekomstmogelijkheden van Nederland, 1950-1970* (The Hague, 1955); and *Scope and Method of the Central Planning Bureau* (The Hague, 1956).

[3] Economist Intelligence Unit, *Britain and Europe* (London, 1957).

[4] Industrial Institute for Economic and Social Research, *Prospects of Development in Western Europe, 1955-1975*, by Ingvar Svennilson (Stockholm, 1957).

[5] United States Congress, Joint Economic Committee, *The Potential Economic Growth in the United States*, by James W. Knowles, 86th Congress, Second Session, Study Paper No. 20 (Washington, D.C., 1960).

[6] Organisation for European Economic Co-operation, *Towards a New Energy Pattern in Europe*, Report of the Energy Advisory Commission (Paris, 1960).

[7] Jan Sandee, " Possible Economic Growth in the Netherlands ", *Europe's Future in Figures*, vol. I, edited by J. R. Geary, Association scientifique européenne pour la prévision économique à moyen et à long terme (Amsterdam, North-Holland Publishing Company, 1962).

by Cobb and Douglas covered only industry.[8] This is also the case in later studies, such as those by B. Wall,[9] C. E. V. Leser,[10] A. Maizels,[11] the Institut für Wirtschaftsforschung of Munich [12] and R. Krengel's contribution on the Federal Republic of Germany to the ASEPELT symposium.[13] Other authors, although considering the whole of the economy too broad a range to be covered by a production function, think it can apply to more than mere industry. Thus, gross domestic product, minus agriculture, housing and services rendered by the State, is the dependent variable in the Luxembourg report,[14] in the first unofficial Belgian forecast for 1975 [15] and in the Belgian and Italian contributions to the ASEPELT volume.[16]

22. In a number of countries, the rate of increase of the gross domestic product is assumed rather than calculated through a production function. This is the case in the French official plans,[17] in the report of the Royal Commission on Canada's Economic Prospects [18] and in Saunders' unofficial projection of the British economy.[19] The absence of a production function does not preclude, of course, the use of a model describing the probable evolution of the main macro-economic magnitudes.

23. A few years ago, the most common production function was:

$$Y = L \times \pi$$

where

Y = the gross domestic product (or a similar flow),
L = the total quantity of labour (in man-hours) and
π = the productivity of labour.

L and π were forecast separately and Y was obtained as their product. This rather simple method was followed by the European Coal and Steel Community,[20] the OEEC,[21] the Economist Intelligence Unit [22] and Svennilson.[23] It is still used at present in some national projections, such as that of Kneschaurek for Switzerland.[24]

24. Another fairly simple production function is:

$$Y = K \times \frac{1}{c.o.r.}$$

where

K is the total quantity of capital and
$c.o.r.$ is the capital/output ratio.

Here again, K and $1/c.o.r.$ are forecast separately, and then multiplied by each other (the relationship between K and investment or saving is discussed below). This type of formula, which originated in the theoretical work by Harrod and Domar, has been used quite recently by Kristensen and associates for the eight regions into which they divide the world [25] and by Krengel for Germany.[26] However, the relationship between Y and K was expressed differently by the Central Planning Bureau of the Netherlands: [27]

$$Y = K^{\frac{1}{2}}$$

25. In these three formulae, only one production factor appears on the right side of the equation: labour in the first, capital in the next two. Underlying these functions is the tacitly expressed assumption of complementarity between the two main production factors: labour and capital. If one of them — capital, for example — is given, it will produce a certain output no matter what the amount of the other factor may be. Technological conditions make only one combination of production factors possible, according to this point of view. There

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[8] C. W. Cobb and P. H. Douglas, "A Theory of Production", *American Economic Review Supplement* (Evanston, Illinois) vol. XVIII, March, 1928.

[9] B. Wall, "A Cobb-Douglas Function for the United States, Mining and Manufacturing", *Econometrica* (New Haven), 16, 1948.

[10] C. E. V. Leser, "Production Functions for the British Industrial Economy", *Applied Statistics* (London), June 1954.

[11] A. Maizels, "Comparative Productivity in Manufacturing Industry, A Case Study of Australia and Canada", *Economic Record*, April 1958.

[12] Institut für Wirtschaftsforschung, *Exponential — und Wachstumsraten — Produktionsfunctionen und ihre Verwendung für eine Projektion*, by K. C. Kuhlo (Munich, 1961).

[13] Rolf Krengel, "Attempt at a Prognosis of Output and Factors of Production of Industry in the Federal Republic of Germany, 1965 and 1970", *Europe's Future in Figures*, op. cit.

[14] Statistical Office of the European Communities, "Méthodes de prévision du développement économique à long terme", *Informations statistiques* (Brussels), November-December, 1960.

[15] Groupe d'études de la comptabilité nationale, "Perspectives de l'économie belge", Département d'économie appliquée, Université libre de Bruxelles, *Cahiers économiques de Bruxelles*, No. 6, February 1960.

[16] Groupe d'études de la comptabilité nationale, "L'économie belge d'ici à 1975" and Vera Cao-Pinna, "Validité théorique et empirique d'une prévision globale de la croissance de l'économie italienne de 1958 à 1970", *Europe's Future in Figures*, op. cit.

[17] The Fourth Plan, which is now being prepared, covers the period 1962-1965 and assumes a growth rate of 5.5 per cent per year. The long-term projections for 1975 envisage alternative annual rates of growth, 3 per cent, 4.5 per cent and 6 per cent and depict three possible future states by showing the repercussions and conditions of expansion at each rate. See "Long-term Projections in France", a paper prepared by F. LeGuay for the United Nations International Conference on Input-output Techniques held in Geneva in 1961 (United Nations, mimeographed document, ST/STAT/CONF.10/L.15).

[18] *Final Report of Royal Commission on Canada's Economic Prospects* (Ottawa, 1958). Here again three possible rates are envisaged.

[19] Christopher T. Saunders, "Outline of a Possible Ten-Year Projection for the British Economy, 1960 to 1970", *Europe's Future in Figures*, op. cit.

[20] European Coal and Steel Community, *Etude sur la structure et les tendances de l'économie énergétique dans les pays de la Communauté* (Luxembourg, 1958).

[21] *Towards a New Energy Pattern in Europe*, op. cit.

[22] *Britain and Europe*, op. cit.

[23] *Prospects of Development in Western Europe, 1955-1975*, op. cit.

[24] Francesco Kneschaurek, "National Product Forecasts in Switzerland", *Europe's Future in Figures*, op. cit.

[25] The Foreign Policy Society, *The Economic World Balance*, by Thorkil Kristensen and associates (Copenhagen, 1960).

[26] Rolf Krengel, op. cit.

[27] See footnote [9].

would thus be a high probability of so-called technological unemployment if one of the factors exceeded requirements.

26. The hypothesis that a given output can be produced with several combinations of production factors, i.e., the assumption of substitutional ability, appears somewhat closer to reality. This explains why most of the recent studies tend to use slightly more complicated production functions based on the Cobb-Douglas formula, which assumes perfect substitutional ability between labour and capital, that is, a given output can be produced with an infinite number of combinations of L and K:

$$Y = L^{\lambda}K^{\mu} \quad \text{or} \quad Y' = \lambda L' + \mu K'$$

where

Y' = annual rate of increase of gross domestic product;
L' = annual rate of increase of the quantity of labour and
K' = annual rate of increase of the quantity of capital.
λ and μ are empirically-determined constants.

A bibliography of such production functions, to which trend and other terms may be added, may be found in the Luxembourg report.[28]

27. The same report proposes, for the endogenous sector of the six Common Market countries:

$$Y' = \frac{2}{3}L' + \frac{1}{3}K' + 0.7h' + 0.015 + \nu$$

where

Y' = rate of increase of the production,
L' = rate of the increase of the number of workers,
K' = rate of increase of the capital employed,
h' = rate of increase of working hours per head and
ν = an economic policy parameter, representing the will of governments to accelerate technical progress.

The figure of 0.7 is somewhat uncertain; the others, 2/3, 1/3 and 0.015, were reached after lengthy econometric calculations based on long-period statistics for five zone A countries, namely, the United States, the United Kingdom, Italy, Canada and Norway. These countries represented more than two-thirds of the zone A gross national product in 1957.

28. The Knowles report proposes a rather more complicated formula for the whole of the American economy:

$$\log Y = -5.43104 + \log L_p + 0.9104 \log \frac{L_e}{L_p} - 3.39\left[\log \frac{L_e}{L_p}\right]^2 + 0.35 \log \frac{K}{L_p} - 5.6411 \log x + 10.356 (\log x)^2 + X + 0.00884t$$

where

L_p = secular trend of labour input,
L_e = actual labour input,
K = capital stock,
x = age of capital
X = mix variable (taking account of the composition of gross national product) and
t = time.

29. H. Stein and E. F. Denison have evolved a method of analysing and projecting national product.[29] This can be assimilated to a Cobb-Douglas function of the type:

$$Y' = \lambda L' + \mu K' + u$$

Y', L' and K' have been defined above. However, L' is a much more refined measurement of the rate of increase in the real quantity of labour than in the previous formulae: the number of man-hours worked is adjusted for increases in output per hour owing to work time reductions (cf. h' in the Luxembourg function), for improvements in the workers' skill and education and for changes in labour quality owing to demographic changes and better utilization of female workers.

30. λ and μ are empirically determined constants (0.714 and 0.203), representing the respective parts of labour and reproducible capital in the distribution of national income. Their sum is less than unity, as the fraction of national income accruing to land is omitted here because this production factor does not increase further in a developed economy. Finally, u is the part of the rate of production growth owing to: (*a*) increase of knowledge, with the exception of that already attributed in L to improvements in formal education; (*b*) economies of scale; and (*c*) less important factors.

31. Lack of data precludes the use of one of the last two functions for the purpose of this exercise. It is suggested that a slightly simplified version of the Luxembourg formula be adopted, ignoring the 0.7 coefficient and considering l the labour input of the endogenous sector, expressed as the total number of hours worked in each year.[30] Thus:

$$Y = Y_{ex} + al^{2/3}k^{1/3}e^{(0.015+\nu)t} \qquad \text{(A)}$$

32. A crucial role is played by the economic policy variable ν. In the Luxembourg report, ν includes a term equal to 0.005 (one-half per cent per year) as the effect of the Common Market on the six participating countries: extra keenness of the producers, fewer national cartels etc. Apart from this, the will to accelerate the rate of growth has been formally expressed for a few

[28] " Méthodes de prévision du développement économique à long terme ", op. cit. See appendix, p. 652.

[29] H. Stein and E. F. Denison, " High employment and growth in the American economy ", a paper prepared for the President's Commission on National Goals (Washington, D.C.), 12 December 1960.

[30] This formula is used for Belgium; cf. *Europe's Future in Figures*, op. cit.

years in France (Commissariat au Plan), Italy (mainly with an eye on the development of the south) and Norway. It is rapidly gaining ground in Belgium, Great Britain and possibly the United States and Canada. The Federal Republic of Germany is the only important industrial country in the zone that does not consider the promotion of expansion to be a government responsibility.

33. One might venture to estimate that an extra one per cent of growth — including the effect of the Common Market — could be obtained by Governments without jeopardising other economic objectives, such as price stability and the level of exchange reserves; this would give $v = 0.01$. At any rate, the model can be tried for some other values, such as 0.005 or 0.015.

34. Y_{ax}, the net output of agriculture, government and housing services, should now be considered. Studies of agriculture have been made by the Food and Agriculture Organization (FAO) [31] and by the Common Market Commission.[32] The subject is also discussed in the Luxembourg report and, no doubt, projections have been made in the United States. It seems certain that agricultural output will continue to progress at a much slower pace than the total gross national product or the output of the endogenous branches. It will depend mainly on: (*a*) the food consumption in zone A (with an income elasticity of roughly 0.6); [33] (*b*) the policy of the Government of the United States of America (price supports and aid given under Public Law 480); and (*c*) the degree of protection against non-zone A imports that will prevail in the Common Market, especially if the United Kingdom and Denmark join the Common Market. It is suggested that the forecast of the value added by zone A agriculture be entrusted to a group comprising, among others, experts from the FAO, the United States Department of Agriculture and the Common Market.

35. The main factors in government output are the defence effort, which all experts — except those in the North Atlantic Treaty Organization — tend to consider likely to decrease in proportion to gross national product; and Parkinson's law, coupled with a gradual increase in the Governments' responsibilities (especially in education), entailing an increasing share of the gross national product. To some extent, an increase in the government output will result from decisions concerning the policy variable v. It is suggested that various combinations of the two factors mentioned be tried.

36. With regard to housing services, the period of post-war shortage is nearly over. Thus, the value added by housing services should increase only with the number of households and with an increase in the quality of the services, which will be very slow because of the extremely long life of capital in this branch. In fact, the official Canadian Commission, as well as the Belgian, British and Italian contributors to the ASEPELT symposium, predicts notably lower rates of growth for this branch than for gross national product.[34] French and Swedish forecasters, on the contrary, foresee a higher rate.[35] The author's suggestion would be an increase of 1.25 to 1.50 per cent per year, taking into account the one per cent per year increase in population that is forecast in the next paragraph.

37. The last exogenous variable in the production function, equation (A), is the labour input l. This magnitude must be determined in three stages: (*a*) total population; (*b*) total quantity of labour (labour input); and (*c*) quantity of labour in the endogenous sector. The main source of information on total population figures is the United Nations.[36] Using the medium assumption, the population figures in table 1-2 are reached.

38. The total quantity of labour (labour input) is influenced mainly by the total population, its age distribution, the school-leaving age, the pensioning regulations and habits, the attitudes towards female work outside the home and the number of hours worked per year. In A-1, the average yearly increase from 1955 to 1980 will be 0.35 to one per cent, according to Kristensen and associates. For the United States alone, Knowles forecasts 0.9 to 1.6 per cent for the period 1959-1975, while Stein and Denison predict 1.15 per cent for the period 1960-1980. In A-2 plus A-3, Kristensen, using figures for western Europe, forecasts an average yearly decrease of 0.15 to 0.85 per cent. In A-4, the Economic Planning Agency of the Japanese Government forecasts an annual rate of growth of 1.2 per cent for the working population of Japan during the period from 1961 to 1970.[37] This would entail an increase of 0.4 to 0.7 per cent per year in the quantity of labour. By combining these figures, a yearly increase of between -0.1 per cent and $+0.6$ per cent is reached, thus indicating an increase of 0.35 per cent on an average.

39. The third stage is the quantity of labour in the endogenous sector. The ratio of the quantity of labour in agriculture to the total quantity of labour is decreasing everywhere.[38] This trend will certainly continue. The same thing is likely to happen to the percentage of the labour force used in defence production. Even if the total defence expenditure remained a constant proportion of the gross national product, there would inevitably

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[31] Food and Agriculture Organization of the United Nations, *Income Elasticities for Food Derived from Household Surveys*, by L. M. Goreux (Rome, 1959).

[32] European Economic Community, Common Market Commission, *Tendances de la production et de la consommation en denrées alimentaires dans la C.E.E., 1956 à 1965*, Direction générale de l'Agriculture. Document à diffusion restreinte (Brussels), October, 1960.

[33] Food and Agriculture Organization of the United Nations, "Income and Food Consumption", by L. M. Goreux, *Monthly Bulletin of Agricultural Economics and Statistics*, October, 1960.

[34] *Final Report of Royal Commission on Canada's Economic Prospects*; and *Europe's Future in Figures*, op. cit.

[35] "Long-term Projections for France", op. cit.; and R. Bentzel and K. Eklof, *Den privata konsumtionen i Sverige 1931-65* (Stockholm, 1957).

[36] United Nations, *The Future Growth of World Population* (Sales No.: 58.XIII.2). See especially appendix C.

[37] Economic Planning Agency, New Long-range Economic Plan, 1961-1970; "Doubling National Income Plan" (Tokyo, *The Japan Times*, 1961).

[38] "Méthodes de prévision du développement économique à long terme", annex 5, p. 671 and 672. See footnote 14.

Table 1-2. Population of zone A

Area	Number of countries	Population (millions) 1955	1960	1965	1970	1975
A-1. North America and Oceania . .	4	193.5	209.5	223.5	240.1	256.1
A-2. European Economic Community.	6	158.6	163.4	168.7	174.9	181.8
A-3. Others — western Europe . . .	9	86.0	87.9	90.1	92.8	96.0
A-4. Others — non-European	3	104.6	112.6	121.8	131.5	141.7
TOTAL	22	542.7	573.4	604.1	639.3	675.6
Index, 1955 = 100		100.0	105.7	111.3	117.8	124.5
Annual percentage of increase (from 1955 to final year)		—	1.1	1.1	1.2	1.2

be some replacement of men (exogenous) by machines (produced in the endogenous sector). These two downward movements probably are not going to be compensated by the rise in the proportion of non-military civil servants in the labour force (even after allowing for an increase in teaching and general administration) and the outflow of technicians from zone A to zone C. Thus, the increase in the exogenous variable l will be slightly higher than that of the total quantity of labour. It is suggested that three figures be used for l: 0.3; 0.6 and 0.9. In view of the exponent $\frac{2}{3}$ in formula (A), the effect of the labour input on the endogenous product would be either +0.2, +0.4 or +0.6 per cent per year.

40. Before concluding this discussion of the production function, it may be worth while to note the rate at which the gross national product increased in zone A between 1950 and 1959 (Table 1-3). These figures were obtained by taking 1957 as a basis and giving each country a weight proportional to its real national income during that year.[39]

41. For the period 1960-1970, a quick survey of existing forecasts gives the following estimates: rate of increase of gross national product, 4.0 per cent; rate of increase of gross national product per capita, 3.0 per cent. Of course, these figures will be replaced by those obtained from the model; nevertheless, it may be interesting to quote them now.

[39] Cf. J. P. Delahaut and E. S. Kirschen, op. cit.

Table 1-3. Index of gross national product of zone A
(1957 = 100)

Year	Index
1950	74.75
1951	80.01
1952	82.92
1953	86.70
1954	87.75
1955	94.25
1956	97.45
1957	100.00
1958	100.24
1959	106.65
Average yearly percentage of increase, 1950-1959 .	4.0

THE FIXED CAPITAL IDENTITY

42. Equation (A) has two endogenous variables, Y and k; it is thus necessary to introduce another equation giving the endogenous capital stock k. This stock is equal to the initial capital k_o, plus additional capital resulting from investment in fixed assets, minus the capital going out of commission through physical wear, obsolescence or sudden destruction. This definition must be clarified on four points:

(*a*) The time at which investment begins to contribute to production;

(*b*) Whether aging capital contributes less and less to production, leading to a gradual depreciation concept, or whether it is fully productive until its removal, leading to a sudden replacement concept;

(*c*) The way in which account may be taken of old capital goods that are kept in reserve and used only in an emergency or during periods of boom;

(*d*) Whether the adjustment of the value of the capital (the endogenous variable) is to be made continuously or by yearly intervals.

43. While the answers to these four questions are not to be based solely on considerations of economic theory, they depend to a great extent on the availability of statistics, which are still very scarce. This will lead to the following solutions:

(*a*) New investment is calculated at one-half during the calendar year when it is completed, because monthly or quarterly figures of new investment are seldom available;

(*b*) Capital goods are subjected to linear depreciation during a lifetime estimated to be z years, because information on the removal of capital goods is very scarce;

(*c*) Capital goods older than z years are no longer considered in the production function, because there is little knowledge about the use of old capital;

(*d*) The variation of the capital through time is estimated both continuously and by recurrence at yearly intervals, because both methods are possible.

44. These choices lead to the identity: depreciated value (sometimes called net value) = initial depreciated value + gross investment − depreciation. This can be written, taking account of the fact that only the endogenous capital is required:

either

$$k = k_0 + \int_0^t (V - v_{ex})dt - \int_0^t \frac{k}{z}\alpha dt \qquad (B)$$

or

$$k = k_0 + \Sigma(V - v_{ex}) - \Sigma\frac{k}{z}\alpha \qquad (B')$$

These equations contain:

Two endogenous variables: depreciated endogenous capital k and total gross investment V;

One exogenous variable: gross investment in exogenous branches v_{ex};

Three constants: the initial depreciated endogenous capital k_0, the average life of capital in endogenous branches z and the ratio, for endogenous capital, of the replacement value to the depreciated value α.

It should be noted that k, V, v_{ex} and k_0 are instantaneous in (B) and are yearly averages in (B').

45. The initial capital stock k_0 has been estimated as $838 billion, at depreciated value for 1957 (average, or mid-year). If the value of capital in the exogenous branches is added to this figure, i.e. agriculture, government and housing, the amount becomes approximately $1,893 billion. The capital-output ratio in the endogenous sector is 1.716 and, therefore, it is 2.19 for the whole of the economy, exogenous branches included. Details per zone and country will appear in a later section of this study.[40]

46. The average life of capital in non-exogenous branches z is known in most countries. The Knowles report goes further and gives figures for the changes, past and future, in the age of capital goods.[41] The variable z can be influenced to a slight extent by the government taxation policy.

47. The variable v_{ex} (fixed investment in the exogenous branches) has to be estimated, in two or three situations, for agriculture, government and housing services. This can best be done at the same time as the estimation of the components of Y_{ex}.[42] In fact, the evolutions of these two exogenous variables are related to some extent. The figures for government and housing services can usually be found in published documents. An even better source of information, however, would be interviews with civil servants, including staff members of the Economic Commission for Europe, Secretariat of the Housing Committee. The group mentioned previously could also be asked to give estimates of future investment in agriculture. The variable v_{ex} could be considered a policy variable, although, in many cases, those making the decision think of the investment as depending mainly on non-economic considerations. This is the case, for instance, with regard to subsidies designed to reduce the cost of new residential construction.

The saving and investment identity

48. Gross investment in a country is the sum of internal investment in fixed assets (V, mentioned previously); internal investment in stocks of raw materials, work in progress and finished products; external investment, i.e., the excess of exports over imports, $(X - M)$;[43] and public gifts to foreign countries (p). This gross investment is financed by net saving and total depreciation of fixed assets.

49. In order to apply the identity of investment and saving to zone A, the following simplifications may be made:

(*a*) Assume that the investment in stocks is proportional to gross national product and is thus represented by sY;

(*b*) Assume that exports of zone A to zone B and imports of zone A from zone B are equal to each other (this is not unrealistic under present circumstances). Then X and M can be deemed to concern only trade between zones A and C;

(*c*) Assume that all public gifts from zone A are destined to zone C; call p this annual flow, and assume no public gifts from zone C to zone A. Thus, p is negative, as it represents public gifts to a foreign zone.

These assumptions will lead to the identity:

$$V + sY + (X - M) + p = S + \frac{k}{z} + d_{ex}$$

or

$$V = S + M - X - sY + \frac{k}{z} + d_{ex} - p \qquad (C)$$

where d_{ex} is the depreciation in exogenous branches.

50. The ratio of stocks to gross national product in zone A is about 0.25.[44] This ratio also can be assumed to be that of the yearly increase in gross national product. On the other hand, the yearly increase in gross

[40] Explanations of computations are given in appendix B.

[41] *The Potential Economic Growth in the United States*, op. cit., p. 20, 22 and 40. See also references to the studies of Dr. Terborgh on p. 53.

[42] See paras. 34 to 36.

[43] In the model presented here, X and M include gold movements as well as private transfers, but they exclude public transfers, essentially gifts.

[44] The OEEC has calculated that this ratio averaged 28 per cent for the member countries during the period 1949-1975. *Towards a New Energy Pattern in Europe*, p. 110. See footnote 6. In Belgium, it amounted to about 20 per cent from 1948 to 1959. See Belgian contribution to *Europe's Future in Figures*, op. cit. This percentage does not include retailers' stocks, owing to the lack of data.

national product is of the order of 4 per cent of the gross national product itself. These assumptions give:

$$s = 0.25 \times 0.04 = 0.01$$

If necessary, formula (C) could be improved by replacing the term sY with the product of a new constant by the rate of increase of the gross national product minus the product of exogenous branches, v_{ex} then being understood as including the increase in stocks in these branches.

51. Depreciation in exogenous branches, d_{ex}, only varies slowly through time, as the assets of these branches, except for agricultural machinery, have a rather long life. The evolution of d_{ex} is closely related to that of v_{ex}, which has been discussed in paragraph 47.

52. The policy variable, p, public gifts from zone A to zone C, is particularly important for this exercise. According to figures — slightly modified to suit the purpose of this study — of the Organisation for Economic Co-operation and Development (OECD), p has taken the following values (in billions of dollars): [45]

1950-1955, average	1.27
1956	2.02
1957	2.27
1958	2.69
1959	2.71

The relationship between p and time is:

$$p = 0.67 + 0.234(t - 1950)$$

53. The extrapolation of this tendency would give $5.4 billion in 1970 and $7.7 billion in 1980 at current prices; thus, it would be less at constant prices. In 1957, the real national income of zone A was about $691 billion.[46] Thus, gifts to zone C represented 2.27 divided by 691 = 0.33 per cent of the real national income of the zone or 0.28 per cent of its national product, as the national income is about 85 per cent of the national product. As p is now increasing at about 10 per cent per year, there is no doubt that it will continue to progress more rapidly than the national income. The rate of increase will depend on:

(*a*) The increase in the sense of international solidarity;

(*b*) The keenness of East-West competition for the support of zone C countries;

(*c*) The amount of other sources for financing zone C imports (this problem will be discussed in a later section);

(*d*) The success of pressure by the United States on other zone A countries to persuade them to raise the amount of their public gifts. Rosenstein-Rodan suggested that the progressive income tax principle be applied to the real gross national product of the rich countries; this would attribute 65 per cent of the total aid to the United States and 35 per cent to western Europe, Oceania and Canada; [47]

(*e*) The improvement of the functioning of international organizations.

54. Rosenstein-Rodan, in the article quoted above, deems that the amount of aid to zone C should decrease in the future (from about 0.006 of gross national product in the first half of the nineteen sixties to 0.005 in the second half and to 0.003 in the first half of the nineteen seventies), as a certain number of countries of zone C will reach the stage of self-sustaining growth where assistance will no longer be required.[48] The writer's opinion, on the contrary, is that the above mentioned factors will provoke a further increase in public gifts from zone A. On the one hand, Rosenstein-Rodan might be somewhat optimistic about the length of time required to attain sustained growth. On the other hand, the disparity of income per capita between zones A and C is not likely to change greatly; if it does, it will be in favour of zone A. The writer suggests trying the following values of $p/Y =$:

In 1970: 0.005; 0.006; 0.0075
In 1975: 0.006; 0.0075; 0.009
In 1980: 0.0075; 0.009; 0.01

The import function

55. Imports are one of the most difficult variables to forecast, as they should ideally involve some assumptions on the economic evolution outside the area covered by the model, such as the ratio of domestic prices to prices abroad and the development of productive capacity in the countries from which one imports. These assumptions are usually implicit and some simple import function is chosen.

56. Four methods are mainly used for import functions:

(*a*) One consists of extrapolating import as a function of time:

$$M = M_0 e^{mt}$$

This method was used in Saunders' forecast for the United Kingdom; [49]

(*b*) Another formula expresses import as an exponential function of gross national product:

$$M = aY^m$$

Such a function is to be found in the Netherlands official forecast for 1970,[50] in the first [51] and the second [52] projections for Belgium by the Groupe d'études de la comptabilité nationale.

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[45] Organisation for Economic Co-operation and Development, *The Flow of Financial Resources to Countries in the Course of Economic Development, 1956-1959* (Paris, 1961). The calculations for the present study are given in appendix C.

[46] Cf. appendix A.

[47] Rosenstein-Rodan, op. cit., p. 107. An appendix to this article shows how the burden of aid should be shared among the developed countries (table 6).

[48] *Ibid.*, p. 137.

[49] Christopher T. Saunders, op. cit.

[50] See footnote 2.

[51] " Perspectives de l'économie belge ", op. cit.

[52] *Europe's Future in Figures*, op. cit.

(*c*) Other authors consider the ratio of imports to gross domestic product to be a function of time:

$$\frac{M}{Y} = e^{mt}$$

which can be written:

$$M = Ye^{mt}$$

This method was adopted in the French [53] and Canadian [54] official forecasts.

(*d*) A more complicated function is proposed in the Luxembourg report.[55] It is that import is not only a function of income and time but also of the ratio of domestic to foreign prices:

$$M = f\left(Y, \frac{p \text{ domestic}}{p \text{ foreign}}, e^{mt}\right)$$

57. Numerous elements influenced the evolution of the ratio of imports to zone A from zone C to the gross domestic product of the former in the nineteen fifties. On the one hand, exhaustion of primary resources — for example, primary energy and metal ores — in developed countries tended to increase this ratio. However, other factors exerted an opposite influence:

(*a*) Technical progress brought about the replacement of some raw materials by substitute products such as man-made fibres, synthetic rubbers and plastics. Furthermore, according to United Nations experts, the use of scrap in the production of metals was proportionally more important than before the war because of improvements in techniques and the presence of enormous quantities of obsolete armaments of the war and post-war periods; [56]

(*b*) The law of Engel explains the sluggish increase of food imports. Moreover, technical progress in the heavily protected agriculture of zone A allowed it to provide for a larger percentage of its needs; [57]

(*c*) Protection against products of zone C, even if it did not increase in absolute terms, certainly increased in relative terms, as a consequence of the discrimination against non-member nations by the constitutional customs unions (Benelux, OECD, Common Market and EFTA) within zone A. This explanation is especially true with regard to imports of manufactured products from semi-industrialized countries of zone C, e.g. some countries of Latin America. Enlargement of exchange with zone B after 1953 may have had similar effects.

58. In fact, the gross national product of zone A and its visible imports from zone C in the last decade followed the evolution shown in table 1-4.[58]

Thus, from 1950 to 1959 the ratio of import to national income at current prices showed a gradual increase amounting to 3.5 per cent per year, whereas it remained stable at constant prices.[59]

59. This discrepancy can be explained by two factors. First, the price index of national income generally tends to increase relatively more than that of foreign trade, as the former contains a larger part of services. Secondly, prices of food and raw materials fell markedly in comparison with the early nineteen fifties. Under-developed countries suffered an important deterioration of their terms of trade.

60. A relation exists between import and gross national product, both at constant prices, of the form:

$$M = bY$$

where b is a parameter, the propensity to import from zone C in the presence of protectionist restrictions. Its value is 0.0215. The average ratio of import to national income is 0.0268 and national income amounts to exactly 80 per cent of gross national product; by multiplying these two figures, the figure of 0.0215 is obtained.

61. In fact, the parameter b can be considered the difference of two parameters:

$$b = m - r$$

The import function is then:

$$M = (m-r)Y \qquad \text{(D)}$$

where m is the income elasticity of imports, in the absence of any protectionist restriction, and r is a policy variable, which shall be called the refusal to import.

[53] *Perspectives de l'économie française en 1965* (Paris, 1956).

[54] *Final Report of Royal Commission on Canada's Economic Prospects*, op. cit.

[55] " Méthodes de prévision du développement économique à long terme ", op. cit.

[56] The percentage of scrap in metal production amounted to an average of 44 per cent, in the case of copper, and 21 per cent, in the case of aluminium, between 1953 and 1955. United Nations, *Commodity Survey, 1957* (Sales No.: 58.II.D.1).

[57] A group of experts came to the conclusion that in western Europe the portion of food consumption covered by imports fell from 26 per cent in 1938 to 19 per cent in 1956. See " L'évolution du commerce international ", a report presented to the General Agreement on Tariffs and Trade (GATT), October 1958, p. 96.

[58] Owing to the lack of time, it was not possible to trace the invisible imports, which, in this case, are not very important except for tourism and military expenditures by Western armed forces in countries of zone C. Furthermore, it seems useful to draw attention to a statistical consideration: whereas the national products of the various countries were converted into United States dollars by using exchange rates representing the purchasing power of the different currencies, which is nearly always underestimated in the official exchange rates (indeed, the price level is lower in countries less rich than the United States), the official exchange rates were used for the conversion into dollars of imports from zone C. This device is justified by the consideration that the discrepancy between price levels in countries with significantly different incomes per capita arises mainly from much higher prices for services in the richer countries. However, as there are practically no services imported from zone C, this discrepancy is greatly reduced. Nevertheless, some statistical bias remains, lowering the ratio of import to gross national product, as any national currency has a greater dollar value for gross national product than for import, but the evolution of this ratio at constant prices is not influenced by it. Details of the computation of imports at current and constant prices are given in appendix D.

[59] In nearly all countries of zone A, the ratio of total import to national income increased markedly in the nineteen fifties. In the United Kingdom, for example, the rate of growth of imp was 2.1 that of national income. In the United States and Belgi it was 1.6. Intra-zone trade thus rose much more rapidly th trade between zones A and C.

Table 1-4. Gross national product of zone A and visible imports [a] from zone C, 1950-1959

(Amount, billions of dollars; index, 1957 = 100)

Years	At current prices					At constant 1957 prices				
	Imports		Gross national product		Ratio of imports to gross national product	Imports		Gross national product		Ratio of imports to gross national product
	Amount	Index	Amount	Index		Amount	Index	Amount	Index	
1950	13.61	74.6	407.4	[illegible]	0.0334	13.47	73.8	516.8	74.8	0.0261
1951	17.37	95.2	474.0	68.6	0.0366	14.33	78.5	553.1	80.0	0.0259
1952	15.15	83.0	509.2	73	0.0298	15.29	83.8	573.2	82.9	0.0267
1953	15.80	86.6	538.0	77.8	0.0294	16.41	89.9	599.3	86.7	0.0274
1954	16.39	89.8	551.7	79.8	0.0297	16.69	91.5	606.6	87.8	0.0275
1955	17.31	94.8	603.5	87.3	0.0287	17.42	95.5	651.5	94.3	0.0267
1956	18.57	101.7	647.7	93.7	0.0287	18.33	100.4	673.7	97.5	0.0272
1957	18.25	100.0	691.3	100.0	0.0264	18.25	100.0	691.3	100.0	0.0264
1958	17.83	97.7	713.1	103.2	0.0250	18.81	103.1	692.9	100.2	0.0271
1959	18.89	103.5	769.0	111.2	0.0246	19.62	107.5	737.3	106.7	0.0266

[a] f.o.b.

62. This refusal to import, implied in the 1961 study by the Economic Commission for Europe,[60] is an impediment to growth in the under-developed countries and creates, for the West, a waste of factors of production, a necessity to give or lend more to the under-developed countries than would otherwise be necessary and a decrease in exports to the under-developed countries. The refusal to import takes two main forms, the effects of which it might be useful to distinguish: (*a*) quantitative restrictions; and (*b*) customs duties.

63. In the light of more general considerations, a present value of 0.0035 for r and thus a value of 0.0250 for m would not seem too unrealistic. For the future, the same value might be kept for m, while trying various r, for example: 0.0025, 0.003, 0.0035 and 0.004. These different values should be accompanied by special studies on the most likely products and countries for which changes in this respect could be recommended. Further considerations on this point are given in a subsequent section dealing with import (see paragraphs 85-95).

The balance of payments equation

64. The question that naturally follows a discussion of imports is that of exports. It has received various solutions:

(*a*) In the Italian contribution to the ASEPELT symposium, export was considered as a linear function of time:

$$X = a + bt$$

(*b*) In the Canadian official forecast, the ratio of export to gross national product was a decreasing function of time:

$$\frac{X}{Y} = a - bt$$

(*c*) In the Netherlands official forecast, export was considered dependent on the national products of the countries that buy goods and services from the Netherlands:

$$X = aY_{ext}^{x}$$

where

X = exports,
Y_{ext} = the national product of the foreign countries and x is a parameter, the elasticity of Netherlands export.

In the fourth French medium-term plan, a similar method was followed. As this leads to a volume of exports that is inferior to that of imports, economic policy measures aimed at increasing exports are envisaged. Thus, the forecast of policy determined exports is obtained.

(*d*) The Luxembourg report proposes the following formula: [61]

$$X = f\left(Y_{ext}, \frac{p}{p_{ext}}, t\right)$$

where p/p_{ext} is the ratio of the internal to the foreign price level.

65. Another solution consists of forecasting the balance of exports over imports, that is, net exports. As imports have been determined previously, exports are then obtained as the sum of imports plus the balance. This method has been adopted in the OEEC energy forecast and in the British and Belgian contributions to the ASEPELT volume. The Belgian forecasters, for instance, considered the balance of exports over imports an economic policy variable — the desired value of which would be attained by eventually using the exchange rate instrument — designed to allow a given increase in the gold and foreign currency reserves of the Central Bank, a given outflow of private capital and a given assistance to under-developed countries.

66. As one of the main purposes of this study is to achieve a tentative prediction of capital inflows into

[60] United Nations, *Economic Survey of Europe in 1961* (Sales No.: 62.II.E.1), chapter V, p. 50.

[61] " Méthodes de prévision du développement économique à long terme ", op. cit., p. 604.

zone C countries, the net exports of zone A [62] will be considered here as a mean of financing: (*a*) private investment designed to promote additional export; (*b*) private investment designed to secure further raw materials and food-stuffs; [63] (*c*) public gifts to zone C; and (*d*) public loans to zone C.

67. This can be described by the identity:

$$\frac{p_x}{p_m} X - M = j\frac{dX}{dt} + n\frac{dM}{dt} + p + q$$

This expresses net export at current relative prices, in which p_x/p_m stands for the terms of trade of zone A towards zone C, that is, the ratio of the price index of its exports to that of its imports from that zone. This term is very important for the determination of net exports. In the nineteen fifties, the terms of trade of zone A towards zone C improved markedly. Whether this constitutes a long-term trend is a question on which experts disagree.[64] For lack of better information, p_x/p_m shall be considered constant in the future, except to the extent that it can be considered a policy variable; its value might depend to a large extent on international agreements on stabilization of raw material prices and on the refusal to import, which has been treated in the previous section. In this identity, j and n are parameters, the former expressing the fraction of export increase of zone A financed by private investment, the latter the ratio of the private investments in zone C (essentially in industries producing raw material and foodstuffs) to the increase of imports from this zone; it can thus be considered a marginal capital-output, or, better, a capital-import ratio. As defined earlier, p represents public gifts, while q is a policy variable representing net unilateral and multilateral public loans from zone A to zone C (minus repayments of past loans)

68. Valuable data on the right term of equation for the above paragraph appear in the OECD publication quoted in footnote 45. By using this source, the results in table 1-5 are obtained for the past.[65]

Table 1-5. Export credits and reinvestments, long-term private credits, etc.

(Billions of dollars)

Year	Export credits $\left(j\frac{dX}{dt}\right)$	Reinvestments, long-term private credits, etc. $\left(n\frac{dM}{dt}\right)$
1950-1955, average	0.20	1.30
1956	0.44	2.50
1957	0.47	3.01
1958	0.20	2.27
1959	0.31	1.87

As may be seen, $j(dX/dt)$ is small in comparison with $n(dM/dt)$. Furthermore, as an important percentage of exports to zone C are constituted by investment goods, a great part of the former enters, in fact, the latter term. For the sake of simplicity, one can thus drop, in an initial approximation, the first term $j(dX/dt)$ and consider that all private investment belongs to $n(dM/dt)$. This leads to formulating the balance of payments equation as:

$$\frac{p_x}{p_m} X - M = n\frac{dM}{dt} + p + q \qquad \text{(E)}$$

69. The problem of p has been treated in the discussion of the saving and investment identity (paragraph 52). This leaves the question of q. According to the Organisation of Economic Co-operation and Development, the figures in table 1-6 applied in the past.[66]

Table 1-6. Public gifts and loans to zone C and their ratios to the gross domestic product of zone A

Year	q (Billions of dollars)	$p+q$ (Billions of dollars)	$\frac{q}{Y}$ (Ratio)	$\frac{p+q}{Y}$ (Ratio)
1950-1955, average	0.69	1.96	0.0012	0.0032
1956	1.25	3.27	0.0018	0.0043
1957	1.65	3.92	0.0020	0.0049
1958	1.78	4.47	0.0022	0.0054
1959	1.82	4.53	0.0022	0.0050

The relationship between p, q and time is:

$$p + q = 0.89 + 0.421(t\text{-}1950)$$

70. The extrapolation of this tendency would give $9.3 billion in 1970 and $13.5 billion in 1980. The consideration with regard to p can also be used for the further evolution of $p + q$ (see paragraph 52). It is suggested that the following values of $p + q/Y$ be tried:

In 1970: 0.009, 0.010, 0.011
In 1975: 0.010, 0.011, 0.012
In 1980: 0.011, 0.012, 0.013

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[62] In the section on the saving and investment identity (paragraphs 48-55) equality between the exports and imports of zones A and B has been assumed. Moreover, the reader will bear in mind that X and M are defined as in national accounting, except that they include gold movements and exclude public gifts.

[63] There is, of course, some overlapping between this kind of loan and the previous one. Many loans permit investments in zone C and, at the same time, give rise to exports of investment goods from zone A. This problem has been ignored in this study, particularly since the first term is not very important (see para. 68).

[64] Affirmative answers are given by M. K. Atallah, *The Long-term Movement of the Terms of Trade between Agricultural and Industrial Products* (Rotterdam, 1958), p. 74; and United Nations, *The Economic Development of Latin America and Its Principal Problems* (Sales No.: 50.II.G.2), p. 13. The opposite point of view is defended by such authors as Colin Clark, *The Conditions of Economic Progress*, third edition, rev. (London, Macmillan, 1957); and H. G. Aubrey, "The Long-term Future of United States Imports and Its Implications for Primary Producing Countries", *American Economic Review* (Evanston), May 1955, p. 270. An intermediary position is taken by Charles P. Kindelberger, *The Terms of Trade, A European Case Study* (Cambridge, Technology Press, Massachusetts Institute of Technology, 1956), p. 239.

[65] Details on computation appear in appendix E.

[66] Details on computation are to be found in appendix C.

71. Since Keynes, it is often assumed that the relationship between the total saving of an economy, S, and its gross national product, Y, can be expressed as:

$$S = gY + h$$

where g and h are constants and h is either negative or assumed to be equal to zero. This gives a still simpler function.

72. The theory of the long-term saving function has not yet attracted the attention of many authors. The best known study is that of Kuznets, who found that in the United States, Canada, the United Kingdom and France, the ratio of saving to national income was stable, while it was rising in Sweden.[67]

73. According to the standardized system of national accounts, saving is split by sectors: households (including non-corporate enterprises), enterprises (corporate and public) and government. As there is no reason to believe, *a priori*, that these economic agents behave in a similar way, the three kinds of saving should be studied separately, in so far as is possible.

74. The most comprehensive statistical survey of saving in zone A is that published quite recently by the United Nations. In the section devoted to trends in savings, no significative change is attributed to government saving or to enterprise saving, except for Japan.[68] On the other hand, interesting discoveries have been made for household saving:

> "The most important single factor accounting for these changes in the proportion of income set aside as saving has been the differences among countries in the rate of growth in real per capita disposable income.[69]
>
> "...
>
> "When the rate of increase in real income has been relatively moderate, its effect on saving behaviour has tended to be neutralized by the steady advance in consumption levels. But when the rate of increase in real income has been rapid as it has in a number of countries during the last decade or so — there has been room for an increase in the share of saving concurrently with a continuing improvement in the standard of living." [70]

75. A dissenting opinion, however, is expressed for Great Britain:

> "One of the outstanding features of the British economy in the fifties was the really impressive resurgence of private saving — if the official calculations, which arrive at total annual savings as a residual item, are accepted. While personal incomes barely doubled, savings increased nearly fifteenfold." [71]

This opinion was also expressed for Canada, where the official commission on economic prospects expects a rising trend in enterprise saving.[72]

76. Saving functions used for long-term projection purposes are generally very simple. The Luxembourg report proposes: [73]

$$S = gY_{disp}$$

where

g is a parameter, and
Y_{disp} = disposable personal income.

For Belgium, the Groupe d'études de la comptabilité nationale uses a constant ratio of savings to disposable income (0.13 from 1960 to 1970, and 0.125 from 1970 to 1975).[74] This is also the case with the Canadian official commission, which, however, hints at a slight decrease, owing to the rise in enterprise saving mentioned above.[75] For Japan, Ichimura and Miyano propose: [76]

$$S = gY_{disp} - h$$

where g equals 0.24 and h (dis-saving when disposable income is zero) about $0.8 billion.

The foregoing list of examples may seem rather short. This is owing to the fact that many authors have recourse to an investment function rather than a saving function, so that they obtain a type of model that is unsuitable for the present purposes.

77. It is suggested that account be taken of the recent United Nations findings and that the following be used as a saving function:

$$S = gY + h + u\frac{d \log \frac{Y}{P_{ex}}}{dt} \qquad \text{(F)}$$

where S and Y have already been defined, while P_{ex} is the number of households (an exogenous variable); and h and u are constants determined from past experience.

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[67] Simon Kuznets, "Towards a Theory of Economic Growth", *National Policy for Economic Welfare at Home and Abroad*, edited by Robert Lekuchman (Garden City, Doubleday, 1955). Other data on this subject are given by the International Association for Research in Income and Wealth, "Capital Accumulation and Economic Growth in South Africa", by D. G. Franzsen and J. J. D. Willers, *The Measurement of National Wealth*, Income and Wealth Series VIII, edited by R. Goldsmith and C. Saunders (London, 1959). All the figures quoted are given in the *Economic World Balance*, p. 117. See footnote 25.

[68] United Nations, *World Economic Survey, 1960* (Sales No.: 61.II.C.1), pp. 37 and 39.

[69] *Ibid.*, p. 35.

[70] *Ibid.*, pp. 36 and 37.

[71] *The Economist* (London), 23 September 1961, p. 1192.

[72] *Final Report of Royal Commission on Canada's Economic Prospects*, op. cit.

[73] "Méthodes de prévision du développement économique à long terme", op. cit.

[74] *Europe's Future in Figures*, op. cit.

[75] *Final Report of Royal Commission on Canada's Economic Prospects*, p. 394.

[76] "The Structure and Growth of the Japanese Economy", a paper prepared by S. Ichimura and S. Miyano for the United Nations International Conference on Input-output Techniques held in Geneva in 1961 (United Nations mimeographed document ST/STAT/CONF. 10/L.10).

78. The coefficient g can be considered either as a constant or as a policy variable. The latter case will apply to the extent that Governments decide that they want to influence the rate of growth by increasing savings rather than acting on v, the technical progress variable. The relative influence of these two methods has been discussed recently by O. Aukrust, who came to the conclusion that efforts in Norway to accelerate the technical progress paid a larger dividend, in terms of increase in the rate of growth, than comparable efforts to raise the rate of saving and investment.[77] Nevertheless, some governments in zone A will undoubtedly want to increase the coefficient g. It is suggested that increases of 0.01, 0.02 and 0.03 be tried for projection purposes; higher increases seem improbable for a coefficient applying to the whole of zone A.

The solution of the system

79. The system of six equations is now complete. The suggested relationships are shown in table 1-7, but other formulae may be substituted for them if necessary. Solving the system means expressing the endogenous variables as functions of: the exogenous variables, the economic policy variables, and the constants. The numerical values to be assigned to these magnitudes have been given in the previous sections, or the way in which they can be reached has been indicated.

[77] O. Aukrust, "Investissement et expansion économique", *Revue de la mesure de la productivité*, No. 16, February 1959, p. 39.

80. The main purpose of the model is to assess and compare the influence that a change of the economic policy variables will exert on the endogenous variables, and on some other important economic magnitudes, which do not appear explicitly in the equations but which can be calculated easily. These are:

(*a*) The consumption (private and public):

$$Y - V - X - M - p$$

(*b*) The productivity in the endogenous sector:

$$\frac{Y - Y_{ex}}{l}$$

(*c*) The over-all capital-output ratio:

$$\frac{k + k_{ex}}{Y}$$

(*d*) The capital-output ratio in the endogenous sector:

$$\frac{k}{Y - Y_{ex}}$$

(*e*) The yearly rate of change of the endogenous variables and of the above magnitude.

81. Solving the system will require the use of an electronic computer. The total number of possible choices suggested for the policy variables is $4 \times 3^5 = 972$, as shown in the following table:

Table 1-7. Description of six-equation model for zone A

Equations	*Endogenous variables*	*Economic policy variables*	*Other exogenous variables*	*Constants*
(A) $Y = Y_{ex} + al^{\alpha}k^{1-\alpha}e^{(0.015+v)t}$	Y Gross domestic product k Capital in endogenous branches	v Acceleration of technical progress	Y_{ex} Gross product of exogenous branches (agriculture, housing services, government services) t Time l Quantity of labour in non-exogenous branches	a $\frac{1}{3}$ $\frac{2}{3}$ 0.015
(B) $k = k_0 + \int_0^t (V - v_{ex})dt - \int_0^t \frac{k}{z}\alpha dt$ or (B') $k = k_0 + \Sigma(V - v_{ex}) - \Sigma\frac{k}{z}\alpha$	V Gross investment		v_{ex} Investment in exogenous branches z Average life of capital in endogenous branches α Ratio of the replacement value of endogenous capital to its depreciated value	k_0
(C) $V = S + M - X - sY + \frac{k}{z} + d_{ex} - p$	S Net savings M Imports from zone C X Exports to zone C	p Public gifts to zone C	d_{ex} Depreciation in exogenous branches	s
(D) $M = (m - r)Y$		r Refusal to import for protectionist reasons		m

(Table continued on facing page)

Table 1-7. Description of six-equation model for zone A *(continued)*

Equations	*Endogenous variables*	*Economic policy variables*	*Other exogenous variables*	*Constants*
(F) $\frac{p_x}{p_m}X - M = n\frac{dM}{dt} + p + q$		q Public loans to zone C (minus repayment of past loans) $\frac{p_x}{p_m}$ Terms of trade of zone A towards zone C		n
(F) $S = gY + h + u\frac{d\log\frac{Y}{P_{ex}}}{dt}$		g Additional saving obtained by policy	P_{ex} Number of households	h u
TOTAL NUMBERS	6	6	8	10

Parameter	*Signification*	*Number of suggested possibilities*
v	Acceleration of technical progress	3
p	Public gifts from zone A to zone C	3 (for each period)
r	Refusal to import	4
$\frac{p_x}{p_m}$	Terms of trade of zone A towards zone C	3
q	Public loans from zone A to zone C	3 (for each period)
h	Additional saving	3

The comparison of the individual solutions will yield the information required on the sensitivity of the main economic magnitudes to changes in economic policy, and will show what assumptions are unlikely or whether some of the equations have to be altered. Of course, the magnitudes of X, M, p and q should be determined in conjunction with the prospects and targets of zone C (see chapter 3). Relationships between zones A and B also must be taken into account.

Detailed projections

INTRODUCTORY REMARKS

82. The model presented in the first section of this study is extremely general, consisting only of about twenty endogenous, exogenous and policy megisto-variables. Its main purpose is to indicate very roughly the possible developments and how they might be influenced by the Governments of the countries in zone A. It seems imperative at this point to disaggregate some of the variables. This will be done at zone A level for imports, exports and production. Lastly, the principal megisto-variables of zone A will be split between the four areas of the zone and, whenever possible, between its twenty-two countries.

83. Even so, the economic magnitudes considered here will still be very large and often very doubtful. Nevertheless, at this stage, it will be possible to refer to the world trade projections made by agencies of the United Nations, such as the Food and Agriculture Organization and the General Agreement on Tariffs and Trade, and to compare over-all figures for the zone with the more familiar national projections.

84. Some of the sections in this part of the study will remain very sketchy, for instance that on exports, mainly because of lack of the time required to gather all the necessary information. The sole purpose here is to show what could be done to process all this information into a workable model of zone A, with a particular emphasis on its relationships with zone C.

DETAILED IMPORTS

85. Thus far, the imports of zone A from zone C have been defined globally by:

$$M = (m-r)Y \qquad \text{(D)}$$

Imports will be discussed now in more detail and will be divided, either by importing branches of activity or by commodities. The first method is theoretically superior, as it ensures the compatibility of import projections with those of the production of branches of activity, but it requires the availability of an input-output table for the importing zone or at least good information on branches. As will appear from the section on detailed production, neither of these requirements is likely to be satisfied in the near future. The second method, which is based on commodity projections, will probably be more useful for individual zone C countries, but there is a danger that the number of commodities involved may tend to obscure the overall picture.

86. The simplest way to use an input-output table for the projection of imports is to assume proportionality between the output of a branch of activity and its imports. However, this method neglects.

(*a*) The possible bottle-necks in certain domestic branches of supply, which may increase the ratio of imports to output (an extreme case of bottle-neck is the exhaustion of raw material sources);

(*b*) Technical progress, which usually tends to substitute domestic goods for imports;

(*c*) Import substitution, owing to changes of foreign trade regulations or of domestic and foreign prices.

87. A somewhat refined method is suggested in the Luxembourg report and is used in the Netherlands contribution to the ASEPELT symposium, in which the imports were split, by a reasoned extrapolation, between four branches of activity (agriculture, manufacturing industry, construction and services) plus the five components of final demand; and the official Netherlands forecast, with thirteen branches of activity (no imports by final demand) and three sets of assumptions on import substitution.

88. It was also used in the projection for Japan by Ichimura and Miyano.[78] The method used by these authors involves the availability of a very detailed input-output table (200 branches of activity). They first consider important competitive imports, i.e., those exceeding a given amount or more than 10 per cent of domestic production, such as food, textile materials, cars, etc. These are linked to the domestic production of the commodity in question during the year and/or the previous year. Thus, the relationship is of the form:

$$M_{it} = aO_{it} + bO_{it(t-1)} + c$$

where

M_{it} represents imports of item i in year t,
O_{it} and $O_{it(t-1)}$ represent domestic output of item i during the year and the previous year, respectively.

In some cases, M_{it} is also related to the domestic consumption of commodity i or to the level of output of some other branch purchasing the higher proportion of this commodity. Thus, there can be several possible combinations of variables in the second member of the equation. For each item, the one that gives the highest correlation coefficient for the past is chosen. Thus, imports of food are related to the domestic production and to the household consumption of food for the year; imports of textile materials are linked to the textile production for the year and for the previous year.

89. After important competitive imports, competitive imports of minor importance are examined. Simple proportionality with domestic production of item i is generally assumed:

$$M_{it} = aO_{it}$$

In some cases, however, O_{it} is replaced by consumption of item i or some other variable, the production of which demands M_{it} as an input. Finally, Ichimura and Miyano examine the problem of non-competitive imports such as oil, rubber, etc., i.e., those which do not exceed a given amount or 10 per cent of domestic production. These imports are supposed to follow the evolution of the domestic purchasing branches:

$$M_i = \sum_j m_{ij} O_j$$

where

O_j is the output of one of the branches purchasing item i;
m_{ij} is the technical coefficient of i towards j.

Another term is added to this equation: domestic production of item i obtained by extrapolating a trend. Thus, the final form of the equation is:

$$M_i = \sum_j m_{ij} O_j - O_i$$

90. On the basis of production projections by branches that are made without the help of an input-output table, the French planners distinguish four categories of imports: food and agricultural products, energy, raw materials and manufactured goods.[79] In the OECD forecast, imports are divided into five categories of goods and four categories of services:

Goods	*Services*
Food and tobacco	Transport
Raw material, except fuel	Travel and tourism
Fuel	Military transactions
Metals, paper and board	Other invisible transactions
Manufactured products	

91. Recourse to the second method for dividing zone A imports, i.e., by commodities, is made easier by the fact that only twenty-three commodities, listed in table 1-8 represent 84.5 per cent of the total imports from zone C in 1959. One commodity, petroleum, accounts for more than one-quarter of this total, while four more (coffee, rubber, sugar and fruit) make up the second quarter and another ten (cotton, non-ferrous ores, unrefined and refined copper, oil-seeds, cocoa, iron ore, tea, oil-fats, meat and timber) comprise the third quarter. In order to allow a comparison with the first method, the twenty-three commodities have been classified according to the importing branches of activity rather than according to the Standard International Trade Classification. Some of the imports attributed to the food processing industries might also have been considered as going directly to private consumption. (See table 1-8.)

92. Medium- and long-term projections on production, consumption and international trade have already been attempted for most of the twenty-three commodities appearing in the table; a list, which may be very incomplete, is given in appendix G.

93. In the present study, the greatest emphasis has been placed on the influence of economic policy variables. The refusal to import has been considered globally in the first part. The commodities particularly affected appear to be:

(*a*) Agricultural commodities competing with those produced in zone A: wheat, meat and particularly sugar, for which there is particularly strong protectionism.[80]

[78] "The Structure and Growth of the Japanese Economy", op. cit.

[79] *Perspectives de l'économie française en 1965*, op. cit.

[80] United Nations, *World Economic Survey, 1958* (Sales No.: 59.II.C.1).

Table 1-8. A break-down of zone A imports from zone C, by commodities [a]

Importing branches of activity in zone A	Commodity	Value of 1959 imports (c.i.f., zone A) Millions of dollars	Percentage of total	Rank
Food and beverage	Wheat	70	0.3	23
	Meat	370	1.7	14
	Fish	140	0.7	21
	Fruit	980	4.7	4
	Sugar	980	4.7	4
	Cocoa	540	2.6	10
	Coffee	1,900	9.0	2
	Tea	450	2.1	12
	Wine and other beverages	310	1.5	17
	Oil-fats	390	1.8	13
	Oil-seeds	560	2.7	9
Tobacco	Tobacco	310	1.5	17
Sawmills	Timber	360	1.7	15
Hides and skins	Hides and fur-skins	250	1.2	19
Oil refining	Oil (Petroleum)	5,770	27.2	1
Rubber manufactures	Crude rubber	990	4.8	3
Textile	Cotton	-	-	-
	Wool	320	1.5	16
	Jute	120	0.6	22
	Other vegetable fibres	160	0.8	20
Steel	Iron ore	530	2.6	11
Non-ferrous metals	Copper	800	3.8	7
	Other non-ferrous metals	760	3.6	8
Miscellaneous	Other food-stuffs Other raw materials Manufactured goods Services	3,280	15.5	-
TOTAL		21,210 [b]	100.0	-

[a] Details on computation are given in appendix E.

[b] This total exceeds the figure which appears in table 1-4 ($18.89 billion) because it is calculated c.i.f., whereas the latter was expressed f.o.b. The evolution of these imports can be calculated for the period 1950-1959.

(*b*) Coffee, which a few countries (the Federal Republic of Germany, Austria, and Italy), consider a luxury and tax heavily; [81]

(*c*) Non-ferrous metals, when they compete with high-cost mines in some zone A countries, such as the United States, France and the Federal Republic of Germany;

(*d*) Petroleum crude oil or products, the import of which is restricted in the United States.

94. Another variable, the terms of trade, has been previously reported as deteriorating against zone C and as liable to stabilization by suitable price or quantity international agreements. It seems in order, therefore, to recall here the character of the stabilization agreements now in force:

[81] General Agreement on Tariffs and Trade, Committee III on Expansion of Trade, "Fourth Progress Report", 18 October 1960 (mimeographed document L/1321), appendix F; and Food and Agriculture Organization of the United Nations, November 1959 (60/B/1074).

Table 1-9. Characteristics of the present stabilization agreements

Commodity	*Limitation of production or export*	*Minimum and maximum prices*	*Buffer stocks*	*Remarks*
Wheat	No	Yes	No	International Wheat Council
Fruit	No	No	No	Study groups (FAO) for citrus and cocoa nut
Sugar	Yes	Yes	No	International Sugar Council
Cocoa	Under negotiation (FAO)	Under negotiation	Under negotiation	Study group (FAO)
Coffee	Yes (short-term) Under negotiation (medium-term)	Under negotiation	Under negotiation	Coffee study group
Olive oil	No	No	No	International Olive Oil Council
Wine	No	No	No	International Wine Council
Oil (Petroleum) .	No	No	No	Contacts between producers
Rubber	No	No	No	Rubber study group
Cotton	No	No	No	International Cotton Advisory Committee
Wool	No	No	No	International wool study group
Jute	No	No	No	Jute study group (FAO)
Copper	Yes (unofficial)	No	No	
Tin	No (though foreseen in clause of the agreement)	Yes	Yes	International Tin Council
Lead	Yes (unofficial)	No	No	Study group (United Nations)
Zinc	Yes (unofficial)	No	No	Study group (United Nations)
Nickel	Yes (unofficial)	No	No	

95. Lastly, it will be necessary to be certain that total imports tally with the sum of branch or commodity imports and that commodity imports are accepted by the experts of zone C as physically and economically feasible.

Detailed exports

96. There are two main methods of forecasting detailed exports. The first consists of projecting the gross national product of the world, except the country or the area for which the forecast is made; deducing therefrom the world imports (by groups of commodities); and estimating the share of world exports that will be attributed to the country or the area concerned. This method was followed in the official Netherlands forecast for 1970 and in the paper prepared by Ichimura and Miyano. Another method is a direct projection of exports by commodities or branches of activity; this was done by the Canadian and French planners, as well as by the British and Netherlands contributors to the ASEPELT symposium.

97. In all the cases mentioned above, exports are always considered from the point of view of the exporting industries. However, the purpose of this paper is to study the influence of zone A exports on the economic development of zone C, rather than the benefit that can be drawn from this trade by the zone A exporting branches. Therefore, the following classification is suggested for exports of zone A to zone C or, to state the same case differently, zone C imports from zone A:

(*a*) Machinery and equipment destined to zone C investment;

(*b*) Raw materials or semi-finished products destined to zone C intermediate demand;

(*c*) Essential consumption goods, e.g., basic foodstuffs;

(*d*) Luxury consumption goods, e.g., Cadillacs;

(*e*) Services, the main part of which consists of earnings on exported capital.

98. The choice between these categories is a most important problem of economic policy for the countries of zone C. The only actions that are required of the countries of zone A, in this respect, are to use more practical judgement with regard to the refusal to import, so that zone C will not be deprived of badly needed foreign currencies; and to avoid systematic interference with the choice of import by zone C Governments, for instance, by insisting on selling luxury consumption goods.

Detailed production

99. Dividing total domestic product in zone A by branches of activity will serve at least three purposes. It will:

(*a*) Improve the knowledge of detailed imports (see paragraphs 86-90);

(*b*) Improve projections of gross domestic product, for which the production function (see paragraphs 19-31) is merely a first approximation;

(*c*) Permit contacts between economic planners and producers which leads to better prognostication and a higher rate of growth, as shown by the French experience of the last fifteen years.

A new type of production function, applying to the various branches of the economy, has been worked out by Arrow, Chenery, Minhas and Solow. However, statistical data are insufficient at present to allow the use of this function.

100. Medium-term projections relating to industrial production — as distinct from agriculture, government, housing and other services — within a large group of countries have been made for western Europe by the OEEC.[82] At the national level, branch projections using an input-output matrix have been done in the Netherlands contribution to the ASEPELT symposium (four branches), the official Netherlands forecast (thirteen branches), the paper by Ichimura and Miyano (thirty-two branches), The Bank of Israel (twenty branches),[83] and Cameron's projection (forty branches).[84]

101. Branch projections made without recourse to input-output analysis appear in the following contributions to the ASEPELT symposium: France (seventeen branches), Belgium (thirty-eight branches), Federal Republic of Germany (forty-three branches) and Saunders for the United Kingdom (eight branches, industrial production only). Such projections also appear in the Canadian official forecast (nine branches).

102. It is suggested that an input-output table be established for a recent year, possibly 1957, and then projected for the terminal year. Apart from the import and export projections already discussed, this entails projections for the internal final demand (private and public consumption, fixed capital formation and change in inventories), projections for the technical coefficients and inversion of the matrix. The table might usefully cover the entire world, being subdivided into the three zones and further divided, for each zone, into some thirty branches of activity. Thus, the matrix could be broken into nine sub-matrices, of which the three inter-industrial zone tables would occupy the main diagonal, while the other six matrices would show inter-zonal trade.

103. The branches in zone A might be:

(*a*) The three exogenous branches mentioned in the first part of this study, agriculture (possibly distinguishing forestry and fishing), government services and housing services, the last two selling only to final demand;

(*b*) The eight branches mentioned in the section on detailed imports as importing large amounts of zone C raw materials: food and beverage (possibly divided), tobacco, sawmills, rubber manufactures, chemicals, textiles, steel and non-ferrous metals (divided by metals);

(*c*) Other branches (about twelve) appearing in the OEEC input-output table:[85] coal, coke and manufactured gas, electricity, consumer durables industries, other mechanical and electrical industries, cement and other materials, other industries, transport (possibly split between rail, canal, sea, road, air and harbours), health services (selling only to final demand), household personnel (selling only to final demand) and other services. This last listing is an enormous residual item, comprising large activities, such as trade and entertainment; medium-sized activities, such as finance, insurance and communications; and a considerable number of smaller activities.[86]

104. Statistical information for this table could be obtained from:

(*a*) National accounts, which should give total final demand plus some break-down of its purchases from a number of branches;

(*b*) National input-output tables, which should supply many data on the structure of inputs and some on the repartition of outputs. Of course, a standardization of national tables would be of great help in this respect;

(*c*) Publications by the United Nations and other world bodies, which should give total outputs and some total inputs;

(*d*) International trade statistics.

Area and country projections

105. In the course of this paper, the twenty-two countries constituting zone A have been considered as a single entity. Of course, they differ in many important respects and these differences are relevant, to various degrees, to the four functions of the model outlined in the first part of the study: the production, saving, import and balance of payments equations.

106. As far as the production function, equation (A):

$$Y = Y_{ex} + al^{2/3}k^{1/3}e^{(0.015+v)t}$$

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[82] *Towards a New Energy Pattern in Europe*, op. cit., pp. 114 and 115.

[83] "Some Recent Applications of Input-output Techniques to the Analysis of the Structure and Development of Israel's Economy", a paper prepared by M. Bruno for the United Nations International Conference on Input-output Techniques, held in Geneva in 1961 (United Nations mimeographed document ST/STAT/CONF.10/L.3).

[84] Burgess Cameron, "The Australian Economy — 1965", *The Economic Record* (Melbourne), August 1959, pp. 159 to 169.

[85] Organisation for European Economic Co-operation, *The Structure of the European Economy in 1953*, by E. S. Kirschen and associates (Paris, 1958).

[86] For more detailed considerations, see "Input-output Analysis Above National Level", a paper prepared by E. S. Kirschen for the United Nations International Conference on Input-output Techniques, held in Geneva in 1961 (United Nations mimeographed document ST/STAT/CONF.10/L.2).

is concerned, it may be pointed out that historical national growth trends show wide discrepancies in the recent past (see appendix A) as well as in the longer term.[87] Furthermore, the combination of fixed capital (see appendix B) and labour differs, having a much greater capital per unit of manpower in sub-area A-1 and a much lower one in A-4. As a consequence, even if parameters of the production functions were the same in all the countries or sub-areas (which is far from proven, especially with regard to the technical progress term), the geographical distribution of increases in fixed capital and working population would have an influence, marginal productivity of capital being lower in A-1 and higher in A-4 and the reverse being true for the marginal productivity of labour. In addition, the degree of government growth policy differs. This has an influence on parameter ν of the production function, which thus becomes a weighted average of quite dispersed figures. However, to some extent, voluntary growth in one country stimulates growth in another country. This "conspicuous expansion" is not so much an economic as a political and psychological phenomenon, each nation resenting its neighbour and/or rival growing more rapidly than itself.

107. Aggregation affects the saving function, equation (F):

$$S = gY + h + u\frac{d\log\frac{Y}{P_{ex}}}{dt}$$

in two ways. First, differences in economic policies have an effect on parameter h that is comparable to that of the production function on parameter ν. Secondly, geographical discrepancies in the rates of growth of the number of households, P_{ex}, also have an effect. In fact, one can scarcely expect a yearly increase of, let us say, 2 per cent in one sub-area and zero per cent in another to have the same consequences as an annual increase of one per cent in both, though it is rather difficult to state exactly what effect such a difference could have.

108. As to the import function, equation (D):

$$M = (m-r)Y$$

it may be stated that the refusal to import, r, is weaker with respect to some zone C countries — mostly colonies or former colonies of western Europe — and stronger with respect to others — for example, Hong Kong and India — under the well-worn plea of wage-dumping.

109. Finally, in the balance of payments function, equation (E):

$$\frac{p_x}{p_m}X - M = n\frac{dM}{dt} + p + q$$

public gifts and loans, p and q, differ widely even if expressed as a percentage of national product, France and the United States being by far the most important contributors. Private investment, $n(dM/dt)$, also shows marked discrepancies. Some countries interfere more resolutely with their terms of trade, p_x/p_m. The most striking example is that of France, which grants price guarantees for several products sold by its former empire. In the last two cases, however, it is probable that these differences have no very important bearing on the reliability of the model.

110. In order to take account of all these differences between countries, it would be necessary to reconstruct all existing national projections in models as similar as possible to that presented in this study. These macro-projections would then be combined and the totals compared with those reached for the megisto-variables. This would be followed by a reconciliation of the two sets.

Final remarks

111. This study was prepared between 10 May and 17 November 1961. During this rather short interval it was not possible to go into very detailed statistical exercices. All the information gathered at the zone A level is summarily described in the first six appendices.

112. Had more time been available, some problems would have been examined further, for example, the life of capital goods, the saving function, the evolution of the principal zone A imports and exports and a review of the existing forecasts of the exogenous sectors. It is hoped, however, that the general picture is reasonably clear.

113. The six-equation model has not been actually solved. In order to do that, some parameters remain to be estimated and the use of an electronic calculator should be secured. One need not be too concerned about the possibility of trying 972 combinations of the economic policy variables. In practice, an average combination will be tried and then variations, probably not more than fifty or sixty, will be explored.

114. No account has been taken of the possibility of zone A gross domestic product being limited by the lack of demand rather than by the supply of factors of production. This assumption would, of course, have led to a completely different chain of ideas.

115. Lastly, it should be recalled that the art of forecasting — whether at short, medium, or long-term — is at its very beginning. The statistics are poor, the model is crude and the assumptions are not very realistic. Let this exercise be considered a work that will, at some time, be considerably improved.

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[87] Cf. Colin Clark, op. cit.; Simon Kuznets, *National Income and Economic Growth*; R. W. Goldsmith, *Financial Structure and Economic Growth in Advanced Countries.*

Appendix A

REAL NATIONAL INCOME OF ZONE A

Explanatory notes

GENERAL REMARKS

1. Zone A is complete.

2. Real national incomes have been obtained on the basis of those calculated for 1957. SOURCE: J. P. Delahaut and E. S. Kirschen, "Les revenus nationaux du monde non communiste", Département d'économie appliquée, Université de Bruxelles, *Cahiers économiques de Bruxelles*, No. 10, April 1961.

3. The stages of calculation are as follows:

(*a*) The indices of national product or income have been calculated (according to the available sources) for each of the countries on the basis of 1957 = 100;

(*b*) Real national incomes were then obtained by multiplication as follows: index × real national income of 1957;

(*c*) Indices of real national income per area were finally calculated on the basis of 1957 = 100.

NATIONAL INCOME AT CURRENT PRICES

4. For sixteen OECD countries, indices are given by the ratio:

$$\frac{\text{gross national product at factor cost each year}}{\text{gross national product at factor cost of 1957}}$$

SOURCE: Organisation for Economic Co-operation and Development, *General Statistical Bulletin*, No. 4 (Paris), July 1961.

5. For five countries — Australia, New Zealand, Finland, Republic of South Africa and Israel — indices are given by the ratio:

$$\frac{\text{national income of each year}}{\text{national income of 1957}}$$

SOURCE: United Nations, "International Summary", *Yearbook of National Accounts Statistics, 1960* (Sales No.: 61.XVII.4), part D; and Statistical Office of the United Nations, *Monthly Bulletin of Statistics*, June 1960.

6. The 1959 figures for Australia, New Zealand, Finland, Republic of South Africa and Israel are still provisional. The 1950 and 1951 figures for Luxembourg and Israel are estimates.

NATIONAL INCOME AT CONSTANT PRICES

7. The figures for sixteen OECD countries are computed from gross national product at constant prices. The figures for Iceland and Ireland are computed from gross national product at market prices. SOURCE: Organisation for Economic Co-operation and Development, *General Statistical Bulletin*, No. 4 (Paris), July 1961, National Accounts, at constant prices, line 8.

8. The 1950 and 1951 figures for New Zealand, Luxembourg and the Republic of South Africa are estimates. This is also in the case with regard to the real national income of the Republic of South Africa in 1959.

9. The real national income for four countries, Australia, New Zealand, Finland and the Republic of South Africa, is calculated by the ratio:

$$\frac{\text{national income at current prices}}{\text{consumption price-index number}}$$

SOURCE: Statistical Office of the United Nations, *Monthly Bulletin of Statistics*, June 1960 and June 1961. Figures relating to 1950 and 1951 for Australia and Finland were taken from Colin Clark, *The Conditions of Economic Progress*, 3rd ed., rev. (London, Macmillan, 1957), table IX (Australia), table XIX (Finland).

10. The indices for Israel were calculated from the net domestic product at constant prices of 1957. SOURCE: Bank of Israel, *Capital Stock Employment and Output in Israel*, by A. L. Gaathon, Special Studies No. 1 (Jerusalem, 1961), table on page 111, col. 6.

11. The figures for Japan were obtained from the economic services of the Japanese Embassy in Brussels.

Table 1-10. National income at constant prices, by country

(Index, 1957 = 100 [a]; amount, millions of dollars [b])

Country	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*	*1957*	*1958*	*1959*
United States	78.3	84.3	87.3	90.9	89.4	96.5	98.4	100.0	98.4	105.3
	282,850	304,524	315,362	328,366	322,948	348,596	355,459	361,239	355,459	380,385
Canada	72.2	76.5	83.7	86.7	83.6	90.4	99.2	100.0	101.0	103.4
	15,794	16,734	18,309	18,966	18,288	19,775	21,700	21,875	22,094	22,619
Australia	88.8	90.9	90.1	92.2	97.6	101.7	103.0	100.0	104.1	110.4
	10,590	10,841	10,745	10,997	11,645	12,131	12,336	11,926	12,419	13,175
New Zealand	87.3	85.2	83.3	89.3	92.6	95.6	96.9	100.0	99.1	103.1
	2,608	2,548	2,490	2,670	2,768	2,858	2,896	2,989	2,961	3,082
Belgium	79.3	83.8	83.8	86.0	89.7	93.6	96.9	100.0	98.8	100.3
	8,062	8,519	8,519	8,743	9,119	9,515	9,851	10,166	10,044	10,196
France	72.3	76.7	78.6	81.0	85.0	89.9	94.4	100.0	101.8	104.1
	35,629	37,798	38,734	39,917	41,888	44,303	46,520	49,280	50,167	51,300
Germany (Federal Republic)	58.1	63.1	69.3	74.5	79.8	88.8	94.9	100.0	103.6	110.5
	31,258	33,948	37,284	40,082	42,933	47,775	51,057	53,801	55,738	59,450
Italy	67.6	73.3	75.6	83.0	85.9	91.7	95.4	100.0	106.1	113.8
	17,859	19,365	19,973	21,928	22,694	24,226	25,204	26,419	28,031	30,065

[a] Index numbers are shown in the first line of figures for each country.

[b] Real national income is shown in millions of dollars in the second line of figures for each country.

(Table continued on page 24)

Table 1-10. National income at constant prices, by country *(continued)*

Country	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*	*1957*	*1958*	*1959*
Netherlands	71.3	73.3	74.8	81.3	87.2	93.9	97.6	100.0	101.4	107.1
	7,749	7,966	8,129	8,836	9,477	10,205	10,607	10,868	11,020	11,640
Luxembourg	82.5	83.8	85.3	86.6	87.0	91.3	95.2	100.0	101.6	104.9
	0,320	0,325	0,331	0,33	0,338	0,354	0,369	0,388	0,394	0,407
United Kingdom	84.0	85.3	85.2	89.1	93.4	96.4	98.3	100.0	100.7	103.1
	49,283	50,046	49,987	52,275	54,798	56,558	57,673	58,670	59,081	60,489
Austria	65.6	72.9	72.4	73.1	80.9	89.2	94.4	100.0	103.1	106.5
	4,286	4,763	4,731	4,776	5,286	5,828	6,168	6,534	6,737	6,959
Denmark	82.9	83.0	84.0	89.5	91.8	92.1	94.3	100.0	102.5	108.1
	4,053	4,058	4,107	4,376	4,488	4,503	4,610	4,889	5,011	5,285
Sweden	80.1	79.7	82.0	84.9	90.4	93.5	96.5	100.0	101.1	106.1
	7,001	6,966	7,167	7,420	7,901	8,172	8,434	8,740	8,836	9,273
Norway	78.4	81.0	84.1	87.4	91.3	93.4	98.0	100.0	99.8	103.7
	3,007	3,107	3,226	3,353	3,502	3,583	3,759	3,836	3,828	3,978
Finland	73.8	86.0	82.7	81.4	90.3	105.2	106.5	100.0	99.8	104.0
	3,196	3,725	3,583	3,527	3,910	4,554	4,610	4,331	4,322	4,506
Iceland	68.8	68.8	67.5	77.9	85.7	93.5	98.7	100.0	105.2	107.8
	0,184	0,184	0,181	0,209	0,230	0,251	0,265	0,268	0,282	0,289
Ireland	89.9	91.9	95.3	97.5	99.3	100.8	98.8	100.0	96.4	99.1
	1,733	1,772	1,837	1,880	1,915	1,943	1,905	1,928	1,859	1,911
Switzerland	69.1	73.7	75.4	79.3	86.0	90.9	96.1	100.0	102.1	107.4
	5,320	5,674	5,805	6,105	6,621	6,998	7,399	7,699	7,861	8,269
South Africa	83.4	81.1	82.8	87.4	91.3	94.3	100.2	100.0	98.2	102.9
	5,653	5,499	5,614	5,921	6,186	6,389	6,789	6,777	6,658	6,973
Israel	45.2	60.0	61.3	62.4	75.7	83.4	92.7	100.0	108.0	117.4
	0,803	1,066	1,089	1,109	1,345	1,482	1,647	1,777	1,919	2,086
Japan	53.0	64.2	70.5	74.6	76.7	85.5	93.3	100.0	103.6	121.9
	19,544	23,695	26,006	27,544	28,312	31,545	34,427	36,903	38,217	44,966

Table 1-11. National income at constant prices, by area

(Millions of dollars)

Year	*Area A-1*	*Area A-2*	*Area A-3*	*Area A-4*	*Total zone A*	*Year*	*Area A-1*	*Area A-2*	*Area A-3*	*Area A-4*	*Total zone A*
1950	311,842	100,877	78,063	26,000	516,782	1955	383,360	136,378	92,390	39,416	651,544
1951	334,647	107,921	80,295	30,260	553,123	1956	392,391	143,608	94,823	42,863	673,685
1952	346,906	112,970	80,624	32,709	573,209	1957	398,029	150,922	96,895	45,457	691,303
1953	360,999	119,842	83,921	34,574	599,336	1958	392,933	155,394	97,817	46,794	692,938
1954	355,649	126,449	88,651	35,843	606,592	1959	419,261	163,058	100,959	54,025	737,303

Table 1-12. Indices of national income at constant prices, by area

(1957 = 100)

Year	*Area A-1*	*Area A-2*	*Area A-3*	*Area A-4*	*Total zone A*	*Year*	*Area A-1*	*Area A-2*	*Area A-3*	*Area A-4*	*Total zone A*
1950	78.35	66.84	80.56	57.20	74.75	1955	96.31	90.36	95.35	86.71	94.25
1951	84.08	71.51	82.87	66.57	80.01	1956	98.58	95.15	97.86	94.29	97.45
1952	87.16	74.85	83.21	71.96	82.92	1957	100.00	100.00	100.00	100.00	100.00
1953	90.70	79.41	86.61	76.06	86.70	1958	98.72	102.96	100.95	102.94	100.24
1954	89.35	83.78	91.49	78.85	87.75	1959	105.33	108.04	104.19	118.85	106.65

Table 1-13. National income at current prices, by country

(Index, 1957 = 100 [a]; amount, millions of dollars [b])

Country	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
United States	64.60	74.76	78.52	82.30	8[illegible]	89.61	95.22	100.00	100.47	108.79
	233,360	270,062	283,645	297,300	295,710	323,706	343,972	361,239	362,937	392,991
Canada	57.34	67.06	75.24	78.44	78.32	85.68	95.71	100.00	103.18	110.06
	12,543	14,669	16,459	17,159	17,133	18,743	20,937	21,875	22,571	24,076
Australia	66.26	69.68	76.55	81.60	87.28	93.62	100.69	100.00	105.97	110.51
	7,902	8,310	9,127	9,732	10,409	11,165	12,008	11,926	12,538	13,179
New Zealand	65.81	67.10	70.75	79.03	86.24	90.75	95.27	100.00	103.44	107.85
	1,967	2,006	2,115	2,362	2,578	2,713	2,848	2,989	3,092	3,224
Belgium	66.06	76.47	77.50	78.24	82.57	87.19	94.41	100.00	99.01	102.12
	6,716	7,774	7,879	7,954	8,394	8,864	9,598	10,166	10,065	10,382
France	48.06	58.34	68.00	70.80	75.11	81.02	89.74	100.00	113.44	122.09
	23,684	28,750	33,510	34,890	37,014	39,927	44,224	49,280	55,903	60,166
Germany (Federal Republic)	45.95	55.53	63.00	67.37	72.40	82.72	91.61	100.00	107.21	115.69
	24,722	29,876	33,943	36,246	38,952	44,504	49,287	53,801	57,680	62,242
Italy	55.08	63.63	67.31	74.90	79.06	86.47	92.69	100.00	107.23	114.13
	14,552	16,810	17,783	19,788	20,887	22,845	24,488	26,419	28,329	30,152
Netherlands	51.99	59.19	62.24	66.63	74.46	84.29	91.16	100.00	103.59	109.71
	5,650	6,433	6,764	7,241	8,092	9,161	9,507	10,868	11,258	11,923
Luxembourg	67.01	72.16	81.69	74.91	77.84	84.96	92.39	100.00	99.59	102.04
	0,260	0,280	0,317	0,291	0,302	0,330	0,358	0,388	0,386	0,396
United Kingdom	60.08	66.03	71.96	76.82	82.11	87.51	94.43	100.00	104.79	108.38
	35,249	38,740	42,219	45,070	48,174	51,342	55,402	58,670	61,480	63,587
Austria	42.17	56.42	64.39	64.01	72.26	82.38	91.19	100.00	103.94	109.84
	2,755	3,686	4,207	4,182	4,721	5,383	5,958	6,534	6,791	7,177
Denmark	66.47	71.28	76.07	81.15	84.46	87.55	93.89	100.00	104.08	114.42
	3,250	3,485	3,719	3,967	4,129	4,280	4,590	4,889	5,088	5,594
Sweden	55.42	67.99	74.93	75.50	80.31	86.21	92.98	100.00	103.96	109.99
	4,844	5,942	6,549	6,599	7,019	7,535	8,126	8,740	9,086	9,613
Norway	54.20	65.69	71.77	72.94	78.66	83.42	94.11	100.00	98.31	102.49
	2,079	2,520	2,753	2,798	3,017	3,200	3,610	3,836	3,771	3,932
Finland	45.74	67.81	67.55	67.86	75.24	85.00	95.80	100.00	106.45	111.00
	1,981	2,987	2,926	2,939	3,259	3,681	4,149	4,331	4,610	4,807
Iceland	37.96	47.39	51.86	60.93	68.81	80.56	94.17	100.00	113.06	120.02
	0,102	0,127	0,139	0,163	0,184	0,216	0,252	0,268	0,303	0,322
Ireland	71.31	75.98	84.49	92.09	93.16	97.14	97.05	100.00	102.86	107.72
	1,375	1,465	1,629	1,775	1,796	1,873	1,871	1,928	1,983	2,077
Switzerland	63.42	68.79	72.82	75.84	82.21	87.92	93.96	100.00	104.03	108.72
	4,883	5,296	5,606	5,839	6,329	6,769	7,234	7,699	8,009	8,370
Republic of South Africa	55.49	59.95	65.51	75.64	81.52	86.88	94.65	100.00	101.99	110.00
	3,761	4,063	4,440	5,126	5,525	5,888	6,414	6,777	6,912	7,603
Israel	25.00	29.00	34.00	44.50	57.29	67.59	81.28	100.00	113.31	130.00
	0,444	0,515	0,604	0,791	1,017	1,201	1,444	1,777	2,014	2,310
Japan	41.40	55.10	61.90	69.90	73.30	81.70	92.20	100.00	103.50	121.60
	15,274	20,315	22,828	25,806	27,035	30,142	31,006	36,903	38,180	44,856

[a] Index numbers are shown in the first line of figures for each country.

[b] National income is shown in millions of dollars in the second line of figures for each country.

Table 1-14. National income at current prices, by area

(Millions of dollars)

Year	Area A-1	Area A-2	Area A-3	Area A-4	Total zone A	Year	Area A-1	Area A-2	Area A-3	Area A-4	Total zone A
1950	255,772	75,584	56,518	19,479	407,353	1955	356,327	125,631	84,279	37,231	603,468
1951	295,008	89,920	64,198	24,893	474,019	1956	379,765	137,862	91,192	38,864	647,683
1952	311,346	100,196	69,747	27,872	509,161	1957	398,029	150,922	96,895	45,457	691,303
1953	326,553	106,410	73,332	31,723	538,018	1958	401,238	163,621	101,121	47,106	713,086
1954	325,830	113,641	78,628	33,577	551,676	1959	433,470	175,261	105,479	54,769	768,979

Table 1-15. Indices of national income at current prices, by area

(1957 = 100)

Year	Area A-1	Area A-2	Area A-3	Area A-4	Total zone A	Year	Area A-1	Area A-2	Area A-3	Area A-4	Total zone A
1950	64.3	50.1	58.3	42.9	58.93	1955	89.5	83.2	87.0	81.9	87.29
1951	74.1	59.6	66.3	54.8	68.57	1956	95.4	91.3	94.1	85.5	93.69
1952	78.2	66.4	72.0	61.3	73.65	1957	100.0	100.0	100.0	100.0	100.0
1953	82.0	70.5	75.7	69.8	77.83	1958	100.8	108.4	104.4	103.6	103.15
1954	81.9	75.3	81.1	73.9	79.80	1959	108.9	116.1	109.9	120.5	111.24

Appendix B

FIXED CAPITAL STOCK OF ZONE A

Explanatory notes

FIXED CAPITAL STOCK IN THE ENDOGENOUS BRANCHES

1. Data are available for eleven countries: the United States and Canada in area A-1; the Federal Republic of Germany, France, Italy, Netherlands, Belgium and Luxembourg comprising all of area A-2, the United Kingdom in area A-3; and Japan and the Republic of South Africa in area A-4.

2. The year of original estimate taken into account is 1957 or the most recent year for which figures are available. In that case, the capital was first expressed at 1957 prices and net investment, also at 1957 prices, was then added. The 1957 endogenous capital has been expressed in dollars on the basis of the real exchange rate used by Delahaut and Kirschen. SOURCE: J. P. Delahaut and E. S. Kirschen, " Les revenus nationaux du monde non communiste ", Département d'économie appliquée, Université libre de Bruxelles, *Cahiers économiques de Bruxelles*, No. 10, April 1961.

3. For Australia and Israel, it has been assumed that the capital of the endogenous sector was one-half the capital of the entire country.

4. For the remaining countries, the writer has proceeded by analogy with countries with a similar economic structure.
Thus, for New Zealand, the ratio obtained for Australia was used:

$$\frac{\text{1957 endogenous capital}}{\text{1957 real national income}}$$

The average ratios of France and Germany were used for Switzerland, Austria and Sweden; the ratio of the United Kingdom was used for Norway, Denmark, Finland, Ireland and Iceland.

5. In table 1-16 the figures of capital and capital-output ratio that were obtained indirectly by using the methods described in paragraphs 3 and 4 are given between brackets.

TOTAL FIXED CAPITAL STOCK

6. Data are available for twelve countries: the United States, Canada and Australia in area A-1; the Federal Republic of Germany, France, Netherlands, Belgium and Luxembourg in area A-2, the United Kingdom in area A-3; and Japan, Israel and the Republic of South Africa, comprising all of area A-4.

7. The year taken into account is 1957 or the most recent year for which figures were available. In that case, the 1957 capital was obtained by the method used for the endogenous sector.

8. For Italy, it has been considered that the total capital was double the endogenous capital.

9. For the remaining countries, the writer has again proceeded by analogy with a similar economic structure by using their ratio:

$$\frac{\text{1957 total capital}}{\text{1957 real national income}}$$

10. In table 1-17 the figures of capital and capital-output ratio that were obtained indirectly are given between brackets.

Table 1-16. Fixed capital stock in the endogenous branches of zone A

Country	Year of original estimate	Depreciated endogenous capital (at current prices)	Endogenous gross domestic product at market prices (at current prices)	Endogenous C.O.R. in the year of original estimate	1957 endogenous depreciated capital (in billions of corrected dollars)	1957 endogenous gross domestic product at market prices (in billions of corrected dollars)	Endogenous C.O.R. in 1957
(1)	(2)	(3)	(4)	(5) = (3) ÷ (4)	(6)	(7)	(8) = (6) ÷ (7)
A-1. *North America and Oceania:*							
United States	1955	328.80 billions of dollars	335.30 billions of dollars	0.98	383.87	373.46	1.03
Canada	1955	22.95 billions of C. dollars	22.42 billions of C. dollars	1.02	27.17	25.06	1.08
Australia					(18.52)		
New Zealand					(4.63)		
					434.19		
A-2. *European Economic Community:*							
Germany (Federal Republic)	1955	146.80 billions of D. Mark	147.61 billions of D. Mark	0.99	66.61	59.57	1.12
France	1954	20,200.00 billions of F. francs	12,270.00 billions of F. francs	1.65	78.53	51.10	1.54
Italy	1955	19,000.00 billions of lire	9,326.00 billions of lire	2.04	44.16	23.71	1.86
Netherlands	1957	50.5 billions of guilders	29.37 billions of guilders	1.78	17.14	10.68	1.60
Belgium	1959	600.00 billions of B. francs	457.80 billions of B. francs	1.31	12.47	10.35	1.20
Luxembourg	1950	37.45 billions of L. francs	9.44 billions of L. francs	3.97 [a]	1.08	0.41	2.63
					219.99		
A-3. *Others: western Europe:*							
United Kingdom	1953	17.48 billions of pounds	14.50 billions of pounds	1.21	78.66	63.19	1.24
Switzerland					(10.93)		
Austria					(9.28)		
Sweden					(12.41)		
Norway					(5.14)	3.98	(1.29)
Denmark					(6.55)	4.10	(1.60)
Finland					(5.80)	3.72	(1.56)
Ireland					(2.58)	1.42	(1.82)
Iceland					(0.36)	0.26	(1.38)
					131.71		
A-4. *Others: non-European:*							
Japan	1955	6,760.00 billions of yen	5,861.70 billions of yen	1.15	41.36	35.69	1.16
Israel					(1.95)	1.51	(1.29)
South Africa	1955	1.92 billions of S.A. pounds	1.61 billions of S.A. pounds	1.15	8.40	7.06	1.19
					51.71		
				TOTAL	837.60		1.16 [b]

SOURCE: United States, Canada, Federal Republic of Germany, Luxembourg, United Kingdom, Japan and Republic of South Africa: International Association for Research in Income and Wealth, *The Measurement of National Wealth*, edited by R. Goldsmith and C. Saunders, Income and Wealth Series VIII (London, 1959); France: Jean Bénard, "Fortune de la France" (1958); Italy: Vera Cao-Pinna, "Validité théorique et empirique d'une prévision globale de la croissance de l'économie italienne de 1958 à 1970", *Europe's Future in Figures;* Belgium: Association scientifique européenne pour la prévision économique à long terme, *Europe's Future in Figures*, vol. 1, edited by J. R. Geary (Amsterdam, 1962); Netherlands: Centraal B. voor de Statistiek 3e Kwartaal 1960.

[a] This figure seems abnormally high.

[b] This figure is obtained as follows:

781.83 ÷ 675.27 = 1.16

781.83 billions of dollars: 1957 endogenous capital of the countries for which we have the endogenous gross domestic product.

675.27 billions of dollars: total of col. 7.

Table 1-17. Total fixed capital stock of zone A

Country	Year of original estimate	Depreciated capital at current prices	Gross domestic product at market prices (at current prices)	C O R in the year of original estimate	1957 depreciated capital (in billions of corrected dollars)	1957 gross domestic product at market prices (in billions of corrected dollars)	C O R in 1957
(1)	(2)	(3)	(4)	(5) = (3) ÷ (4)	(6)	(7)	(8) = (6) ÷ (7)
A-1. *North America and Oceania:*							
United States	1955	828.00 billions of dollars	397.15 billions of dollars	2.08	976.45	441.76	2.21
Canada	1955	46.90 billions of C. dollars	27.39 billions of C. dollars	1.71	54.71	29.71	1.84
Australia	1956	13.17 billions of A. pounds	5.75 billions of A. pounds	2.29	37.04	15.03	2.46
New Zealand					(9.30)	3.54	(2.63)
					1,077.50	490.04	2.20
A-2. *European Economic Community:*							
Germany (Federal Republic)	1955	310.00 billions of D. mark	179.06 billions of D. mark	1.73	129.78	71.91	1.80
France	1954	42,600.00 billions of F. francs	15,970.00 billions of F. francs	2.67	167.38	66.37	2.52
Italy					(88.32)	33.78	(2.61)
Netherlands	1957	101.70 billions of guilders	35.12 billions of guilders	2.90	34.52	13.21	2.61
Belgium	1959	1,750.00 billions of B. francs	565.70 billions of B. francs	3.09	39.07	12.76	3.06
Luxembourg	1950	64.40 billions of L. francs	12.71 billions of L. francs	5.07	1.77	0.52	3.40
					460.84	198.55	2.32
A-3. *Others: western Europe:*							
United Kingdom	1953	33.37 billions of pounds	16.76 billions of pounds	1.99	148.02	72.40	2.04
Switzerland					(22.40)	8.84	(2.53)
Austria					(19.01)	7.32	(2.60)
Sweden					(25.43)	11.89	(2.14)
Norway					(9.67)	4.85	(1.99)
Denmark					(12.32)	5.96	(2.07)
Finland					(10.91)	5.35	(2.04)
Ireland					(4.86)	2.26	(2.15)
Iceland					(0.68)	0.33	(2.06)
					253.30	119.20	2.13
A-4. *Others: non-European:*							
Japan	1955	12,810.00 billions of yen	8,262.00 billions of yen	1.55	75.03	45.32	1.66
Israel	1957	5.50 billions of I. pounds	3.05 billions of I. pounds	1.80	3.89	2.15	1.81
South Africa	1955	5.10 billions of S.A. pounds	2.04 billions of S.A. pounds	2.50	22.63	9.01	2.51
					101.55	56.48	1.80
				TOTAL	1.893.19	864.27	2.19

Sources: United States, Canada, Australia, Federal Republic of Germany, Luxembourg, United Kingdom, Japan and Republic of South Africa: International Association for Research in Income and Wealth, *The Measurement of National Wealth*, edited by R. Goldsmith and C. Saunders, Income and Wealth Series VIII (London, 1959); France: Jean Bénard, "Fortune de la France" (1958); Netherlands: Centraal B. voor de Statistiek, 3e Kwartaal 1960; Belgium: Association scientifique européenne pour la prévision économique à long terme, *Europe's Future in Figures*, vol. I, edited by J. R. Geary (Amsterdam, 1962); Israel: Bank of Israel, *Capital Stock Employment and Output in Israel*, by A. L. Gaathon, Special Studies No. 1 (Jerusalem, 1961).

Appendix C

PUBLIC GIFTS AND LOANS

Explanatory notes

DELIMITATION OF ZONES

1. For the years 1950-1955, zone A consists of members and associated countries of the Organisation for Economic Co-operation and Development (OECD); zone C consists of countries that are considered under-developed by the OECD. SOURCE: Organisation for Economic Co-operation and Development, *The Flow of Financial Resources to Countries in the Course of Economic Development 1956-1959* (Paris, 1961).

2. This study does not take account of contributions for the years 1956-1959 by the following countries: Australia and New Zealand in area A-1; Finland and Iceland in area A-3; and South Africa and Israel in area A-4.

MULTILATERAL FINANCIAL AID

3. It is supposed that international organizations are included in zone A. Thus, account has been taken of the total of net gifts and loans made by these institutions to zone C. Institutions making gifts are: United Nations and its specialized agencies (technical assistance); Development Fund of the European Economic Community; and European Productivity Agency and its Technical and Scientific Office. Lending institutions are: International Monetary Fund, International Finance Corporation, Council of Europe, Fonds européen and International Bank for Reconstruction and Development.

4. Public gifts, *p*, include bilateral and multilateral gifts. SOURCE: *The Flow of Financial Resources to Countries in the Course of Economic Development, 1956-1959.*

(*a*) Bilateral gifts are net gifts from the public sector, plus reparations and indemnities.[a] See table 1, col. 1, for the period 1950-1955; table 2, col. 1 + col. 2, for the period 1956-1959;

(*b*) Multilateral gifts are composed of the figures from table 4 and the estimated figures for the period 1956-1959 ($3 million per

[a] German indemnities to Israel and Italian reparations to Yugoslavia are excluded.

Table 1-18. Public gifts[a]

Year	Zone	Public gifts (millions of dollars)		
		Bilateral	Multilateral	Total
1950-1955, annual average	A-1			
	A-2			
	A-3			
	A-4			
	TOTAL, A	1,200	70	1,270
1956	A-1	1,310		
	A-2	505		
	A-3	130		
	A-4	10		
	TOTAL, A	1,955	60	2,015
1957	A-1	1,345		
	A-2	625		
	A-3	145		
	A-4	70		
	TOTAL, A	2,185	85	2,270
1958	A-1	1,390		
	A-2	835		
	A-3	140		
	A-4	240		
	TOTAL, A	2,605	75	2,680
1959	A-1	1,445		
	A-2	955		
	A-3	145		
	A-4	70		
	TOTAL, A	2,615	95	2,710

[a] Gifts = *p*.

Table 1-19. Public loans[a]

Year	Zone	Public loans (millions of dollars)		
		Bilateral	Multilateral	Total
1950-1955, annual average	A-1			
	A-2			
	A-3			
	A-4			
	TOTAL, A	600	85	685
1956	A-1	740		
	A-2	250		
	A-3	25		
	A-4	80		
	TOTAL, A	1,100	150	1,250
1957	A-1	730		
	A-2	370		
	A-3	20		
	A-4	15		
	TOTAL, A	1,135	510	1,645
1958	A-1	1,095		
	A-2	160		
	A-3	155		
	A-4	25		
	TOTAL, A	1,440	340	1,780
1959	A-1	875		
	A-2	510		
	A-3	170		
	A-4	135		
	TOTAL, A	1,690	130	1,820

[a] Loans = *q*.

year) of gifts from the following groups: World Health Organization, International Atomic Energy Agency, International Labour Organisation and United Nations Educational, Scientific and Cultural Organization. The relationship of p and time has been calculated by the method of least squares. The linear equation for A is:

$$p = 0.234(t-1950) + 0.67$$

5. Public loans include bilateral and multilateral loans.[b] SOURCE: *The Flow of Financial Resources to Countries in the Course of Economic Development, 1956-1959.*

(*a*) Bilateral loans for the period 1956-1959 are figures obtained by the addition of cols. 3, 4, 6, 7 and 9 of table 2, minus cols. 6 and 8 from table 2. For the period 1950-1955, see table 1, col. 2;

[b] Consolidation credits from Italy and Netherlands to Israel and Yugoslavia deducted.

(*b*) Multilateral loans are the total of loans from: International Bank for Reconstruction and Development (total receipts of zone C given in appendix D, table 1, minus table 2 and contributions of zone C to IBRD);[c] International Monetary Fund (figures taken from appendix D, table 10); International Finance Corporation (figures not included in the amounts published, probably $13 million during the period 1956-1959, see appendix D, table 7); Fonds européen (figures given in paragraph 53); and Council of Europe (figures given in paragraphs 56 and 57). Relationship between $p + q$ and time has been calculated by the method of least squares. The linear equation for A is

$$p + q = 0.421(t-1950) + 0.89.$$

[c] Thus, these are over-rated figures because they include net loans and private sector contributions of zone C to IBRD, $10 and $15 million, respectively, during the period 1956-1959.

Appendix D

IMPORTS OF ZONE A FROM ZONE C

Explanatory notes

1. The figures for imports at current prices are given in f.o.b. values. In most cases, they have been calculated on the basis of exports f.o.b. from zone C to zone A.[a] SOURCE: United Nations, *Yearbook of International Trade Statistics, 1960*, vol. I (Sales No.: 61. XVII.2, Vol. I), table B for period 1950-1955; vol. II, tables relating to total trade, for period 1956-1959.

[a] When only c.i.f. data were available, they were converted into f.o.b. values by an arbitrary reduction of 10 per cent. This was the case for imports of Israel and Finland (see tables for individual countries). Data on imports from Portugal, Greece, Spain and Turkey are given by United Nations, *Yearbook of International Trade Statistics, 1952* (Sales No.: 53.XVII.3); and *Yearbook of International Trade Statistics, 1955* (Sales No.: 56.XVII.4), tables for individual countries.

2. For imports at constant prices, the figures at current prices were converted into constant prices by dividing them by the so-called Schulze price index, which comprises about ninety raw materials and food-stuffs.[b] This device is not as rough as it may appear at first sight, as twenty-three commodities made up 84.5 per cent of the imports for 1959 (see paragraph 74).

3. With regard to delimitation of the zones, the figures for the period 1950-1955 are rather rough; imports into Ireland and Iceland are not taken into consideration. For the period 1956-1959, the coverage is assumed to be complete.

[b] Regularly published by the review, *Der Volkswirt*.

Table 1-20. Imports at current prices

(F.o.b.; billions of dollars)

Year	Area A-1	Area A-2	Area A-3	Area A-4	Zone A total
1950	5.61	3.81	3.60	0.61	13.61
1951	6.54	5.08	4.76	0.99	17.37
1952	5.97	4.64	3.57	0.97	15.15
1953	6.02	4.77	3.77	1.23	15.80
1954	5.80	5.44	3.96	1.19	16.39
1955	6.21	5.78	4.04	1.28	17.31
1956	6.53	6.22	4.37	1.45	18.57
1957	6.54	6.14	4.14	1.43	18.25
1958	6.30	5.98	4.22	1.34	17.83
1959	6.60	6.24	4.50	1.55	18.89

Table 1-21. Imports at constant prices

(F.o.b.; billions of dollars)

Year	Area A-1	Area A-2	Area A-3	Area A-4	Zone A total
1950	5.55	3.77	3.56	0.59	13.47
1951	5.40	4.19	3.93	0.81	14.33
1952	6.02	4.69	3.60	0.98	15.29
1953	6.25	4.95	3.91	1.29	16.41
1954	5.90	5.59	4.04	1.21	16.69
1955	6.25	5.82	4.06	1.29	17.42
1956	6.45	6.14	4.31	1.43	18.33
1957	6.54	6.14	4.14	1.43	18.25
1958	6.65	6.31	4.45	1.41	18.81
1959	6.85	6.48	4.67	1.61	19.62

Appendix E

PRIVATE INVESTMENT OF ZONE A IN ZONE C

Explanatory notes

1. The delimitation of the zones is the same as for p and q (see appendix C).

2. SOURCE: Organization for Economic Co-operation and Development, *The Flow of Financial Resources in the Course of Economic Development*, 1956-1959 (Paris, 1961). For export credits $j(dX/dt)$, during the period 1950-1955, see table 1, col. 3; see table 2, col. 10 for the period 1956-1959. For private investments designed to secure raw materials, $n(dM/dt)$, see table 1, col. 4 + col. 5 for the period 1950-1955; table 2, col. 11 + col. 12 for the period 1956-1959.

Table 1-22. Private investment of zone A in zone C
(Millions of dollars)

Year	Zone and area	Export credits to exports $\left(j\frac{dX}{dt}\right)$	Private investments designed to secure raw materials $\left(n\frac{dM}{dt}\right)$		
			Other new loans and investments of the private sector	Reinvested profits	Total
1950-1955, Annual average					
	A TOTAL	200	700	600	1,300
1956	A-1	6	916	390	1,306
	A-2	400	292	414	706
	A-3	24	290	180	470
	A-4	11	...	...	13
	TOTAL	441	1,498	984	2,495
1957	A-1	20	1,419	444	1,863
	A-2	186	312	298	610
	A-3	252	308	210	518
	A-4	8	...	...	17
	TOTAL	466	2,039	952	3,008
1958	A-1	—34	652	295	947
	A-2	217	391	322	713
	A-3	5	356	230	586
	A-4	8	...	...	24
	TOTAL	196	1,399	847	2,270
1959	A-1	—5	469	280	749
	A-2	276	312	305	617
	A-3	16	293	190	483
	A-4	24	...	...	18
	TOTAL	311	1,074	775	1,867

Appendix F

COMMODITY IMPORTS OF ZONE A FROM ZONE C

Explanatory notes

1. The following method of collection was used:

(*a*) Figures were obtained by the addition of imports c.i.f. product by product;

(*b*) Figures concern only 1959;

(*c*) Imports of the Republic of South Africa and Israel are not included. SOURCE: United Nations, *Commodity Trade Statistics*, Statistical Papers, Series D, vol. IX, No. 4. See detailed tables.

2. The percentage of total imports c.i.f. was obtained from the same source (see summary tables—total trade).

Table 1-23. Commodity imports of zone A from zone C

Area	Imports c.i.f (millions of dollars)
A-1	7,270
A-2	7,110
A-3	5,260
A-4 [a]	7,570
TOTAL, ZONE A	27,210

[a] Imports into Republic of South Africa and Israel are excluded; their total amount is approximately $300 million.

Table 1-24. Commodity imports, by product

(C.i.f., millions of dollars)

Commodity	SITC	A-1	A-2	A-3	A-4	Total A *	Percentage of total imports
Petroleum and petroleum products	312, 313	2,030	1,900	1,440	400	5,770	27.2
Coffee	071	1,160	540	190	10	1,900	9.0
Rubber (crude)	231	440	250	190	110	990	4.8
Sugar	061	580	90	210	100	980	4.7
Fruit and nuts (fresh), dried fruit, fruit preparation	051, 052, 053	240	470	250	20	980	4.7
Cotton	263	60	390	150	270	870	4.1
Ore and metal (non-ferrous)	283	360	160	90	80	690	3.3
Oil seeds	221	80	270	160	50	560	2.6
Copper (refined)	682	50	260	230	10	550	2.6
Cocoa	072	190	230	110	10	540	2.5
Iron ore	281	180	130	100	120	530	2.5
Tea and maté	074	100	20	330	—	450	2.1
Vegetable and animal oil fats	411, 412, 413	90	180	110	10	390	1.8
Meat (fresh, dried and canned)	011, 012, 013	90	80	200	—	370	1.7
Wood (round and shaped)	242, 243	50	140	70	100	360	1.7
Wool and hair	262	120	100	80	20	320	1.5
Alcoholic and non-alcoholic beverages	111, 112	10	260	40	—	310	1.5
Tobacco	121, 122	90	100	120	—	310	1.5
Hides and fur skins	211, 212	70	130	40	10	250	1.2
Minerals	272	70	60	40	20	190	0.9
Non-ferrous metal refined (except copper)	683-684, 685-686, 687	100	50	20	10	180	0.9
Vegetable fibres	265	50	50	40	20	160	0.8
Fish (fresh and preserved)	031, 032	80	50	10	—	140	0.7
Jute	264	10	60	40	10	120	0.6
Total for 24 commodities		6,300	5,970	4,260	1,380	17,910	84.4
Other goods and services		970	1,140	1,000	190	3,300	15.6
GRAND TOTAL		7,270	7,110	5,260	1,570	21,210	100.0

* Imports into the Republic of South Africa and Israel are excluded.

Appendix G

TENTATIVE BIBLIOGRAPHY OF COMMODITY PROJECTIONS

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Chapter 2

METHODS OF LONG-TERM PROJECTIONS FOR THE CENTRALLY PLANNED ECONOMIES *

JÓZEF PAJESTKA **

Introduction

METHOD AND PLAN

1. The purpose of this study is to present the methods of long-term economic planning applied in the countries with centrally planned economies listed in paragraph 2; and to propose the methods of long-term economic projections to be applied for these countries in the world economic projections.

2. The zone covered by the projections comprises the following countries, grouped into three areas:

Area 1: Union of Soviet Socialist Republics;

Area 2: Albania, Bulgaria, Czechoslovakia, Eastern Germany, Hungary, Poland, Romania and, possibly, Yugoslavia;

Area 3: Mainland China, Mongolia, North Korea and North Viet-Nam.

3. Any type of projection covering areas larger than one country requires statistical investigations of the relevant variables based on appropriate methods of aggregation, i.e., of the national variables. This paper does not propose to deal with those problems in detail and assumes that the necessary statistical studies will be made, so that the projections may be based on reliable statistical data. It is further assumed that, in so far as development plans or programmes — published or otherwise available — exist for the various countries concerned, they are acceptable for the world economic projections. It follows that the proposed methods are of subsidiary character and are applicable, for example, to the extension of planned development over the period covered by the existing plans, to the variables not formulated in the plans etc.

4. There is one proposition that is required to make the model for world economic projections a workable device: when making the projections for the discussed group of countries, it is not necessary to duplicate or even to resemble the methods of plan construction applied to them; it is possible to replace these by a reasonable extrapolation of the observed past trends of development or of planned development. This appears to be the only feasible approach on which to base the world economic projections. It can be applied without much risk to the countries with long-established planned economies and advanced industrial development, i.e., the Soviet Union and most of the countries of area 2. However, the same method appears to be less reliable for other countries which may undergo many revolutionary changes in the course of their future economic development. It is also assumed that the projections are made in such a way as to allow the respective countries to check and correct the figures concerning their development that are accepted for world economic projections.

An outline of development planning methods

GENERAL REMARKS

5. It seems useful to indicate certain general features of the planning system applied in the countries with centrally planned economies that are relevant to further discussion. Planning is institutionally established in all these countries and takes its most important features from the social ownership of the means of production and the predominant role of the state in the management of economic activities. One of its most important features may be termed "active planning", which consists of an active projection of economic activities (allocation of resources, distribution of incomes, etc.), as opposed to the passive forecasting of spontaneous development. Whereas certain projections for the private enterprise economies contain, in addition to forecasting, some elements of active planning, such planning is a universal characteristic of the economic and social system of these countries.

6. This feature of planning has more serious implications for the methods of plan construction than it does for the methods of forecasting. Forecasting may be

* The grouping of countries and the data used in this chapter are those of the author and do not necessarily correspond to those in chapter 3 prepared by the United Nations Secretariat. The style and terminology have been slightly edited to conform to United Nations usage.

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termed "guessing" about future development, while development proceeds independently of the forecasters. Even in the models that allow for economic policy instrument variables, such forecasting constitutes their main core. On the other hand, planning in these countries means determining the best solutions for future development, which is, to a very great extent, determined by the planners. Therefore, while extrapolation of the past development trends — in its simple form and in its more refined forms, i.e., with the application of economic models — is a paramount method of making projections for the private enterprise economies, the same method has only a limited, auxiliary role in the planning of the these countries, which use appropriate economic calculations and reasoning in making decisions. Many of the parameters, e.g., saving ratio, propensity to import, etc., that appear in the various models designed for private enterprise economies are, however, extremely important variables in the present case.

7. It seems important to observe that planning is actually a method of managing the economy in the countries under review. There is a system of plans, comprising the central plan (the so-called national economic plan) and plans for the various economic organizations, enterprises, etc. All economic units are engaged in planning. Such activities as competition among the various firms, co-ordination of their activities, some bargaining and initiative for improvements and extension all appear in planning and through planning. Construction of the central plan is by no means an effect of a self-sufficient and independent action of the central planning body. On the contrary, there is nation-wide planning, out of which arise both the central plan and the plans for various economic units, which are combined to form a consistent system. Therefore, it is impossible to consider the methods of constructing the central plan, while disregarding the entire system of planning throughout the economy. It is important to note that plans presented by the various economic organizations — more precisely, the draft plans — constitute the most important elements of the national economic plan. This method differs from the forecasting or projection-making of the private enterprise economies, where such plans are not at the disposal of those making the projection and they must rely mainly on their own statistical and economic analyses.

8. Apparently, these two features of the planning system have, to a great extent, influenced planners in the countries under review to tend to disregard, as important planning instruments, the various projection models based on formulation of economic relationships among the highly aggregated economic variables. The above-mentioned features of planning also explain the great emphasis that these countries place on organization of the work of planning throughout the country, i.e., phases of plan-work, unified forms, the "system of indicators", etc., which is one of the principal functions of the central planning bodies. It is noteworthy that most of the discussions of improvements of the planning methods, which are held almost continuously in these countries, deal only with the problems of organizing the work of planning throughout the country.

9. The planning system in the countries covered in the present chapter contains three principal types of nation-wide plans:

(*a*) Short-term plans (the annual plans);

(*b*) Medium-range plans (the five-year plans);

(*c*) Long-range plans (the so-called perspective plans).

10. In the past the annual and five-year plans have usually been of major importance in shaping the planning system. Both these plans are formal documents, confirmed by the highest state organs. They have an obligatory character, i.e., the appropriate economic bodies have the responsibility for their fulfilment. In current practice, the five-year plans may be changed by the annual plans. Major changes in the five-year plans would require re-elaboration of the plan and its confirmation by the respective authorities. This has not been the common practice in the past, however.[1] The annual and five-year plans operate on a central scale as well as universally, i.e., in all economic units. The connexion of planning in the enterprises to the central plan was formerly effected mainly through the annual plans. However, serious attempts have been made in the recent past to change this practice and to link central planning with planning in the enterprises mainly through the five-year plans.

11. It was not until recently that many countries began to supplement the annual and five-year plans with the perspective plans. In most of the countries working on the perspective plans, one or more drafts have been prepared and works are nearing completion. In many cases, drafts of the perspective plans were quite helpful in the elaboration of the five-year plans. The perspective plan is elaborated for the national economy as a whole. There are also attempts to formulate perspective plans for the various economic regions and also for some enterprises. However, there is no general system of perspective planning for all economic units, such as exists for the five-year plans. It is assumed that the perspective plans will be re-elaborated occasionally and will be prolonged for the next few years. The perspective plans now under elaboration cover the period to 1980. The subsequent discussion of methods of long-range planning deals with the methods used for elaboration of the five-year and perspective plans.

Comments on the methods of planning

12. This chapter is not intended to give an exact, detailed picture of the procedure and practical planning methods applied in the countries under examination. Rather, it is intended to present a description and an interpretation of the planning methods that will promote understanding of the system of planning and that are relevant to the topic of this paper. As already indicated, organization of the planning work throughout the economic units of the country is of the greatest importance to

[1] In the Soviet Union, attempts are made to introduce the principle of "continuous planning", which means an annual re-elaboration of the five-year plan (and its extension by one year).

the system of planning in these countries. There are three main stages of construction of the national economic plan:

(*a*) The directives for elaboration of the plan, or the so-called control figures;

(*b*) The draft plans of the various economic organizations;

(*c*) The final national economic plan.

13. The directives actually form a preliminary, comprehensive draft of the national economic plan. Their main function consists of constituting the framework for elaboration of the draft plans throughout the economic apparatus. Elaboration of the directives is the task of the central planning body. It may be perceived that at this stage the methods of planning in the countries reviewed in this chapter might resemble, to a certain extent, the methods applied in some other countries. This is because the central planning body must begin the work of planning by making its own projections, relying on the available statistical information and its knowledge of interdependent economic factors. It is, however, only at the very early stages of work on the directives that the planners apply some simple forecasting techniques of a more general or partial character, based on statistical analysis, e.g., the extrapolation of past trends of growth, the extrapolation of certain parameters for assessment of development of the interdependent variables etc. The planners soon turn to concrete analysis and calculations, in preference to reliance on aggregated economic models and the extrapolation of past trends.

14. At this stage the planners begin to study the plans of the economic, technical and other experts in the various organizations: projections bureaus, scientific institutes, industrial organizations and even enterprises. Thus, rather than relying on statistical estimates, e.g. of capital coefficients for the various economic sectors, the planners depend upon calculations presented by experts, assessing the necessary capital requirements for an assumed increase of output in a concern, along with the labour input and raw materials input etc. of the same concern. The planners make projections for the separate industries — often beginning with the " main " branches — combine them and attempt to make a reasonable and internally consistent entity. This process may be repeated several times, producing the successive versions of the plan, i.e., of the directives. Each successive version represents an improvement. In this process, attempts are made to increase the national product through better utilization of the resources (manpower and capacities), technical improvements, increased efficiency of capital investment etc. Occasionally the proposed changes are combined and made consistent, mainly through " balancing ", to produce a new version of the plan.

15. The scheme of the planning logic, traceable in the planning practices, may be described as follows:

(*a*) Certain restrictions are accepted as more or less exogenous variables, e.g., the disposable economic resources (manpower, existing capacities etc.), the maximum possibility of expansion of certain sectors (a form of technical absorptive capacity), and the limitations in export possibilities etc.;

(*b*) Development projections for the various sectors are made in such a manner as to attain an internally consistent programme and to achieve a maximum increase of the national product, *inter alia*, by way of maximum utilization of the available resources;

(*c*) It is assumed that the maximum must be attained with the simultaneous realization of certain levels, proportions etc. that are accepted on the basis of certain social and political principles or as requirements of further economic development.

16. It may be perceived that the above points resemble the general logic of the programming techniques: as there is a maximization function with an internal consistency condition (*b*), and the various types of constraints — (*a*) and (*c*). It should not be visualized, however, that a mathematical model, for example, the linear programming type, was elaborated for any of the plans. The problems envisaged in plan construction appear to be too complicated to be confined within the framework of a manageable model. The practical methods, when compared with the theoretical models, are simpler in some respects but more complicated and more flexible in others.

17. When the planners achieve a version of the plan that seems satisfactory, it is presented for approval and eventually becomes formal directives. The directives may be defined as:

(*a*) A feasible programme, i.e., a programme that is internally consistent and within the constraints;

(*b*) A programme that approaches the optimum programme, i.e., the final version of the national economic plan. This is an important characteristic, as it is understandable that the closer the directives are to the final plan, the easier the work of making a consistent national plan from the draft plans presented by the various organizations.

18. As mentioned previously, the directives constitute a framework for elaboration of the draft plans by the various organizations. Work on the draft plans may be characterized as consisting mainly of further disaggregation of the variables, checking of the technical constraints (especially with regard to capacities), calculation of coefficients, determination of partial optima and elaboration of an internally consistent draft. All this work is performed within the directives, which are, in a way, binding. The directives fix certain constraints, such as minimum output targets, upper limits of capital expenditure and employment limits; and also indicate optimization criteria for optimum conditions, which may be the maximum growth of output, minimum costs, minimum capital expenditure etc. The criteria for optimum conditions, though not necessarily formulated on a systematical basis for the various cases, are still applied in the elaboration of the drafts and particularly in the analysis, appraisal, corrections, etc. of the draft plans, carried on the various phases of plan elaboration.

19. The draft plans formulate the output figures and the necessary inputs. These figures include, in addition to capital expenditure, employment (with separate calculations for the qualified staff), raw materials and equipment. Most of the data are formulated to allow for aggregation and co-ordination of the various draft plans. In the final stage of plan elaboration, the draft plans are thoroughly analysed, co-ordinated and combined, so that they eventually appear in the form of an aggregated national economic plan. This stage of work is quite laborious; many times it is necessary to recalculate the draft plans and change output figures, coefficients, etc. Hundreds, even thousands, of people are engaged in this task for several weeks.

20. Some general features of the methods applied in plan construction may be indicated:

(*a*) The methods applied are mostly of an analytical rather than a synthetic character;

(*b*) The synthesis (the aggregated plan) is reached through successive approximations (iterative procedure), on the basis of aggregation of the draft plans elaborated by the various economic organizations;

(*c*) Though consumers' demand is not always a starting point for production planning, the production plans are confronted with independent estimates of the demand and are adapted to them;

(*d*) The co-ordination methods put the main emphasis on material balances in physical terms for main commodities; for them it is possible to calculate the technical coefficients. It is worth mentioning that the "main commodities" happen to be highly capital-intensive commodities. Thus, the precise determination of output of these commodities has a great importance for capital investment planning. Although the practical planning methods applied in the socialist countries are of analytical character and follow various partial criteria, an attempt will be made to present them in a more general, albeit simplified, form.

21. It may be stated that production in the countries with centrally planned economies cannot be limited by insufficient effective demand. This concerns, of course, total output and not a particular production sector. Consequently, the factors determining the growth of production should be found on the supply side. It seems to be theoretically correct and also to correspond with the practical planning methods to present the volume of output as a function of the three main factors:

$$P = f(C, Z, T)$$

where

C = fixed capital,
Z = productive employment and
T = technical progress.

As it is often preferable in planning to consider the incremental relations, the above production function also may be expressed in the following way:

$$P = P_0 + \Delta P(I, E, T)$$

where

I = capital investment;
E = increase of employment;
P_0 = output in the base year; and
ΔP = increase of output.

Although the aggregated production functions are not utilized as a planning instrument, the practical methods of planning may be described as consisting of determination of the volume of output on the basis of assessment of the available resources, C and Z, and their utilization.

22. Employment policy was one of the most important instruments of the growth policy of these countries in the early stages of their economic development. Application of the maximum employment policy which also meant maximum utilization of the existing capacities, resulted in an acceleration of the rate of growth and permitted the rapid achievement of a high investment ratio. It is to be expected, however, that the future growth of productive employment will be more stabilized and rather close to the natural rate of growth of the working-age population. This segment of the population is calculated on the basis of demographic studies. It may be assumed:

$$P_w = h(P_0)$$

where

P_w = population in the working age and
P_o = total population.

23. The labour force is calculated as a function of the working-age population:

$$F = h'(P_w)$$

It would not be a great mistake to assume for the future:

$$F = aP_w$$

where a is a constant, although it is rather accepted that it is increasing slightly. Since full employment is accepted as a principle of the socialist system, employment is assumed to be equal to the labour force. Labour inputs, which are a function of outputs and production techniques, are considered equal to the total working time:

$$Z = Fb$$

where

Z = labour inputs,
F = available labour force and
b = average working time.

24. It is common practice in planning to consider employment problems by dividing the labour force into two groups:

$$F = F_a + F_n$$

where

F_a = agricultural active population and
F_n = employment in non-agricultural sectors.

In a predominantly agricultural economy with the existence of agricultural under-employment, the employment

planning may be presented as follows. Labour inputs in the non-agricultural sectors are calculated as a function of the labour requirements of these sectors:

$$Z_n = g(P_n, T_n)$$

$$Z_n = F_n b_n$$

where

Z_n = labour inputs in the non-agricultural sectors,
P_n = output in the non-agricultural sectors,
T_n = techniques in these sectors,
F_n = employment in these sectors and
b_n = average working time.

The resultant agricultural labour force is:

$$F_a = F - F_n.$$

When agricultural under-employment disappears, the employment planning may be presented:

$$Z_n = g(P_n, T_n)$$

$$Z_a = g'(P_a, T_a)$$

$$Z_n + Z_a = F_n b_n + F_a b_a.$$

25. In aiming at the maximum long-range rate of growth, the countries with centrally planned economies tend to put the investment volume at the highest feasible level in their planning practice. In it they observe certain limitations with regard to the investment possibilities, which are, generally speaking, of twofold character: (*a*) the availability of capital goods; and (*b*) the social costs of accumulation. The availability of capital goods was once the most important factor that limited the volume of capital investment during the early development periods in almost all the countries. It may be argued that this situation still continues for some countries, although it is no longer a general characteristic of the entire zone. For the situation in which the availability of capital goods is a limiting factor, the following formula may be written to describe the factors determining the volume of capital investment:

$$I = C_c + IC_c + M_c$$

where

I = investment volume (gross),
C_c = existing capacities for capital goods,
IC_c = technically possible increment of capacities for capital goods and
M_c = import of capital goods (net).

26. A similar formula still holds true as a balance equation in planning, although there no longer are restrictions of the above-mentioned character to limit the investment volume. The volume of output of capital goods — changed by the foreign trade balance of capital goods — is considered equal to the desired investment volume. After the physical possibilities ceased to be the most important factor limiting capital investment, considerations connected with growth of consumption and with income distribution have determined capital investment.

27. With regard to the investment to national income ratio policy, one may distinguish two main periods, which can be observed in most of the countries under discussion. The first period is characterized by strong efforts to raise the investment ratio, in order to achieve favourable structural conditions for a rapid and steady economic development. In the second period, the investment ratio is somewhat stabilized or has a slight upward trend. In most of the countries the first period is finished and there is a more or less stabilized investment ratio. This should mean that the attained investment ratio is considered close to a certain socio-economic optimum.

28. In a balanced plan there always appears:

$$I = S + D + L$$

where

I = gross investment,
S = domestic savings,
D = depreciation and
L = foreign loans (net).

Savings may be considered a function of national income:

$$S = g(Y)$$

where

S = savings and
Y = national income.

However, it must be stressed that the planners do not treat the saving ratio as a parameter. Therefore, the formula: $S = sY$, in which s, the saving ratio, functions as a parameter, does not represent the planning logic applied. Of course, the saving ratio obtained in planning may behave as a constant, but this is a different matter. The last appears to be more likely for the future than it has been in the past. When loans appear as a positive value, it means that domestic savings are insufficient to meet the desired investment ratio. In this case, there is a possibility that the saving ratio will grow, to meet the desired investment ratio. The national expenditure for defence has not been included in savings in the above formulae.

29. When capital and labour inputs are expressed in volumes, other factors influencing their productivity must be taken into account. They may be introduced as technical progress. This is by no means a homogeneous element and it comprises the technical progress *sensu stricto* as well as other factors that may influence output, e.g. proper allocation of resources, functioning of the various institutional arrangements, better skills, foreign trade etc. As the aggregated production functions are not utilized as a planning instrument, then planning does not include a single variable to represent technical progress. Technical changes, as well as the other factors mentioned, are assessed in plan elaboration, calculated or estimated, in their manifold results. Their

total effect on output can be derived from the statistical or plan data.

30. Disregarding the procedure of solution, the degree of coverage etc., the following formula may be written to represent an internally consistent plan:

$$O + M = CA + K + I + X$$

where

O gross output,
M imports,
K consumption,
I investment and
X = exports, all in vectors, and
A matrix of current coefficients.

The foregoing is the form in which the so-called material balances for commodity groups or individual commodities are elaborated. As a rule, the material balances are elaborated in physical terms, although some of them are given in value terms, e.g., capital equipment. They cover the most important commodities or commodity groups, the first being the raw materials and the semi-products. The coefficients accepted for the balances are estimated and/or calculated for future conditions.

31. Aggregating outputs into two main sectors, capital goods and consumer goods, one may accept the very simplified formulae:

$$P_c + M_c = I + X_c$$

$$P_k + M_k = K + X_k$$

where

P_c, P_k = final output of the respective sectors,
M_c, M_k = imports,
X_c, X_k = exports,
K = consumption and
I = capital investment.

Very similar equations are used in development planning in the form of synthetic value balances — e.g., the so-called balance of national income. No coefficients are applied in the value balances. They are elaborated on the basis of the various sectoral projections in order to check the general economic equilibrium. Both the material balances and the synthetic value balances are elaborated for the separate years covered by the plan. Each year of the five-year plan is "balanced", as is usually the case with the final year of each five-year period in the perspective plan.

32. The foreign trade balance, as it appears in the development plans, may be presented in the well-known equation:

$$M = X + L$$

where

M = imports of goods and services,
X = exports and
L = foreign loans or gifts (net).

Non-competitive imports which have played a very important part in the total imports of many countries, may be assumed to be: [2]

$$M_n = f(P)$$

Assuming restrictions in export possibilities, the equation would be:

$$M \leq E$$

When this inequality is not satisfied, foreign trade constitutes a real bottle-neck to development, and consequently, the volume of output is determined by export capacities and loans, E. There were periods in the economic development of the centrally planned countries when foreign trade was a serious impediment to development. However, this is no longer a general characteristic of these countries.

33. Non-competitive imports are still a rather important part of the total imports of some countries — with the significant exception of the Soviet Union — but it is assumed that they will decrease in the future. Taking into account the functioning of the economic system in the centrally planned economies, it seems more appropriate to treat total imports as a function of export possibilities rather than *vice versa*. This is particularly relevant to relations with the under-developed countries. The centrally planned countries can adapt their economies to receive various imports from those countries if they can find markets for their products there.

Proposed methods for long-term economic projections

34. The scope and methods of long-term projections proposed for the centrally planned economies are designed to determine the rate of growth of zone B and its economic relations with the under-developed countries of zone C. With regard to the first task, it is the writer's opinion that separate projections should be made for each country and thereafter aggregated. For the second task, it seems easier to work with the entire zone or with its separate areas as defined above, possibly aggregating the first two areas. It seems advisable to apply various methods of projection, checking the results of one against the other, rather than to rely on only one method.

Simple extrapolation of trends of growth

35. Extrapolation of the past and/or the planned rates of growth appears to be the best initial step. There are certain reasons that permit this very simple forecasting technique to be quite adequate for the countries of this zone. The following arguments may be presented to support this proposition:

(*a*) The rates observed in the recent past and in the known plans are rather stabilized;

[2] It would be quite unreliable to relate the non-competitive imports to the aggregated volume of output. In practical planning the necessary imports are calculated with the help of balances, which resemble the input-output computations.

(*b*) The achieved rates of growth are apparently considered rather satisfactory;

(*c*) Assuming that certain factors emerge to cause a declining rate, e.g., the increasing capital-output ratio, it may be expected that the countries would be likely to attempt to undertake the appropriate measures against it, such as raising the investment ratio.

36. Extrapolation of the trends of growth can be made:

(*a*) For total national income or gross national product: [3]

$$P_t = P_0 e^{rt} \tag{1}$$

where r = rate of growth;

(*b*) For the major economic sectors:

$$Pa_t = Pa_0 e^{r(a)t}$$

$$Pi_t = Pi_0 e^{r(i)t}$$

$$Pn_t = Pn_0 e^{r(n)t}$$

aggregated:

$$P_t = P_0 e^{r't} \tag{1a}$$

$$r' = r(a)w(a)+r(i)w(i)+r(n)w(n);\ w(a)+w(i)+w(n) = 1$$

where

Pa = agricultural net product,
Pi = industrial net product,
Pn = net product of other sectors,
$r(a)$, $r(i)$, $r(n)$ = rates of growth of the respective sectors and
$w(a)$, $w(i)$, $w(n)$ = weights of the respective sectors in total net product.

Rates of growth can be calculated for a period of about five to ten years, on the basis of statistical and plan data series. Should there appear certain distortions in the observed rates of growth for the various sectors, different time periods can be investigated for the various sectors, and the result aggregated according to formula (1*a*).

Other methods of growth projections

37. It seems advisable to try the application of models based on simple production functions. The most promising models appear to be those using aggregated or disaggregated (for the major production sectors) capital-output ratios.

Aggregated model

38. The aggregated model would be:

$$\left.\begin{aligned} P_t &= P_0 + N_t \frac{1}{k} e^{vt} && (2.1)\\ N_t &= \sum_0^{t-1} I_n && (2.2)\\ I_t &= s_t P_t + L_t && (2.3) \end{aligned}\right\} \quad (2)$$

where

P = national income or gross national product,
N = new capital,
k = capital coefficient,
v = time trend (reflecting changes in capital coefficient),
I = capital investment (net),
s = savings ratio and
L = foreign loans or gifts (positive for received, negative for bestowed).

If justified, a longer time lag should be accepted in equation 2.2, e.g. two years.

39. In the above model the variables appear as:

Equations	*Endogenous variables*	*Policy or exogenous variables*	*Parameters*	*Data*
2.1	P_t , N		k, v	P_0
2.1 (alternate) . .	P_t , N	v	k	P_0
2.2	I_n			I_0
2.3	P_t	I_t	s	
2.3 (alternate) . .	P_t	L_t , s_t		

Alternative methods are possible with regard to parameters v and s. Other values than those derived from statistical analysis — as policy variables — can be accepted for them. The model uses the capital-output ratio, k, for new capital which produces more reliable results than the total capital-output ratio. The parameters k and v should be calculated for a period of about ten to fifteen years, on the basis of past and/or plan data. The capital-output ratio can be calculated for a period of, for example, five years:

$$k = \frac{\sum_0^{t-1} I_n}{P_t - P_0}.$$

The parameter v can be calculated for the period of about five to ten years, from an equation of the type shown above (2.1).

40. Making allowance for progress owing to technical innovations, economies of scale on the internal market, co-ordination of development undertakings among the countries of zone B, extension of foreign trade with the other zones etc., another way of introducing v may be presented:

$$v' = v + v(p) + v(e) \tag{2.4}$$

where

v = parameter (calculated as shown above),
$v(p)$ = correction because of technical progress and other factors and
$v(e)$ = correction because of extended foreign trade with other zones.

Of course application of formula (2.4) will produce a higher rate of growth. No adequate methods for setting $v(p)$ and $v(e)$ can be presented. As far as $v(p)$ is concerned, it is hoped that confronting the results obtained from

[3] In planning practice the rates of growth are calculated according to the formula: $P_t = P_0(1+r)^t$.

model (1) with those of model (2) may provide some hints. The factor $r(e)$ should be introduced for calculations in which it is accepted that foreign trade with other zones will develop more rapidly — in relation to national income — than can be observed for the past or the plan period.

41. Assuming a constant saving ratio may prove to be an incorrect assumption. Particularly for countries in which an increasing investment ratio is accepted in their development plans, a further increase of the saving ratio should be considered. It may be assumed that countries with a relatively lower income per capita have reasons for increasing the investment ratio. With regard to the saving ratio, some variants may be presented in case of doubt.

Disaggregated model

42. When an aggregated model (2) does not produce satisfactory results because unreliable figures are obtained for parameters k and v, disaggregation should be tested. It seems particularly advisable to employ a model using a capital-output ratio for industry and a simple extrapolation of the trends of growth for other sectors. This model would take the following shape:

$$Pi_t = Pi_0 + Ni_{t_k}^{1} e^{vt} \qquad (3.1)$$

$$Ni_t = \sum_{0}^{t-1} Ii_n \qquad (3.2)$$

$$Pa_t = Pa_0 e^{r(a)t} \qquad (3.3)$$

$$Pn_t = Pn_0 e^{r(n)t} \qquad (3.4)$$

$$P_t = Pi_t + Pa_t + Pn_t \qquad (3.5)$$

$$Ii_t = (s_t P_t + L_t) m_t \qquad (3.6)$$

(3)

where

- Pi net output of industry,
- Pa net output of agriculture,
- Pn net output of other sectors,
- Ni new capital in industry,
- Ii capital investment in industry,
- $r(a)$ rate of growth of agricultural net product,
- $r(n)$ rate of growth of other sectors,
- m industrial investment to total investment ratio,
- k capital coefficient in industry and
- v time trend in industry.

43. In the above model the variables appear as:

Equations	Endogenous variables	Policy or exogenous variables	Parameters	Data
3.1	Pi_t , Ni_t		k, v	Pi_0
3.2	Ii_t			Ii_0
3.3	Pa_t		$r(a)$	Pa_0
3.4	Pn_t		$r(n)$	Pn_0
3.5	P_t			
3.6		L_t , s_t , m_t		
3.6 (alternate) . .		L_t	s, m	

The comments made with regard to model (2) are also pertinent to model (3). For countries assuming a rather constant $m(m = Ii/I)$ in their development plans, m can be treated as a parameter in the discussed projections. In cases where m is changing with some regularity and there are no reasons to discontinue the observed tendency, it can be extrapolated.

44. It is necessary to introduce employment considerations in order to check the results obtained from models (2) and (3). When a regular increase in the available labour force can be observed both for the base period, i.e., the past and the plan period for which parameters have been calculated, and for the period covered by the projections, it is possible to dispense with the introduction of employment considerations into the models. For this purpose the following equation should be tested for x:

$$Z_0 e^{xt} = P_0 e^{xt} a_t b_t \qquad (4)$$

$$Z_t = P_t a_t b_t$$

where

- Z labour inputs,
- P population,
- x rate of growth of labour inputs,
- s natural rate of growth of population,
- a labour force to total population ratio and
- b average working time.

From equation (4), it follows that whenever s is constant, and $a_t b_t$ is constant, x will also be constant. When x varies only slightly in the projection period, in comparison to the base period, it can be neglected. However, for countries where x changes considerably, it should be introduced into the model in some manner.

45. Little will be known about the variables a and b, although b should be expected to decrease somewhat in all the countries, while a may still increase, despite the fact that it has increased considerably in the past. In countries having a great percentage of agricultural population, a should be expected to increase, owing to the utilization of some hidden surplus labour that may still exist in agriculture. For such cases, a can be expected to grow so rapidly as to upset I which is decreasing. In some instances, however, the product $a_t b_t$ may decrease. Then x should also decrease on that account. The writer does not believe it justifiable to introduce x into the model by formulating a smooth functional relationship. An extremely simple solution would seem to be to take x into account when setting $v(p)$ in equation (2.4) of model (2). Small changes can be introduced into $v(p)$ because of the changing x. It should be taken into consideration, however, that b is not being changed with the aim of decreasing the rate of growth.

46. Introducing corrections that are caused by the changing x is more troublesome for model (3). The following method may be proposed for this purpose:

(*a*) Estimates of the rate of growth of total labour inputs are made, according to formula (4);

(*b*) It is assumed that industrial employment grows with the trend observed for the base period;

(*c*) The rate of growth of labour requirements for the *Pn* sector is calculated:

$$z(n) = r(n) - p(n)$$

where

$z(n)$ = rate of growth of labour requirements in *Pn* sector,
$r(n)$ = rate of growth of net output in *Pn* sector and
$p(n)$ = rate of growth of labour productivity in *Pn* sector

(*d*) The resulting rate of growth of labour productivity in the agricultural sector is calculated:

$$z(a) = x - z(i) - z(n)$$

$$p(a) = r(a) - z(a)$$

where

$z(a), z(i), z(n)$ = rates of growth of labour requirements of the respective sectors,
$p(a)$ = rate of growth of labour productivity in agriculture and
$r(a)$ = rate of growth of agricultural net output;

(*e*) When $p(a)$ is not deemed feasible, $z(i)$ should be changed and introduced into equation 3.1 in the manner suggested for the introduction of x into model (2).

Confronting results

47. It is assumed that, as a rule, at least two preliminary forecasts will be made for any country: one according to model (1) or (1*a*) and one according to model (2) or (3). The results thus obtained should be confronted. Using $R = P_t/P_o$ and R' for results obtained from model (1) or (1*a*) and R'' for results obtained from model (2) or (3), the results may be:

$$R' \sim R''$$

In this case the results are accepted as final or:

$$R' \neq R''$$

in which case further analysis is necessary. In some instances, e.g., when $R' > R''$, the parameters s, the saving ratio; v, time trend; and m, industrial investment to total investment ratio of model (3), should be reconsidered.

Aggregation for areas and entire zone

48. The results obtained for the separate countries can be aggregated for the areas and for the entire zone:

$$^{(a)}R = \sum_i R_i w_i \qquad (5)$$

where

$R = \frac{P_t}{P_0}$; $^{(a)}R$ represents the whole areas,

$w_i = \frac{^{(i)}P_0}{^{(a)}P_0}$,

where

$^{(i)}P_0$ = output of country i in the year 0 and

$^{(a)}P_0$ = output of the area in year 0.

In the same way, $^{(i)}R$ can be calculated for the zone.

49. Should the availability of data allow, a model of type (2) or (3) can be tested for the separate areas:

$$^{(a)}P_t = {}^{(a)}P_0 + {}^{(a)}N_t \frac{1}{^{(a)}k} e^{vt} \qquad (6)$$

In the equation the variables $^{(a)}P_t$, $^{(a)}P_0$, $^{(a)}N_t$ and $^{(a)}k$, are considered aggregated values of the respective variables obtained for various countries in model (2); the parameter v is calculated for the entire area. Similarly, on the basis of model (3):

$$\left.\begin{aligned} ^{(a)}Pi_t &= {}^{(a)}Pi_0 + {}^{(a)}Ni_t \frac{1}{^{(a)}k_t} e^{vt} \\ ^{(a)}P_t &= {}^{(a)}Pi_t + {}^{(a)}Pa_t + {}^{(a)}Pn_t \end{aligned}\right\} \qquad (7)$$

Foreign trade with other zones

50. Tendencies in foreign trade with the other zones can be tested for the base period and, on this basis, hypothetical forecasts for the separate areas can be made. The following formulae may be presented for this purpose:

$$\left.\begin{aligned} ^{(a)}M_t &= {}^{(a)}M_0 e^{gt} && (8.1) \\ g &= cr && (8.2) \\ ^{(a)}X_t &= {}^{(a)}M_t + {}^{(a)}L_t && (8.3) \end{aligned}\right\} \qquad (8)$$

where

$^{(a)}M$ = imports of the area,
$^{(a)}X$ = exports,
$^{(a)}L$ = loans and gifts (net),
r = rate of growth of the national income or gross national product of the area and
c = imports to output elasticity.

51. The variables appear as:

Equations	*Endogenous variables*	*Policy or exogenous variables*	*Parameters*	*Data*
8.1	$^{(a)}M_t$, g			$^{(a)}M_0$
8.2			c, r	
8.3	$^{(a)}X_t$	$^{(a)}L_t$		

One may also tentatively assume a certain trend for $^{(a)}L$. The results obtained from model (8) will be, of course, very hypothetical, especially as parameter c will not be calculated for a sufficiently long period, covered by the development plan.

52. The following procedure is suggested for including the discussed zone in the world projections model. In the preliminary forecasting model, the results obtained

from models (5) and (8) should be directly included into the world projections. Then in models testing international trade variants, various assumptions with regard to ${}^{(a)}X_t$, ${}^{(a)}M_t$ and ${}^{(a)}L_t$ should be shown — in some manner — in their impact on output forecasts. Only models (6) and (7) can be used for this purpose; (5) is unsuitable. In this regard, the following tentative proposals are presented:

(*a*) The changes in ${}^{(a)}L_t$ influence ${}^{(a)}N_t$ in (6) and

(*b*) The changes in ${}^{(a)}X_t$ influence parameter v in (6) and (7).

Appendix

APPLICATION OF THE PROPOSED FORECASTING METHODS TO POLISH ECONOMY

Extrapolation of rates of growth

Choice of the base period

1. The period 1955 to 1965 seems most appropriate as a basis for extrapolation. This period covers two five-year plans (1956-1960 and 1961-1965). The statistical series for 1955-1960 and the plan figures for 1961-1965 are available. It is considered that the targets accepted for 1965 in the five-year plan will be surpassed on some points.

Results of calculation of the rates of growth during the base period

2. Rates of growth are calculated for national income, which does not include the so-called unproductive services, e.g., social, health, educational and cultural services, central administration, defence etc.

3. According to the formula:

$$P_t = P_0 e^{rt}$$

the rates of growth, r, are presented below:

Period covered	*Prices*	*Rate of growth*
1955-1965	Constant 1956	0.0666
1955-1965	Constant 1960	0.0674

Forecasts for 1970, 1975 and 1980

4. Extrapolation of the rates of growth found for the base period produces the following indices of national income growth:

1960 = 100

	1970	*1975*	*1980*
1956 prices	194.6	271.6	378.9
1960 prices	196.2	274.8	384.9

5. It should be mentioned, however, that the rate of growth for 1965-1980 is expected to be higher than the rate achieved during the period 1955-1965. The basis for this expectation is to be found in certain features of the economic conditions of the country during the period 1965-1980 in comparison to the years 1955-1965 and also in the development policy followed during the period 1955-1965 (particularly 1955-1958) and planned for the future.

Projection utilizing aggregate capital coefficient

6. The formula applied is:

$$P_t = P_0 + N_t \frac{1}{k} e^{vt}$$

Choice of the base period

7. For the parameter k, the capital coefficient, the period 1956-1960 has been selected, and for the parameter v, the period 1960-1965. Thus, the parameter k is based on statistical appraisal and the parameter v is partly based on plan data.

8. As the average gestation period has been assumed to be two years, the parameter k is calculated on the basis of capital investment figures [a] for 1954-1958 and on national income figures for 1956-1960, as has the parameter v. Another calculation has been made for the gestation period of one year. As the results obtained are not very different, only the results of the first calculation are presented below.

Parameters obtained for the base period

9. The formula applied is:

$$\frac{1}{k} = \frac{P_{1960} - P_{1955} - 0.426}{N_{1958}}$$

From:

$$P_{1965} = P_{1960} + N_{1963} 0.426 e^{5v}$$

is found:

$$v = -0.0028$$

10. There is no basis for setting the saving ratio and the investment ratio for the future.[b] Therefore, another method of estimating the future capital investment figures has been chosen. It seems quite reasonable to assume a constant rate of growth of the productive investment. The average annual rate of growth, observed for the period 1955-1965, is approximately 8 per cent. The annual rates of growth of productive capital investment are shown below:

1955	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*	*1963*	*1964*	*1965*
(Percentage)										
2.2	2.2	6.4	8.8	17.0	7.5	11.0	10.8	7.3	5.9	5.0

It does not seem inconsistent with the anticipated development policy of the country to assume an annual rate of growth of the productive capital investment of about 8 per cent. The forecasts of output growth presented below are based on this rate of growth of capital investment.

[a] According to the concept of national income applied, only the so-called productive investment is included in the calculations.

[b] It is rather considered that the investment ratio will grow slowly throughout the period, although its growth will be somewhat faster during the first five to ten years, mainly because of the anticipated employment situation.

TENTATIVE FORECASTS

11. The national income index is given below:

1960	1970	1975	1980
100.0	202.1	287.2	409.9

This rate of growth would be accompanied by a very slow increase of the investment ratio; i.e., the productive investment to national income ratio. This is the result of the negative value obtained for the parameter v.

Analysis of results and final forecast

CONFRONTING THE RESULTS

12. The two methods applied above produce somewhat different results, as is shown in the national income indices in the following table:

1960 = 100

	1970	1975	1980
1. Extrapolation of past rates of growth . .	196	275	385
2. Capital-output model	202	287	410

The second method brings higher rates of growth than the first one. This may be explained by changes in the investment ratio during the base period. Capital investment — as well as productive capital investment — grew very slowly until 1958 and grew much more rapidly after that time. There seem to be no reasons to assume that the exceptional situation (and policy) with regard to the investment ratio in the years 1954-1958 will occur in the future. Therefore, the results obtained from the capital-output model appear to be more reliable.

GROWTH OF EMPLOYMENT

13. The detailed demographic prognosis — accepted for elaboration of the perspective plan — gives the following population estimates:

Table 2-1. Population prognosis

(Millions)

Item	1960	1965	1970	1975	1980
Total population					
High estimate	29.75	31.87	34.06	36.30	38.58
Low estimate	29.75	31.62	33.47	35.43	37.42
Natural increase for five-year period (percentage)					
High estimate		13.7	13.3	12.7	12.2
Low estimate		12.2	11.3	11.4	10.9

The two estimates have no impact on manpower estimates, with the rather insignificant exception of the period 1975-1980.

14. Detailed estimates of the active population, based on the analysis of age-structure, activity coefficients, etc., give the following figures for manpower.

Table 2-2. Manpower estimates

Year	Active population (millions)	Indices for five-year periods	Active population as percentage of total population	
			High population estimate	Low population estimate
1960 . .	13.87		46.7	46.7
1965 . .	14.89	107.4	46.7	47.0
1970 . .	16.26	109.2	47.7	48.6
1975 . .	17.80	109.5	49.0	50.2
1980 . .	19.15	107.5	49.7	51.2

15. As may be seen from tables 2-1 and 2-2, the growing ratio of active population to total population more than compensates for the declining natural rate of growth. As a result, a slightly faster increase in manpower is expected for the years 1965-1980 than for the period 1955-1965. However, the increase does not appear to be significant enough to require a more serious change in the parameters.

TWO-SECTOR MODEL

16. To check the results obtained from the aggregated capital-output model, a two-sector model has been tested. The formula applied for industry is:

$$Pi_t = Pi_0 \cdot Ni_t - 2\frac{1}{k}e^{vt}$$

and that applied for other sectors is:

$$Pn_t = Pn_0 e^{r(n)t}$$

For the base periods that were explained earlier, the parameters found are:

$$\frac{1}{k} = 0.433$$

$$v = 0.0266$$

$$r(n) = 0.0457$$

17. Assuming the constant ratio of industrial capital investment to total productive investment, the indices found for national income are:

1960 = 100

1970	1975	1980
208	313	484

The results are higher than those obtained from the aggregated model. This may be explained, *inter alia*, by the lower and declining capital coefficient in industry in comparison with the averages and by the fact that during the base period industrial capital investment is growing more slowly than total investment. Application of the above model would always give higher rates of growth of the national income as a result of the increasing rate of growth of industrial capital investment. Assumption of a non-declining share of industrial investment in the total productive investment seems to be in conformity with the anticipated development policy of the country. Still, the above estimates are considered rather high because of the apparently favourable parameters obtained for the capital coefficient (k and v) in the base period.

FINAL FORECAST FOR NATIONAL INCOME GROWTH

18. There seems to be sufficient reason to assume, as a low estimate of national income's growth, the results obtained from the aggregated capital-output model and, as a high estimate, the results obtained from the two-sector model. These estimates of national income indices are:

1960 = 100

	1970	*1975*	*1980*
1. High estimate	208	313	484
2. Low estimate	202	287	410

Part II

STUDY BY THE ECONOMIC PROJECTIONS AND PROGRAMMING CENTRE OF THE BUREAU OF GENERAL ECONOMIC RESEARCH AND POLICIES

Chapter 3

METHODS OF AGGREGATIVE ECONOMIC PROJECTIONS FOR THE DEVELOPING MARKET ECONOMIES

Introduction

1. This chapter sets forth the basic economic model used for estimating the trade needs of the developing countries in order to achieve the acceleration in economic growth implicit in the United Nations Development Decade objectives. These estimates, summarized for illustrative purposes here, were presented to the United Nations Conference on Trade and Development and are reproduced in the *World Economic Survey, 1963*. The present chapter is a revised version of the paper originally submitted in June 1962 to the Group of Experts on Long-term Economic Projections.

2. In order to identify the scope and magnitude of the policy measures required for an accelerated pace of growth in the developing countries, it is pertinent to introduce an economic model which describes the quantitative interdependence of the basic economic variables in a typical developing country. The purpose of this chapter is to discuss a number of questions arising in the construction of aggregative models for making long-term economic projections in the developing countries.[1]

3. The chapter is divided into four major sections. In the first section, a number of methodological issues emerging from different hypotheses about the mechanism of economic development are discussed at some length. The basic thesis expounded in this section is that economic development is restricted not only by the low level of domestic saving but, also and more immediately, by a limited supply of foreign exchange; given the rigid and highly compartmentalized structure of a less developed economy, foreign trade can perform a key role in alleviating the imbalance between supply and demand which is likely to persist during the process of development. Special emphasis is placed on the interdependency among saving targets, prospects for foreign exchange earnings and structure of domestic production.

4. The remaining sections of the chapter, which are devoted to problems of an empirical nature, represent an attempt to illustrate further the major implications of the assumptions expounded in the first section. For purposes of statistical verification, these assumptions have been organized into a simple aggregative model.[2] In the second section, the working of the model is illustrated by utilizing available statistics for the group of developing countries taken as a single unit. The third section is devoted to a discussion on the predictive value of the model as tested by experience in the developing countries during the last decade. The last section contains a series of hypothetical projections, designed to highlight the broad area of structural changes required to achieve the objectives set up by the General Assembly for the United Nations Development Decade.

Elements of an aggregative model for economic projections in the developing countries

5. Despite the marked progress in the theory of the development process, some significant aspects of growth are not as yet fully understood. Little, for example, is known about the quantitative effect of investment in human resources or in social overhead generating "external economies". But even with respect to factors that lend themselves more readily to statistical measurement, the testing of hypotheses presents serious problems. On the one hand, the period for which data are available is too short to provide a basis of firm experience.[3] On

[1] In this chapter the country coverage of the developing countries is as follows: Latin American Republics, Continental Africa and associated islands excluding the Republic of South Africa, Far East excluding Japan and Asian centrally planned economies, West Asia including Iran but excluding Turkey and other countries or territories n.e.s. In the description of the model the term "developing countries" is often designated as "zone C". The rest of the world is divided into two major groups: developed market economies and centrally planned economies. The group of developed market economies bearing the technical designation "zone A" includes the United States, Canada, the member countries of the European Economic Community (EEC) and the European Free Trade Association (EFTA), Finland, Greece, Iceland, Ireland, Spain, Turkey, Japan, Australia, New Zealand and the Republic of South Africa. The centrally planned economies designated also as "zone B" consist of countries in eastern Europe including Yugoslavia and of the Asian centrally planned economies (mainland China, Mongolia, North Korea and North Viet-Nam).

[2] Appendix B sets forth the major lines along which more detailed and sectoral models should be developed.

[3] The shortness of the available time series also imposes stringent conditions upon the number of admissible independent variables. A small number of independent variables is dictated not only by the low order of the available degrees of freedom but also by the fact that the time series of the independent variables are highly correlated.

the other hand, inter-country analysis cannot be usefully employed unless the economic structure itself can be incorporated as an additional variable in the regression equations, a condition which is not likely to be met until some basic aspects in economic dynamics are more adequately studied.

6. Notwithstanding these shortcomings, the experience gained during the past decade points to the systematic occurrence of a number of factors that have determined — albeit to a varying degree — the development process in most developing countries. The model presented in this chapter represents an attempt to illustrate the problems inherent in development efforts under constraints of more or less general validity. The simplicity of the model, which has been dictated, at the present stage of analysis, by the availability of data for the developing countries, leads inevitably to important abstractions from reality by neglecting features particular to specific countries or regions. Some of these aspects will be examined in a forthcoming study dealing with problems of application of this model to economic regions and individual countries. In the meantime, a study on the basis of such a model may well compensate for the shortcomings by highlighting the effects of factors that are shared, in common, by all developing market economies.

7. The model presented here is primarily for purposes of illustrating methodological issues. An effort has been made, however, to construct this model in such a way so as to allow for future improvements with minimum changes in its structure and/or its basic assumptions. More specifically, the model is constructed on the basis of the following specifications:

(*a*) The variables which enter the system of equations must exercise a permanent and systematic (non-stochastic) influence. Short-term cyclical phenomena and non-systematic exogenous shocks to the system are to be ignored.[4] Furthermore, the variables must be organized in such a way so that the system should reflect adequately the key behavioural and technical relationships that have affected economic growth and are expected to exercise their influence in the future under specified policy and institutional constraints. This specification reflects the purpose for which the models are constructed. The ultimate goal is not to predict the future course of events but to project into the future the historically changing structure of the developing economies under alternative and specified conditions referring to internal and external policy variables. In this respect, the task of the model is twofold: first, to describe the interplay of forces determining the process of development and, secondly, to measure the quantitative effect of changes of policy parameters upon the rate of growth and the balance of payments;

(*b*) The second principle on which the model has been built is flexibility. The model should be flexible enough so as to accommodate further elaboration and necessary modifications in the application at the regional or country level without substantial changes in its structure. Differences among economies with respect to their level of development or the nature of resources must be reflected, so far as possible, as simple differences in the values of the parameters of its structural equations;

(*c*) The model is " real " and its variables are measured in terms of volume flows (in a common currency unit of a specified year). Only the terms of trade enter explicitly into the model, but even these are assumed at this stage to affect solely the magnitude of the capacity to import without exercising any influence on the sectoral allocation of resources. The exclusion of monetary flows and relative prices does not imply that their long-run effect on consumers' choice and production decisions are assumed to be unimportant. The assumption results rather from statistical necessity. Even if there were a general theory of growth, it is doubtful whether it could be tested with the limited information available. It seems necessary, therefore, to postpone the incorporation of price variables into the model until more experience is gained and the required statistics become available;

(*d*) Although the variables have a time dimension the model is not truly dynamic since all variables refer simultaneously to the same period. This is, of course, an abstraction from the actual course of development, where lumpy investments with long gestation periods do occur. The simultaneity of all the variables of the system implies that the economy is assumed to move along an equilibrium path where equality between *ex ante* and *ex post* magnitudes has been achieved. Again, it has been thought proper to postpone the introduction of time-lags and related problems with respect to the process of achieving an equilibrium between desired and realized magnitudes until more experience is gained in more fundamental elements of development.

THE BASIC ASSUMPTIONS

8. The thesis that a major prerequisite for growth is the availability of a surplus over current consumption is self-evident. A first limit upon the rate of growth is thus by the availability of saving. But this is only a first limit to the rate of growth. A further question arises as to whether other more limiting factors might set a rate of growth significantly lower than that implied by the level of potential saving. Indeed, the existence in a typical under-developed economy of idle resources which can be potentially transformed into investment indicates that the supply of total saving may not necessarily be the key limiting factor. Thus, during the nineteen fifties, there have been many cases where investment plans have had to be cut back because of acute shortages of foreign exchange, in spite of the fact that there was no evidence of shortage of domestic saving.

9. The present model, instead of being confined to the supply of saving as the sole limiting factor, also

[4] They need to be taken into consideration, however, in cases where the estimation of the coefficients of the structural equations is based upon a small sample of continuous periods. The use of appropriate statistical methods minimizing the influence of short-term systematic disturbances on the estimates of the coefficients is essential.

considers the economy from the structural side. The uninterrupted process of development requires a balance between the supply and demand of consumer and capital goods. In industrial countries, where the inter-sectoral mobility of resources is typically high and the market mechanism adequate, the economy can be expected to move along an equilibrium path dictated by the pattern of demand. In the developing countries, the possibility of achieving such an equilibrium without appropriate measures or favourable external conditions is more remote. Essentially, this difficulty stems from the rigid and compartmentalized structure of the economy. Given a low degree of mobility of resources, it is indeed very unlikely that the pattern of demand emerging from the process of development can be adequately satisfied by the domestic sectors of economic activity. Foreign trade, however, can play an important role in this respect by absorbing excess supply and/or covering excess demand. Thus, the availability of foreign exchange derived either from exports of goods and services or from capital transfers, plays a key role during the period of transition in matching the composition of supply to the pattern of demand.

10. The argument can be summarized as follows: given a certain rate and pattern of development, the level of required investment expenditures can, other factors being given, be uniquely determined. Since the domestic capacity to produce capital goods is limited, a certain amount of the required investment goods has to be imported. At the same time, the growth of income will induce an increase in the demand for consumer goods, and probably some part of this increase has to be covered by imports. Of course, the proportions of consumer and capital goods that need to be covered by imports depend upon the stage of development; typically, the domestic sectors producing consumer goods develop first, thus freeing a proportion of foreign exchange for additional imports of capital goods. Finally, imports have to be financed, in the long run, either by exports or by capital transfers. Both these factors are largely — though by no means exclusively — determined by exogenous forces. In some countries, the increased demand for imports may be met for a time by making use of excess capacity in the export sector. In that case, investment can increase freely up to the level of available saving; the latter factor, therefore, by determining the level of investment, sets the upper limit to the rate of growth. Unfortunately, this case represents the exception rather than the rule. During the nineteen fifties, the majority of the developing countries have witnessed an excess of demand for imports over their capacity to pay. While this deficit has been covered temporarily by drawing down reserves, the choice they must eventually face is either to check the growth of imports for consumption, thus permitting investment to expand up to the level of the target rate of saving, or to cut down investment plans. While it is very difficult to draw general conclusions from the experience in the nineteen fifties, there seems to have been a tendency for Governments to cut down public investment projects in addition to restricting imports for consumption. It becomes evident, therefore, that an increase of capital transfers, or alternatively, improvement of the terms of trade, can significantly enhance the process of development by creating the possibility of ameliorating the imbalance between export earnings and import demand which is bound to persist during the period of transition.[5]

Equations describing the structure of the economy

11. The ideas outlined above can be illustrated by employing a simple model. First, it is assumed that there is an explicit relationship between gross domestic product, Q, and capital stock K: [6]

$$Q = f(K) \tag{1.1}$$

12. Before an explicit equation is chosen for the production function, a few general points may be appropriately noted:

(*a*) This production function is extremely aggregate in nature. Apart from the fact that it lumps together such diverse sectors as services, agriculture and manufacturing, it implicitly assumes that there is full utilization of productive capacity. Although in the long run such an assumption is not very restrictive, in the short run expansion of output can be achieved also by utilizing latent excess capacity. An increase, for example, in the demand for agricultural products can be met for a considerable period by a sustained increase in supply provided by under-employed resources, such as land and labour, and with a minimal capital expenditure. Attention should be drawn, therefore, to the fact that the term "growth of output" is used here to imply the normal growth of output coming only from expansion of productive capacity;

(*b*) A host of other factors, such as skilled labour, entrepreneurial ability, investment in education, and others, are entirely omitted from the production function. Although, admittedly, these factors are of key importance, lack of information at the present time makes it necessary to resort to a model which implicitly assumes that changes in these other factors will be correlated with changes in the stock of capital during the period of projection to the same degree as they were during the reference period;

(*c*) For purely statistical reasons, the capital stock is derived from estimates of gross domestic fixed capital formation which include residential construction. But even when residential construction is excluded, the measurement of capital stock still raises questions that have not yet been answered definitively. While such issues will have to be examined at a later stage, in this chapter the time series of capital stock are taken, for illustrative purposes only, as cumulative totals of the volume of fixed investment.

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[5] In the long run, import substitution policies can, of course, play an important role in closing this gap.

[6] For ready reference, the symbols used in this chapter are all brought together in table 3-1.

Table 3-1. List of variables,[a] parameters and constants used in chapter 3

Symbol	Variables (policy), parameters or constants
Q	Gross domestic product
K	Estimated capital stock
I	Gross domestic fixed capital formation
M_I	Imports of machinery and transport equipment
M_C	Imports of commodities other than machinery and transport equipment
M	Imports of commodities (total)
Z	Capacity to import
X	Exports of commodities to the rest of the world
X_A	Commodity exports to developed market economies (exports to zone A)
X_B	Commodity exports to centrally planned economies (exports to zone B)
Q_A	Volume index of production in developed market economies
E_1	Balance of services in current prices (excluding investment income from abroad)
E_2	Net investment income in current prices
C	Capital transfers in current prices (includes private and public donations, long-term public loans and private loans)
$\hat{C}$	Capital transfers in constant prices (includes private and public donations, long-term public loans and private loans)
S	Total saving
D^S	Domestic saving
p_x	Unit value of exports
p_M	Unit value of imports
k	Output-capital ratio
η	Proportion of gross fixed investment assumed for depreciation
λ_i	Denotes annual exponential rate of growth of a variable
β_i	Denotes the elasticity of the dependent variable with respect to the independent one
A_i	Denotes factor of proportionality
a_i	Signifies the constant term of a linear equation
b_i	Signifies the slope of a linear equation

[a] Unless otherwise stated, all variables are measured in millions of United States dollars and 1960 prices.

13. The choice of an explicit functional form between capital stock and output is of fundamental importance. Indeed, the growth potential of the developing economies depends critically upon whether the increase of output is in increasing, proportional or decreasing relationship with the investment efforts. Depending upon the stage of development, a case can be made to rationalize *a priori* all three theoretical possibilities. For example, if the economy is at the initial level of transition, where lumpy investments are required for the establishment of an economic infrastructure, one can reasonably anticipate a deepening of capital structure and, consequently, a decreasing output-capital stock ratio. On the other hand, if the economy has already passed the early stages of development the ratio of output to capital stock may well remain constant or even show a tendency to increase. The testing of these hypotheses, however, cannot be performed adequately with the data that are presently available. The time series of cumulative fixed investment and national product cover a period of only ten to twelve years, which is certainly too short to reveal slowly changing trends.[7] An inter-country study of the capital coefficients may shed some light on this aspect. For the purposes of this study, however, we make the simplifying assumption that the average productivity of capital is constant and therefore equal to the marginal productivity:

$$Q = kK, \tag{1.1a}$$

where k is the constant output-capital stock ratio. If it is further assumed that depreciation is a constant[8] proportion η of the total gross domestic fixed capital formation, I, the capital stock at time, t, will be:

$$K(t) = K(0) + (1-\eta)\int_0^t I(\tau)d\tau \tag{1.1b}$$

where $K(0)$ is the initial capital stock.

From equations (1.1*a*) and (1.1*b*) it follows that output can be expressed as a function of the cumulative gross fixed capital formation:

$$Q(t) = kK(0) + k(1-\eta)\int_0^t I(\tau)d\tau \tag{1.1c}$$

14. The constant term of the equation $kK(0)$ and the slope $k(1-\eta)$ can be estimated by fitting least squares; if one further assigns a numerical value either to the initial capital stock, $K(0)$, or to the depreciation coefficient, η, the constant output-capital ratio, k, can be readily calculated.

15. Turning now from the determination of output to the determination of fixed investment, it is assumed that the latter is associated with a specific volume of imports of capital goods (M_I):[9]

[7] The following example may illustrate how slowly this ratio may change: beginning with a capital stock of $250 billion, an annual output of $100 billion and, consequently, with an output-capital stock ratio of 0.4; the fraction of net output invested is assumed to be 10 per cent. An annual rate of growth of output of 4 per cent will leave the capital coefficient unchanged. A rate of growth of output of 6 per cent will increase this coefficient to 0.5 after a period of fifteen years, while a rate of growth of output of 2 per cent will reduce it to 0.32, after fifteen years. It can be seen, therefore, that the capital coefficient changes very slowly even if the rates of growth are altered drastically. In general, the output-capital stock ratio will approach asymptotically a value equal to the ratio of the annual rate of growth of net output and its fraction which is reserved for investment.

[8] This assumption is introduced here primarily for purposes of simplicity.

[9] In reality the direct import requirements are not restricted only to capital goods but also to intermediate commodities, such as base metals, iron and steel. Since a study on imports of intermediate commodities requires analysis at the sectoral level, this factor is omitted here.

$$I \quad \phi[M_I] \tag{I.2}$$

16. Since the above functional relationship introduces a feature of basic importance, it is worth-while explaining its major implications: the underlying assumption is that once imports of capital goods are determined, then the level of permissible fixed investment is given by relation (I.2). Thus, the model postulates that the inter-industry mobility of resources is so low that if imports of capital goods are fixed at a level which corresponds to a lower volume of investment than was planned *ex ante*, it is the level of investment that bears the brunt of adjustment.[10] For purposes of statistical measurement the relationship between imports of capital goods and fixed investment is assumed to be given here by the following linear approximation:

$$I \quad a_1 + b_1 M_I \tag{I.2a}$$

where $b_1 > 0$.

17. The direct import content of fixed investment is in increasing or decreasing relation with the level of investment depending upon the algebraic sign of the constant a_1. In general, if $a_1 < 0$, the ratio M_I/I would tend to *decrease* towards a value equal to $1/b_1$, as investment increases. Conversely, if $a_1 > 0$ the value $1/b_1$ represents the upper asymptote of the ratio M_I/I. In economic terms, the algebraic sign of the constant term a_1 indicates whether the domestic capital goods industry has expanded faster or lagged behind the level of investment activity during the period in which the structural coefficients a_1 and b_1 were measured.

Behavioural and policy functions relating to foreign trade

18. The relationships introduced so far describe the technical and structural aspects of the economy. Thus, equation (I.1*c*) shows the growth-generating capacity of investment, while equation (I.2*a*), by assuming a rigid but possibly improving economic structure, shows the degree of dependence of investment plans on foreign trade. The remaining functional relationships that will now be introduced describe behavioural and policy activities which are likely to take place within the framework of the economic structure described above. What must be explained now is how imports of capital goods, M_I, are determined. In the present model total imports are divided into two broad categories: imports of capital goods, M_I, and imports of consumer and intermediate goods, M_C. The level of total imports is equal — at least in the long run — to the capacity to import, Z. Finally, the demand for imports of non-capital goods is assumed to be a linear function of gross domestic product, Q. Hence, we have:

$$M_I = M - M_C \tag{I.3}$$

$$M \quad A_3 Z \tag{I.4}$$

where $A_3 = 1$

and

$$M_C \quad a_2 + b_2 Q \tag{I.5}$$

where $b_2 > 0$.

Equation (I.5) expresses a basic behavioural assumption of the model. It postulates that at a given level of economic activity there exists a specified demand for imports of consumer goods in final or intermediate form. It should be noted here that equation (I.5) is not an aggregate consumption function; rather, it connotes the requirements for imports of commodities other than capital goods at a given level of income. These imports could be either non-competing with or substitutes to the domestic production. Of course, the ratio of imports of these goods to total income need not remain unchanged. Indeed, if domestic production of consumer goods rises faster than the aggregate demand, the ratio M_C/Q will tend to decrease.[11] This case arises when $a_2 > 0$.

[10] This statement must be qualified slightly in cases where the domestic supply of construction materials is elastic. If, for example, intended financing of investment in machinery and equipment is frustrated by import restrictions, the loanable funds can be allocated in construction activities, such as residential buildings. From the point of view of its impact upon economic growth, however, this forced change in investment plans is comparable to an increase of expenditures on consumer durables.

[11] In order to clarify further the nature of equation (I.5), it is, perhaps, useful to start from an aggregate consumption function of the following form:

$$C = \alpha_1 + \beta_1 Q$$

where total consumption, C, is either imported, C_M, or produced domestically, C_D:

$$C = C_M + C_D$$

But in a simplified system, national income, Q, is equal to the sum of the value added in the consumer goods sector, $\bar{C}_D$, the capital goods sector, $\bar{I}_D$, and the export sector, $\bar{X}$:

$$Q = \bar{C}_D + \bar{I}_D + \bar{X}$$

As will be discussed later the prospects of the export sector are determined exogenously. Further, there is an implicit assumption in equation (I.2*a*) of the model that the capital goods industry expands at a certain relation with total investment. Hence, an increase in income implies *ceteris paribus* a certain increase in the production of consumables. For purposes of illustrating the argument, assume that the linear approximation of this relationship is of the following form:

$$C_D = \alpha_2 + \beta_2 Q$$

Then the aggregate consumption function reduces to an import function:

$$C_M = \alpha_1 + \beta_1 Q - \alpha_2 - \beta_2 Q$$

or

$$C_M = [\alpha_1 - \alpha_2] + [\beta_1 - \beta_2] Q$$

Therefore, the coefficients a_2 and b_2 of equation (I.5) could be considered as expressing the net effect of the consumer behaviour and the capacity of the consumer goods industry to expand in relation to total production.

VARIABLES DETERMINING THE CAPACITY TO IMPORT

19. Perusal of equations (I.1 to I.5) shows that the capacity to import plays a key role in determining the economic growth. Import capacity (Z) is defined to be equal to the import equivalent of net receipts of foreign exchange (excluding short-term capital movements and changes in foreign exchange reserves). Hence we have:

$$Z = \frac{P_x X}{P_M} + \frac{E_1}{P_M} + \frac{E_2}{P_M} + \frac{C}{P_M} \qquad (I.6)$$

where P_x = the unit value of export goods
P_M = the unit value of import goods
X = volume of export goods
E_1 = net services
E_2 = net factor income [remitted] from abroad
C = net long-term capital inflow

20. Equation (I.6) expresses the capacity to import in terms of parameters and variables that are influenced primarily by conditions existing outside the economic system of the developing countries. While an exhaustive analysis of these factors lies beyond the scope of the present paper, a few remarks may be presented here with respect to the functional relationships of the components.

21. *Export and import prices* are taken, at this stage of work, as parameters whose value can be significantly influenced by policy decisions. Obviously, the margin within which the value of these parameters can change is determined by the interplay of the forces determining the supply and demand of exports. Depending, however, upon the price elasticity of exports and the existence of close substitutes in the importing country, policy measures on the part of either the exporting or importing country may establish a price level different from that implied by the equilibrium of supply and demand, with limited effect on the quantity of exports.

22. With respect to the imports of developing countries, since these represent only a small portion of the total production in the rest of the world, it seems likely that prices will largely reflect the conditions governing the production cost in the developed and centrally planned economies. Again, as in the case of export prices, the actual prices paid for imports in the developing countries may be influenced to a considerable degree either by protective tariffs in the importing countries or by specific export policies in the rest of the world.

23. In view of the importance of export and import price movements, it will be necessary at a later stage of work to study this subject separately. Indeed, when the models of the major economic regions are integrated into an interlocking global economic system, these price parameters will need to be included along with other factors as the linking variables through which economic conditions are propagated from one region to another.

24. The *volume of exports* depends, among other things, upon the economic conditions prevailing abroad. If Q_A denotes the gross domestic product in the developed market economies, the demand for such exports (X_A) is assumed, as a first approximation, to be given by the following equation:

$$X_A = A_1(Q_A)^{\beta_1} \qquad (I.7)$$

where A_1 and β_1 are constants.

25. Exports to the centrally planned countries (X_B), are assumed to grow at a rate which is implied in the development plans of these economies:

$$X_B = A_2 e^{\lambda_1 t} \qquad (I.8)$$

where A_2 and λ_1 are constants. The total exports of the developing countries to the rest of the world are:

$$X_A + X_B = X \qquad (I.9)$$

26. According to equations (I.7) and (I.8), exports are demand-determined, the assumption being that the capacity to expand along the traditional lines of exports is perfectly elastic within the relevant range. This is certainly an over-simplification forced by the paucity of available data; but, for the group as a whole, it does not seem to violate any evidence to the contrary. Admittedly, these demand equations are extremely crude but further analysis belongs essentially to the domain of studies relating to the rest of the world.

27. *Net services* refer primarily to freight and insurance payments associated with imports. In the present model it is assumed, as a first approximation, that net services (E_1) depend linearly upon the volume of imports:

$$E_1 = a_3 + b_3 M \qquad (I.10)$$

where a_3 and b_3 are constants.

28. The choice of independent variables determining the *outflow of factor income* (mainly investment income), E_2, is a difficult one; it requires essentially a functional theory of long-term private capital movements. Obviously, such a study cannot be carried out at the level of the developing countries and without taking into consideration general economic conditions prevailing in the other two major groups of countries. At the purely empirical level, investment income seems to be highly correlated with export receipts. This is by no means a coincidence; it merely reflects the fact that the amount remitted abroad as investment income must bear some relationship to the level of profits. Since the bulk of foreign investment is allocated to export industries, export receipts can be used as a substitute variable for profits:

$$E_2 = a_4 + b_4(p_x X) \qquad (I.11)$$

where a_4 and b_4 are constants.

29. The flow of net capital — in current prices — is taken as a simple function of time (t), and of a policy parameter (P).

$$C \quad F(t; P). \tag{I.12}$$

While some of the components of the dependent variable, such as private long-term capital, are determined largely by conditions referring to behavioural functions of the private sectors in the rest of the world, it has not been possible to provide here separate functions for each of the components. Since one of the questions which long-term economic projections will have to answer is the probable share of these components in a given level of total capital transfers, this subject will require more detailed investigation at a subsequent stage.

Behavioural function relating to savings

30. In equilibrium, investment equals total saving supplied either by domestic or external sources. Hence we have:

$$S \quad I \tag{I.13}$$

$$S \quad \hat{C} + D^S \tag{I.14}$$

where S denotes total gross saving;

D^S denotes domestic saving; and

$\hat{C}$ refers to net capital inflow (foreign saving) in constant prices.

31. Finally, the planned level of domestic saving is taken to be a linear function of gross domestic product, with the marginal propensity to save (b) higher than the average propensity.

$$D^S \quad a_2 + b_2 Q \tag{I.15}$$

The overdeterminancy of the model and its economic implications

32. The above equations (*see* also table 3-2) have sketched the salient features of an aggregate model for the developing countries. By counting equations and unknowns it becomes apparent that the system is over-determined since the number of equations and identities exceeds the number of endogenous variables by one. Indeed, perusal of the equations of table 3-2 shows that the saving function — equation I.15 — is either redundant or incompatible with the other equations of the system.

33. Since this overdeterminancy of the system hinges upon an important thesis of the model, it may be useful to examine the underlying reasons more closely. As can be seen from table 3-2, the equations in group B describe the capacity to import and ultimately the permissible level of imports in terms of the exogenously determined factors, i.e., exports to the rest of the world X^* and long-term capital inflow C^*. By utilizing these values and substituting into equations of group C we obtain:

$$I = \alpha + b_1 Z^* - b_1 b_2 Q \tag{I.16}$$

where Z^* expresses the exogenously determined capacity to import; and

$$\alpha \quad a_1 \quad a_2 b_1 .$$

34. Since investment is identically equal to the sum of domestic and foreign saving (equations I.12 and I.13), the permissible level of *ex post* domestic saving (D^{S*}) is implied in equation I.16:

$$D^{S*} \quad \alpha + b_1 Z^* \quad b_1 b_2 Q \quad C^* \tag{I.17}$$

where

C^* is the exogenously determined level of capital inflow.

35. In most cases the permissible level of domestic saving, D^{S*}, emerging from (I.17), will not be consistent with the *ex ante* level of saving indicated by equation (I.15).[12] It appears, therefore, that the model offers two distinct possibilities. The first case arises when limitations on the availability of foreign exchanges impose an upper limit to the rate of growth of output while *ex post* domestic saving is adjusted to the level implied in equation (I.17). This possibility is incorporated in the equations of groups A, B and C of table 3-2; and for purposes of exposition, this case would be referred to as " foreign exchange limitations sub-model ". While the actual outcome may vary from country to country, the experience gained thus far [13] tends to suggest that more often than not the rate of growth has been critically influenced by the availability of foreign exchange in a manner similar to that sketched in the above crude sub-model. The supply of domestic saving in excess of that implied by foreign exchange restrictions (equation I.17) has been wiped out through changes in relative prices or speculative investment in non-productive resources (real estate, gold hoarding, etc.).

36. The basic thesis of the " foreign exchange limitations sub-model " can be summarized as follows: in a typical developing country, targets for raising the level of domestic saving and consequently of investment cannot be set independently of measures aiming at structural changes. A consistent development plan should provide for changes in the structure of production (implicit in equations I.2*a* to I.5) and/or in the external conditions determining Z and C so as to render feasible the transformation of planned domestic saving into investment programmes.

37. In contrast to the above sub-model, a second case may arise where the level of planned domestic saving (equation I.15) is realized while the imports and exports adjust themselves to the exogenously given level of capital inflow. This case, called henceforth " the simple saving-investment sub-model " implies that the structural rigidities incorporated in equations of group C are not valid and, therefore, the equations of groups B and C are irrelevant to the determination of the rate of development.

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[12] For discussion of this case, *see* technical note at the end of this section.

[13] *See*, for example, United Nations, *World Economic Survey, 1959* (Sales No.: 60.II.C.1).

Table 3-2. Description of an aggregate model

Group	*Number of equation in text*	*Equation or accounting identity*	*Endogenous variables*	*Exogenous variables*	*Structural parameters subject to change by policy measures* [a]	*Constants and proportionality factors* [a]
Group A ...	I.1*c*	$Q(t) = kK(0)+k(1-\tau_i)\int_0^t I(\tau)d\tau$	Q, gross domestic product I, gross domestic fixed capital formation		k, output-capital ratio τ_i, proportion of gross fixed investment assumed for depreciation	$K(0)$, capital stock in the base year
Group B ...	I.9	$X = X_A + X_B$	X, total exports to the world			
	I.7	$X_A = A_1(Q_A)^{\beta_1}$	X_A, commodity exports to developed market economies (zone A)	Q_A, volume index of production in developed market economies (zone A)	β_1	A_1
	I.8	$X_B = A_2e^{\lambda_1 t}$	X_B, commodity exports to centrally planned economies (zone B)		λ_1	A_2
	I.10	$E_1 = a_3+b_3M$	E_1, balance of services in current prices (excluding investment income from abroad)		b_3	a_3
	I.11	$E_2 = a_4+b_4(p_xX)$	E_2, net investment income in current prices	p_x, unit value of exports	b_4	a_4
	I.12	$C = F(t; P)$	C, long-term capital inflow in current prices	P, external factors and policy measures relating to capital inflow		
	I.6	$Z \equiv \frac{pxX}{P_M}+\frac{E_1}{P_M}+\frac{E_2}{P_M}+\frac{C}{P_M}$	Z, capacity to import	P_M, unit value of imports		
	I.4	$M = A_5Z$	M, imports of commodities			A_5
Group C ...	I.2*a*	$I = a_1+b_1M_I$	M_I, imports of machinery and transport equipment		b_1	a_1
	I.3	$M_I = M-M_C$	M_C, imports other than machinery and transport equipment			
	I.5	$M_C = a_2+b_2Q$	—		b_2	a_2
Group D ...	I.13	$S = I$	S, total saving			
	I.14	$S \equiv \hat{C}+D^S$				
	I.15	$D^S = -a_6+b_6Q$	D^S, domestic saving		b_6	a_6
TOTAL NUMBER		15	14	5		

[a] It should be noted that the delineation of "policy parameters" and "constants" is arbitrary. In this chapter, as is often the case in economic literature, it is assumed that policy measures will affect only the slope of the linear—or linearized—equation.

The equations relevant to this case which are included in groups A and D describe a system similar to the one referred to in economic literature as the Harrod-Domar model. It can be shown,[15] for example, that if the rate of growth of capital inflow is zero then output will tend to increase, at the limit, at a rate equal to the product of the marginal propensity to save, b_5, and the output-capital ratio $\bar{k}$. Capital inflow could accelerate the rate of growth above the one implied in the value of the product $\bar{k}b_5$. In fact, according to the "simple saving investment sub-model" the need of foreign assistance to the developing countries would be unambiguously measured by the difference between a desired rate of growth of output and the one indicated by the product $\bar{k}b_5$. Hence, given a desired rate of economic development, the lower the level of domestic saving and/or the marginal productivity of capital stock the higher the level of foreign assistance which would be required to sustain the development target.

38. The sharp and somewhat arbitrary delineation of these two cases can provide a useful basis for identifying the broad areas of economic policy which should accompany a programme for accelerating the pace of development. Indeed, use of the first sub-model will provide a first approximation of foreign exchange requirements needed to finance imports essential for economic growth in the absence of policy measures and structural changes. The second sub-model will yield a magnitude of capital inflow required to supplement the domestic saving target; in this case, it is assumed that all structural rigidities have somehow been removed.

39. As is shown in the technical note attached to this section, the results emerging from these two cases will — most likely — be incompatible with each other. The next step, therefore, should be to examine the changes which ought to be effected in the domestic structure of production or in the international environment in order to achieve consistency between foreign exchange needs and domestic saving targets. In the framework of an aggregative model, the most that can be done in this respect is merely to illustrate the order of magnitude of alternative policy measures. The choice of a specific set of feasible measures and their implementation can be pursued further only in the light of more detailed sectoral models and of specific development strategies of national governments.

Technical Note

As was noted in the text, the equations shown in table 3-2 incorporate two complete sub-models. This technical note sets forth the determinants of growth which arise in each of the two cases.

THE FOREIGN EXCHANGE LIMITATION SUB-MODEL (EQUATIONS OF GROUPS A, B AND C)

Let $Z^*(t)$, $C^*(t)$ and $X^*(t)$ be the predetermined levels of the capacity to import, long-term capital inflow and commodity exports, respectively. Then, from equation (I.4) we obtain:

$$M(t) = Z(t) \qquad (I.1')$$

for $A_3 = 1$.

By utilizing now the equations of groups A and C, fixed investment and output are determined as follows:

$$I_t = \alpha + b_1 M_0 e^{\lambda t} - b_1 b_2 [k\bar{k}(0) + \bar{k}\int_0^t I(\tau)d\tau] \qquad (I.2)$$

where

$\alpha = a_1 - a_2 b_1$

$\bar{k} = k(1-\eta)$

and

$M_0 e^{\lambda t}$ expresses the exogenously determined capacity to import as function of time.

$$\frac{1}{\bar{k}}\frac{dQ}{dt} + b_1 b_2 Q_t - b_1 M_0 e^{\lambda t} - \alpha = 0 \qquad (I.3')$$

By solving the above linear differential equation (I.3'), we obtain the following expression for Q_t:

$$Q_t = \frac{\alpha}{b_1 b_2} + \frac{(\bar{k}b_1 M_0)}{(\bar{k}b_1 b_2 + \lambda)} e^{\lambda t} + C_0 e^{-\bar{k}b_1 b_2 t} \qquad (I.4')$$

where C_0 is the constant of integration. Similarly, since

$$I = \frac{1}{\bar{k}}\frac{dQ}{dt}$$

we have:

$$I_t = \frac{\lambda b_1 M_0}{[\bar{k}b_1 b_2 + \lambda]} e^{\lambda t} - b_1 b_2 C_0 e^{-\bar{k}b_1 b_2 t} \qquad (I.5')$$

From solutions (I.4') and (I.5') it can be easily seen that for $t \to \infty$, the annual compound rate of growth of both output and fixed investment will tend to increase at a rate equal to that of the capacity to import, λ. Hence, the groups of equations A, B and C shown in table 3-2 describe a complete economic system. The completeness of this sub-system could be illustrated further by demonstrating the redundancy of equation (I.15). Indeed, since fixed investment is already determined through the import capacity (I.4) above and capital inflow, C_t^*, is a predetermined component of the import capacity, it becomes quite clear that the equilibrium *ex post* domestic saving, D_t^{s*}, is determined through identity (I.14). In fact by utilizing equations (I.2*a* to I.5), we may rewrite equation (I.14) as follows:

$$D^{S*}{}_t = \alpha + b_1 M_0 e^{\lambda t} - b_1 b_2 Q_t - C_t^* \qquad (I.6')$$

The permissible level of domestic saving, ${}_D{}^{S*}$, emerging from (I.6') may or may not be consistent with the *ex ante* level of saving indicated by equation (I.15). From this point of view it would be interesting to see what the value of the marginal propensity to save (b_5) should be in order to secure equality between *ex ante* (${}_D{}^S$) and *ex post* (D^{S*}) saving. In order to illustrate this point a simplified case may be visualized in which $C^* = 0$. Then, the value of the ratio D^{S*}/Q implied in equation (I.6') is:

$$\left(\frac{D^{S*}}{Q}\right) = \frac{b_1 M_0 e^{\lambda t}}{Q^t} - b_1 b_2 \qquad (I.7')$$

But according to equation (I.4') the ratio of imports to gross domestic product will approach asymptotically the value

$$\left[\frac{kb_1 b_2 + \lambda}{b_1 k}\right].$$

[15] *See* technica' note at the end of this section.

Hence equation (I.7') becomes:

$$\lim_{t\to\infty}\left(\frac{D^{So}_t}{Q_t}\right) = b_1 b_0 + \frac{\lambda}{\bar{k}} - b_1 b_0 \qquad (I.8')$$

or

$$\lim_{t\to\infty}\left(\frac{D^{So}_t}{Q_t}\right) = \frac{\lambda}{\bar{k}} \qquad (I.8'a)$$

The above equation shows that, at the limit, the ratio of permissible domestic saving to gross domestic product implied in the groups of equations A, B and C (*see* table 3-2) is equal to the ratio of the annual compound rate of growth of the capacity to import (λ) to the output-capital ratio $\bar{k}$. Thus, in this simplified case, if the increase of the capacity to import is say 4.5 per cent per annum and the output-capital ratio is equal to 0.3, then at the limit the ratio of saving to gross domestic product would be 0.15. Further, it is interesting to note that the parameters bounding the permissible level of saving with respect to output are of a non-behavioural nature. Indeed, the value of λ is determined by exogenous factors such as export prospects and net foreign borrowing. The value of $\bar{k}$ on the other hand reflects the capital productivity in the economy. Hence, consistency between realized saving and *ex ante* saving will be secured only in the purely coincidental case that the marginal propensity to save (b_0) is *chosen ex ante* to be equal to $\lambda/\bar{k}$, since from equation (I.15) we have:

$$\lim_{t\to\infty}\left(\frac{D^{S}}{Q}\right) = b_0 \qquad (I.9')$$

The simple saving-investment sub-model (equations of groups A and D)

Let $C_0 e^{\lambda_1 t}$ be the exogenously determined level of long-term capital inflow. Further, and under the assumption that imports and exports can be adjusted accordingly so that the planned level of capital inflow be realized, we obtain:

$$Q_t = kK(0) + \bar{k}\int_0^t [-a_0 + b_0 Q(\tau) + C_0 e^{\lambda_1 \tau}]d\tau \qquad (I.10')$$

and after differentiation with respect to t:

$$\frac{dQ}{dt} = -a_0\bar{k} + \bar{k}b_0 Q_t + C_0 e^{\lambda_1 t} \qquad (I.11')$$

The general solution of the above differential solution is given by:

$$Q_t = \frac{a_0}{b_0} + C_1 e^{\bar{k}b_0 t} + \frac{\bar{k}C_0}{(\lambda_1 - \bar{k}b_0)} e^{\lambda_1 t} \qquad (I.12')$$

where C_1 is the constant of integration.

In the simple case that the rate of growth of capital inflow is zero ($\lambda_1 = 0$), it can be easily seen that the limiting rate of growth of output would be equal to the product of the parameters $\bar{k}$ and b_0. A continuously increasing flow of foreign capital ($\lambda_1 > 0$) would help increase the level of output. The limiting value of the rate of growth of output in the latter case would tend to approximate the dominant root of equation (I.12'), i.e., the highest of the two values $\bar{k}b_0$ or λ_1.

Application of the model to the developing countries

40. The model presented in the first section has been built on a relatively small number of variables whose magnitudes can be measured with a tolerable degree of reliability for almost all developing countries. The relevant data for the nineteen fifties are shown in tables 3-3 to 3-7.[18] The numerical values of the structural parameters of the model have been estimated by using ordinary least squares to the available time series. For purposes of statistical convenience, the model explained above was modified and expanded slightly.

Firstly, the production function used is of the following form:

$$Q_t \quad kK(0) + k(1 \quad \eta)\sum_{t=0}^{t-1} I_t \qquad (II.1)$$

where t 0 for the year 1950.

Second, the dependent variables of equations (I.5) and (I.7) have been further broken down into the following major commodity categories:

- Imports from the rest of the world, (M_{01}) and exports to the developed market economies (X_{01}) of foodstuffs including commodities of Standard International Trade Classification (SITC) sections 0 and 1;
- Imports from the rest of the world, (M_{24}) and exports to developed market economies (X_{24}) of agricultural raw materials and ores including commodities of SITC sections 2 and 4;
- Imports from the rest of the world, (M_{30}) and exports to developed market economies (X_{30}) of fuels including commodities of SITC section 3;
- Imports from the rest of the world, (M_{50}) of chemicals including commodities of SITC section 5;
- Imports from the rest of the world, (M_{68}) of other manufactures and base metals, including commodities of SITC sections 6 and 8;
- Exports to the developed market economies, (X_{568}) of manufactures and base metals, SITC sections 5 to 8.

The corresponding stochastic equations used are as follows:

$$\left.\begin{aligned} M_{01} &= a_{01} + b_{01}Q \\ M_{24} &= a_{24} + b_{24}Q \\ M_{30} &= a_{30} + b_{30}Q \\ M_{50} &= a_{50} + b_{50}Q \\ M_{68} &= a_{68} + b_{68}Q \end{aligned}\right| \qquad (II.2)$$

and

$$\left.\begin{aligned} \log(X_{01}) &= \log(A_{01}) + \beta_{01}\log(Q_A) \\ \log(X_{24}) &= \log(A_{24}) + \beta_{24}\log(Q_A) \\ \log(X_{30}) &= \log(A_{30}) + \beta_{30}\log(Q_A) \\ \log(X_{568}) &= \log(A_{568}) + \beta_{568}\log(Q_A) \end{aligned}\right| \qquad (II.3)$$

[18] These tables show estimates in billions of United States dollars; the numerical values of the parameters obtained by the method of least squares are based on unrounded figures of the variables in millions of United States dollars.

Table 3-3. Developing countries: gross domestic product, 1950-1960

(Billions of dollars at 1960 prices and exchange rates)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Grand total	110.3	115.2	119.8	125.3	132.7	137.9	143.3	149.7	155.7	160.8	169.8
Latin America	39.1	41.7	42.9	43.8	47.1	49.4	51.1	54.9	56.9	58.3	61.4
Africa	18.1	19.1	19.9	20.6	21.8	22.3	23.4	24.1	25.1	25.9	27.0
Far East	45.2	46.8	48.7	51.9	54.2	55.9	58.0	59.5	62.0	64.2	68.3
Middle East	6.6	6.4	7.0	7.6	8.2	8.7	9.0	9.2	9.8	10.4	10.9
Other [a]	1.2	1.3	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2

SOURCE: Bureau of General Economic Research and Policies of the United Nations Secretariat, based on data from United Nations *Yearbook of National Accounts Statistics* and from national sources.

[a] Jamaica, Trinidad and Tobago, other dependent territories in Central and South America.

Table 3-4. Developing countries: gross domestic fixed capital formation, 1950-1960

(Billions of dollars at 1960 prices and exchange rates)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Total	15.7	17.1	17.6	18.1	19.9	21.5	22.7	24.4	24.8	25.2	26.9
Latin America	6.6	7.1	7.4	7.5	8.4	8.7	9.0	9.4	9.7	9.5	10.0
Africa	3.0	3.3	3.3	3.5	3.5	3.8	3.8	3.8	4.0	4.1	4.5
Far East	5.2	5.6	5.8	6.0	6.6	7.3	8.1	8.9	8.7	9.0	9.8
Middle East	0.6	0.7	0.7	0.7	0.9	1.1	1.3	1.4	1.6	1.8	1.9
Others [a]	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.8	0.8	0.8	0.6

SOURCE: Bureau of General Economic Research and Policies of the United Nations Secretariat, based on data from United Nations *Yearbook of National Accounts Statistics* and from national sources.

[a] See footnote [a] in table 3-3.

Table 3-5. Developing countries: gross domestic capital formation and crude estimates of its finance, 1950-1960, in 1960 prices and exchange rates

(Billions of dollars)

Item	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
1. Gross domestic capital formation, total	16.0	18.9	18.9	18.8	21.6	22.6	24.4	25.2	26.4	26.9	28.4
1*a*. Gross domestic fixed capital formation	15.7	17.1	17.6	18.1	19.9	21.5	22.7	24.4	24.8	25.2	26.9
1*b*. Changes in stocks	0.3	1.8	1.3	0.7	1.7	1.2	1.7	0.8	1.6	1.7	1.5
2. Gross saving, total	16.0	18.9	18.9	18.8	21.6	22.6	24.4	25.2	26.4	26.9	28.4
2*a*. Foreign saving [a]	1.1	3.4	3.1	1.6	2.6	3.0	4.1	5.7	4.2	3.4	4.3
2*b*. Gross domestic saving [b]	14.9	15.4	15.8	17.2	19.0	19.6	20.3	19.5	22.2	23.4	24.1

SOURCE: See table 3-3.

[a] Foreign saving in 1960 prices — imports of goods and services deflated by imports price index—exports of goods and services deflated by exports price index—investment income from the rest of the world deflated by export price index.

[b] Derived residually.

Table 3-6. Developed market economies: imports (f.o.b.) from developing countries and gross domestic product, 1950-1961, in 1960 prices and exchange rates

(Billions of dollars)

Item	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Commodity imports (f.o.b.) from developing countries, total	13.3	13.3	13.0	14.5	14.9	15.8	17.0	17.1	17.5	18.9	19.7	20.4
Of which:												
Foodstuffs	4.6	4.7	4.5	5.3	5.0	5.3	5.8	5.6	5.8	6.1	6.2	6.0
Agricultural raw materials and ores	4.9	4.5	4.4	5.1	5.1	5.3	5.5	5.3	5.3	5.8	5.7	6.0
Fuels	2.0	2.4	2.5	2.7	3.0	3.4	3.7	3.9	4.4	4.7	5.2	5.6
Manufactures and base metals	1.6	1.6	1.4	1.4	1.6	1.8	1.8	2.0	1.9	2.3	2.5	2.7
Gross domestic product	621.8	665.3	693.4	724.4	729.7	782.1	807.9	832.0	831.5	883.0	920.1	951.4

SOURCE: The series of commodity imports are derived from table 41 of United Nations, "Handbook of international trade statistics" (document E/CONF.46/12/Add.1). Estimates of gross domestic product have been prepared by the Bureau of General Economic Research and Policies of the United Nations Secretariat on the basis of United Nations *Yearbook of National Accounts Statistics* and national sources.

Table 3-7. Developing countries: commodity exports (f.o.b.) from the rest of the world to developing countries by major commodity groups, 1953-1960, in 1960 prices and exchange rates

(Billions of dollars)

Item	1953	1954	1955	1956	1957	1958	1959	1960
Total	15.1	16.9	17.8	19.9	21.8	21.1	20.6	22.5
Foodstuffs	2.1	1.9	2.0	2.4	2.6	2.8	2.8	3.2
Agricultural raw materials and ores	0.5	0.6	0.6	0.7	0.8	0.8	0.8	1.1
Fuels	0.5	0.6	0.5	0.6	0.6	0.7	0.6	0.6
Chemicals	1.1	1.2	1.4	1.5	1.7	1.7	1.9	2.1
Machinery and transport equipment	5.2	5.6	6.1	7.1	8.0	7.7	7.3	7.9
Other manufactures and base metals	5.0	5.8	6.4	6.7	7.5	6.9	6.6	7.2

SOURCE: The series are derived from United Nations, "Handbook of international trade statistics" (document E/CONF.46/12/Add.1), tables 28 and 41.

where Q_A is gross domestic product of zone A and a, b, A and β are structural parameters to be estimated.

Thirdly, equation 1.2*a* was rewritten as follows:

$$\left.\begin{aligned} M_I &= \frac{a_1}{b_1} + \frac{1}{b_1} I \\ \text{or} \\ M_I &= \hat{a}_1 + \hat{b}_1 I \end{aligned}\right| \qquad \text{(II.4)}$$

While this permutation facilitates the exposition of the statistical results later on, the estimates of the coefficients in this case are only slightly affected by the reversal of the order of dependent-independent variables.

41. It should be emphasized that the estimation of the coefficients was attempted for purposes of illustrating the structure of the economies on a crude basis only. Among the factors which tend to reduce the reliability of the estimates presented in this part the following deserve special mention:

(i) First, all developing countries are lumped together and are treated as one economic unit. While such a method provides a bird's-eye view of the general conditions prevailing in the developing countries, the bias introduced by summing heterogeneous groups seems to be of such an order of significance as to make a lower level of aggregation essential. The major lines of the intended disaggregation of the developing countries into sub-groups are indicated in appendix B.1 to this chapter.

(ii) Secondly, the estimates have been derived from observations covering a short period (1950-1960) of ten to eleven years; hence, they are influenced by short-term cyclical phenomena. In many instances, the numerical value of a parameter may change significantly if one or two "exceptional" years are excluded from the sample.

(iii) Thirdly, the time series of the variables may be subject to significant errors of measurement. While an effort has been made to minimize this type of error, the time series shown in tables 3-3 to 3-7 should, nevertheless, be taken only as rough approximations of the true facts.

(iv) Lastly, use of single-equation least squares methods implies that the explanatory variables were treated as truly independent while in fact they are linked together through identities. However, unbiased estimation of the structural parameters of the complete system including the identities would have called forth a substantial expansion of the number of exogenous variables in each stochastic equation. It is questionable, however, whether benefits of higher statistical efficiency arising from such extension of the model would have outweighed the disadvantages which would have been introduced by the drastic reduction in the number of degrees of freedom of this small sample.[16]

42. The estimates of the parameters are shown in table 3-8. The standard errors of the coefficients are listed in parentheses below each coefficient and R^2 denotes the value of the coefficient of determination. As a measure of serial correlation in the residuals the Von Neumann statistic, δ^2/Z^2, is used. For samples of sizes 8, 10 and 12 there is no significant auto-correlation at the 5 per cent level, if the values of δ^2/Z^2 fall between the limits 1.123 to 3.4486, 1.180 to 3.264 and 1.23 to 3.134 respectively.[17]

THE PRODUCTION FUNCTION (EQUATION 1.1*c*)

43. The time series of gross domestic product and gross domestic fixed capital formation which are required for the estimation of the parameters of the production function are shown in tables 3-3 and 3-4. As may be seen from table 3-8, the fit obtained for the regression line is very good and the numerical estimates of the coefficients are:

$$\left.\begin{array}{ll} kK(0) & 111.8 \\ k(1-\eta) & 0.28 \end{array}\right\} \qquad (11.5)$$

If we assume that, on the average, net investment is two-thirds of gross investment,[18] the output-capital stock ratio (k) will be 0.42 or its inverse $1/k$ 2.4. Applying this coefficient to the estimated value of the constant term of $111.8 billion, we obtain the figure of $266 billion as an approximate estimate of the total capital stock of these countries for the same year.

44. Since the data are classified by major regions, it is of some interest to see whether the capital-output ratio varies significantly among the major groups of the sample. As may be seen from the following table, the differences are indeed of significant order.

Region	*Constant term* $kK(0)$ *	*Slope* $k(1-\eta)$	*Coefficient determination* R^2
Zone total	111.8	0.28 (0.0060)	0.996
Latin America . . .	39.4	0.27 (0.0086)	0.992
Africa	18.5	0.24 (0.0037)	0.998
Far East	46.3	0.30 (0.0127)	0.986
Middle East	6.7	0.41 (0.0328)	0.951
Others	1.2	0.20 (0.0113)	0.975

* The variables are measured in billions of dollars.

45. While the estimates of these parameters fall within the margin of what might normally be expected, they should be taken as simply suggestive of the actual situation. Indeed, errors of measurement of the dependent and independent regional variables may account to a considerable degree for the difference of the values of the estimated slope. Thus, while the value of the slope increases roughly as the regional income per capita increases, it should be also noted that the estimates of this coefficient were lowest in the regions with incomplete statistical coverage such as Africa and "others".

THE IMPORT DEMAND FUNCTIONS (EQUATIONS 1.2*a* AND II.2)

46. As can be seen from table 3-8 the fit of these equations is fairly good. The salient features of these

[16] The difficulty in adopting more efficient statistical techniques, such as indirect least squares, or two stage least squares, etc. arises from the fact that some of the structural parameters are over-identified. Technically, this over-identifiability can be removed by introducing new exogenous variables in the stochastic equation. However, such an extension of the model would have reduced the degrees of freedom of the stochastic equations to about 6. For the general problem of identification of structural parameters in a complete economic system, *see*, for example, W. Hood and T. Koopmans, ed., *Studies in Econometric Method* (John Wiley and Sons, Inc., New York, 1953).

[17] The values are taken from a table produced by B. I. Hart, "Significance levels for the ratio of the mean square successive difference to the value", in *Annals of Mathematical Statistics*, vol. 13, No. 4, 1942, page 446.

[18] This assumption is based on the observed relation between net and gross fixed investment in twenty-five countries accounting for 60 per cent of total investment in the developing countries.

Table 3-8. Numerical values and regression analysis of the stochastic equation of the model

Number of equation in the text	*Dependent variable*		*Constant term*	*Coefficient of independent variable*	*Independent variable*	*Coefficient of determination R^2*	*Period covered*	*Ratio of the mean square successive difference to the variance $\delta^2 Z^1$*
Group of equations A								
I.1c . . .	Q_t,	GDP	111,783	0.280 (0.006)	$\sum_{t=0}^{t-1} I_t$, cumulative lagged fixed investment	0.996	1951-1960	1 296
Group of equations C								
II.4 . . .	M_t,	imports of capital goods	1,158	0.350 (0.049)	I, GDFCF	0.896	1953-1960	1.246
II.4a . . .	M_{a1},	imports of foodstuffs	1,763	0.029 (0.005)	Q, GDP	0.868	1953-1960	1.958
II.4b . . .	M_{a2},	imports of agricultural raw materials and ores	858	0.011 (0.001)	Q, GDP	0.915	1953-1960	1.967
	M_{a3},	imports of fuels	252	0.002 (0.001)	Q, GDP	0.693	1953-1960	3.414
	M_{a4},	imports of chemicals	1,710	0.023 (0.002)	Q, GDP	0.963	1953-1960	2.797
	M_{a5},	imports of manufactures and base metals	394	0.042 (0.013)	Q, GDP	0.634	1953-1960	1.196
Group of equations D								
I.15 . . .	D^S,	gross domestic saving	2,751	0.160 (0.011)	Q, GDP	0.961	1950-1960	2.318
Group of equations B[a]								
II.3a . . .	X_{a1},	exports to zone A of foodstuffs	−1.14009	0.830 (0.088)	Q_A, GDP of zone A	0.899	1950-1961	2.579
II.3b . . .	X_{a2},	exports to zone A of agricultural raw materials and ores	0.12344	0.610 (0.111)	Q_A, GDP of zone A	0.752	1950-1961	2.057
II.3c . . .	X_{a3},	exports to zone A of fuels	−11.04472	2.475 (0.088)	Q_A, GDP of zone A	0.987	1950-1961	2.461
II.3d . . .	X_{a45},	exports to zone A of manufactures and base metals	−4.95620	1.395 (0.280)	Q_A, GDP of zone A	0.775	1950-1961	0.657

Note: Time (t) is measured in units of calendar years and unless otherwise stated, $t = 0$ for 1950; the subscript t is omitted in cases where it is easily implied. The variables are measured in millions of United States dollars in 1960 prices and exchange rates.

a All variables and constant term expressed in logarithms.

estimates is that they imply – on the average – an income elasticity of import substantially higher than one.[19] An important exception to this rule is the case of manufactures other than chemicals and machinery. In theory

[19] In these equations as in all equations of linear form the income elasticity of imports of group i is given implicitly:

$$e_i = \frac{Q \Delta M_i}{M_i \Delta Q}$$

Thus, in a linear equation of the form $M_i = a_i + b_i Q$ the elasticity is given by the following expression:

$$e_i = \frac{1}{\frac{a_i}{b_i Q} + 1}$$

If the constant term is negative then the income elasticity would tend to decrease asymptotically towards a value equal to unity.

By applying the above definition, the elasticities of imports by the end of the period are:

Foodstuffs	1.6
Agricultural raw materials and ores	1.9
Fuels	0.6
Chemicals	1.8
Machinery and other equipment (with respect to gross domestic fixed capital formation)	1.1
Other manufactures and base metals	0.9

the relatively low income elasticity of these imports may be due to two factors. The first possibility is that the rate of growth of domestically produced manufactures exceeds the growth of the domestic demand. A second possibility is that domestic policies have been, on the average, successful in improving the share of imports of other commodities to the limited supply of foreign exchange at the expense of an *ex ante* planned level of imports of these manufactures higher than the one actually observed. While at the present level of country aggregation it is not possible to discern the major contributing factors, there is some evidence that both factors have been at work during the period under review.

47. Another striking example emerging from these estimates relates to the imports of foodstuffs, which have shown an exceptionally high income elasticity. It should be mentioned, however, that these estimates have been influenced to a large extent by the rapid increase of imports of foodstuffs under the United States Public Law 480. Such imports accounted for about 30 per cent of total imports of foodstuffs in 1960 as against 20 per cent in 1955. Undoubtedly part of the imports financed under this system would have been imported even in the absence of this programme of assistance; but at the same time there seems to be some validity to the argument that at least part of these imports did not represent a genuine component of *ex ante* market demand.

The demand of imports into the developed market economies (equation II.3)

48. In contrast to the experience of imports into the developing countries, their major exports to the developed market economies have shown a pronounced tendency to lag behind the latter's growth of gross domestic product. Foodstuffs and agricultural raw materials which together account for more than 50 per cent of total exports have been particularly affected. Their income elasticities were found to be 0.83 and 0.61 respectively.[90]

49. At the other extreme fuels have been showing a tendency to rise rapidly. Special studies on the prospects of fuel demand in the developed countries have concluded, however, that the future income elasticity may be significantly lower than the one observed in the nineteen fifties. The hypothetical projections shown in the next part are based on the assumption that the future income elasticity of fuel imports would be 1.40 rather than 2.47.[91]

50. Exports of manufactures and base metals show an elasticity of about 1.4 in relation to income of the importing developed countries. It should be noted, however, that even if these exports continue to expand rapidly it is only in the long run that their effect would become significant to the rate of growth of total exports, since these exports accounted for about 13 per cent only of the total. In addition, the acceleration of exports of manufactures to developed countries depends to a large extent upon the future trade policies of the latter countries.[92]

Exports to the centrally planned economies (equation I.8)

51. Although exports from the developing countries to the centrally planned economies are comparatively small, they have been increasing quite rapidly in recent years.[93] In this case past experience is inadequate to indicate the future course of events which will be influenced by decisions of the planning authorities in the centrally planned economies. Since information on such targets for the future is not available, it is assumed that the ratio of exports from the developing countries to the centrally planned economies to the total trade turnover of the latter economies would remain the same as in 1960. Under these assumptions and on the basis of information available on the trade turnover targets it appears that the exports from the developing countries to the centrally planned economies would reach the level of $2.7 billion in 1970 and $3.8 billion in 1980 as against $1.3 billion in 1960.[93]

The domestic saving function (equation I.15)

52. As can be seen from table 3-8 the estimated marginal propensity to save is 0.16 and is higher than the average propensity to save. Since the time series of gross domestic saving were derived as a residual from the investment-saving identity it follows that the estimates of the parameters of the saving function may have been influenced by significant errors of measurement. The derived marginal propensity to save and the implied average propensity should, therefore, be taken only as very rough approximations.

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[90] In equations of the form $X_i = A_i(Q_A)^{\beta_i}$ the income elasticity is constant and equal to the value of β_i:

$$e_i = \frac{X}{Q}\frac{\Delta Q}{\Delta X} = \beta_i$$

[91] The estimate of elasticity 1.40 is implicit in United Nations *Economic Survey of Europe in 1960* (Sales No.: 61.II.E.1).

[92] For a discussion of this problem, *see* United Nations, "Measures for the expansion of markets of the developed countries for exports of manufactures and semi-manufactures of developing countries" (document E/CONF.46/6), reproduced in *World Economic Survey, 1963*.

[93] *See* United Nations, "Past trade flows and future prospects for trade between the centrally planned economies and developing countries" (document E/CONF.46/35).

Other variables of the system

53. For purposes of the illustrative examples shown in the next part two more estimates are needed, i.e., changes in stocks and net payments for services (including investment income). The available series of both variables are rather crude and inadequate for statistical analysis. Thus, instead of treating them as endogenous variables it was chosen to estimate their future trends on rather arbitrary bases. Specifically, changes in stocks were assumed to be one per cent of gross domestic product. This ratio represents the average experience in the nineteen fifties.

54. Net services and investment income were derived on the basis of past experience in the major regions comprising the group of developing countries. The figures [24] used in the hypothetical projections of the next part should be understood only as crude approximations.

Verification and accuracy analysis of the model

55. The previous two sections have dealt with the fit of each equation. If the models consisted of only one equation, the predictive quality of the model would, of course, have coincided with the standard error of estimate of the equation itself. In the present case, however, the predictions are of a " higher order " since predictions have to be made on the basis of predictions of other quantities. Before proceeding to project the system forward, it is necessary therefore to see to what extent the whole system of interdependent variables " explains " the past. The results of such a verification test are shown in tables 3-9 and 3-10.

56. Since the model is intended to be used for estimation of foreign exchange requirements under a given development target, the " predictive " value of the system of equation was tested by estimating the values of the endogenous variables in the following manner: the lagged cumulative investment and fixed investment at time period, t, were taken as the explanatory variables. Then by using equation (I.2*a*) the value of output was estimated; these estimates were in turn used to predict total imports by use of equations II.2 and II.4 and domestic saving through equation (I.15). This procedure provides a test on the predictive power of the model since it can reveal any systematic bias which may be introduced through the cumulative effects of estimation errors. In this case where predictions of imports or saving are based on the predicted value of output the estimates may be considered as predictions of " second order ".

57. With respect to exports there seems to be no need for verification since they depend directly on an exogenous variable, namely, the output of developed market economies. The fit of these regressions was of sufficiently high order so as to warrant their use for projections of export proceeds.

58. As can be seen from tables 3-9 and 3-10 and from diagrams 3-1 to 3-3, the model describes rather faithfully

[24] United Nations, " Trade needs of developing countries for their accelerated economic growth " (document E/CONF.46/58), technical appendix, reproduced in *World Economic Survey, 1963*.

Table 3-9. Observed and " second order " predicted values of gross domestic product imports and domestic saving, 1950-1961

(Millions of dollars in 1960 prices and exchange rates)

Year	Observed lagged cumulative investment $\sum_{t-30}^{t-1} I_t$ and fixed investment I_t used as predetermined variables		Gross domestic product		Total imports (SITC 0 to 8)		Domestic saving	
	$\sum_{t-30}^{t-1} I_t$	I_t	Actual	Predicted	Actual	Predicted [a]	Actual	Predicted
1950	...	15,699	110,260	...	(12,483) [b]	(12,331) [c,d]	14,882	(14,780) [d]
1951	15,699	17,065	115,202	116,182	(15,816) [b]	(13,435) [c]	15,443	15,722
1952	32,764	17,619	119,816	120,963	(14,853) [b]	(14,137) [c]	15,796	16,482
1953	50,383	18,112	125,330	125,900	14,411	14,833	17,237	17,267
1954	68,495	19,939	132,744	130,975	15,683	16,010	19,013	18,074
1955	88,434	21,464	137,851	136,562	17,088	17,135	19,621	18,962
1956	109,898	22,666	143,306	142,576	18,947	18,193	20,302	19,919
1957	132,564	24,381	149,684	148,927	21,192	19,464	19,497	20,928
1958	156,945	24,814	155,699	155,759	20,447	20,340	22,190	22,015
1959	181,759	25,217	160,849	162,712	20,169	21,218	23,482	23,120
1960	206,976	26,867	169,829	169,778	22,017	22,543	24,049	24,244
1961	233,843	(28,050) [e]	...	(177,306) [c]	(22,634) [b]	(23,755) [c]	...	25,441

[a] Summation of predicted imports by major groups shown in table 3-10.

[b] Rough estimates based on Statistical Office of the United Nations *Monthly Bulletin of Statistics*, January 1964, special table B, p. xii. These estimates were excluded from the sample.

[c] Predictions for years excluded from the sample used for calculating the regression equations.

[d] Estimates based on observed figures of explanatory variables.

[e] Preliminary estimate.

Table 3-10. Actual and predicted values of imports by major commodity groups, 1950-1961

(Millions of dollars in 1960 prices and exchange rates)

Year	M_1 Imports of capital goods of machinery and transport equipment		M_{0+1} Imports of foodstuffs		M_{2+4} Imports of agricultural raw materials and ores		M_3 Imports of fuels		M_5 Imports of chemicals		M_{6+8} Imports of manufactures and base metals	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
1950	...	4,329	...	1,411 [a]	...	337 [a]	...	500 [a]	...	771 [a]	...	4,983 [a]
1951	...	4,806	...	1,582	...	401	...	513	...	904	...	5,229
1952	...	5,000	...	1,720	...	453	...	524	...	1,012	...	5,428
1953	5,178	5,172	2,138	1,862	484	507	534	535	1,056	1,123	5,021	5,634
1954	5,604	5,811	1,855	2,008	606	562	559	547	1,247	1,237	5,812	5,845
1955	6,096	6,344	1,979	2,169	630	622	547	559	1,446	1,363	6,390	6,078
1956	7,080	6,764	2,370	2,342	736	688	565	573	1,527	1,498	6,669	6,328
1957	8,013	7,363	2,614	2,525	758	756	588	587	1,728	1,641	7,491	6,592
1958	7,656	7,515	2,764	[illegible]	758	830	650	602	1,733	1,795	6,886	6,877
1959	7,345	7,656	2,815	[illegible]21	848	906	578	618	1,942	1,951	6,641	7,166
1960	7,885	8,232	3,200	3,125	1,050	982	642	634	2,085	2,110	7,155	7,460
1961	...	8,646	...	3,342	...	1,064	...	651	...	2,279	...	7,773

a Predicted figures in parentheses are estimated by using the observed values of the explanatory variables.

the actual path of the economies during the nineteen fifties. The maximum error on the estimation of output occurs in 1959 where the "predicted" value exceeded the actual performance by about one per cent. The maximum error of the second order predictions refer to the trade cycle year of 1957 where total imports were overestimated by 1.7 billion while domestic saving was underestimated by nearly the same amount.

59. Obviously this test is of limited power since it limits itself to a structure which is included in the sample. From this point of view it is of special interest to see how the system predicts total imports for the years 1950-1952 and 1961. These years were excluded from the sample because of inadequate coverage of the component groups, but estimates of total imports are available. As can be seen from table 3-9 the model predicts with high degree of accuracy the actual levels of imports for the years 1950, 1952 and 1961. As might be expected the year 1951, which was strongly influenced by the events of the Korean hostilities, showed a performance of imports "unpredictable" by the "normal" structure of the economies during the nineteen fifties.

60. While the discrepancies between predicted and realized values are of small order, there is still another final test of verification to which the system must be subjected. This test refers to the nature of the forecasting errors. Ideally, we would like to have exact predictions; but if errors exist, it is important to know their nature. If, for example, the errors, no matter how small, show a systematic pattern, the model presents an inadequate reflection of the systematic forces operating on the economy; consequently, if the system is projected beyond the observed sample, the unexplained errors may become so important as to invalidate the predictive power of the model.

61. The model has been subjected to this additional test, and the results have indicated that the forecasting errors are attributable to short-term phenomena of no importance to long-term models. Results of the test and description of the methods used are presented in appendix A.1.

Prospects and scope of policy measures in the framework of the aggregative model; illustrative examples

62. As was shown in the previous section, the model appears to be consistent with the historically observed behaviour of the developing countries. None the less, projections derived from past experience cannot be made in a mechanical way. This is particularly true in the case of the present model where the policy parameters are not included in the predicted values. Thus, the tentative projections presented in this section do not constitute predictions of future events but linear extensions of the historical structure. In principle any one of the variables of the system may be singled out for projection: we may, for example, project the rate of growth of output for given values of the exogenous variables and policy parameters. Alternatively — and this is the approach adopted here — the system may be solved to show the values that a policy parameter would have to take in order to achieve a target rate of growth. The purpose of this exercise is twofold: first, to discuss the differences which may conceivably arise in this respect between saving targets and foreign exchange requirements and, secondly, to discuss alternative policy measures which could contribute towards closing this gap.

Extrapolation of past trends and illustrative requirements for fixed investment, saving and foreign trade

63. Before considering the conditions necessary to achieve a target rate of growth, it is instructive to consider the saving and foreign exchange that will be needed by

Diagram 3-1. Relationship between observed and predicted values of gross domestic product

(Billions of dollars)

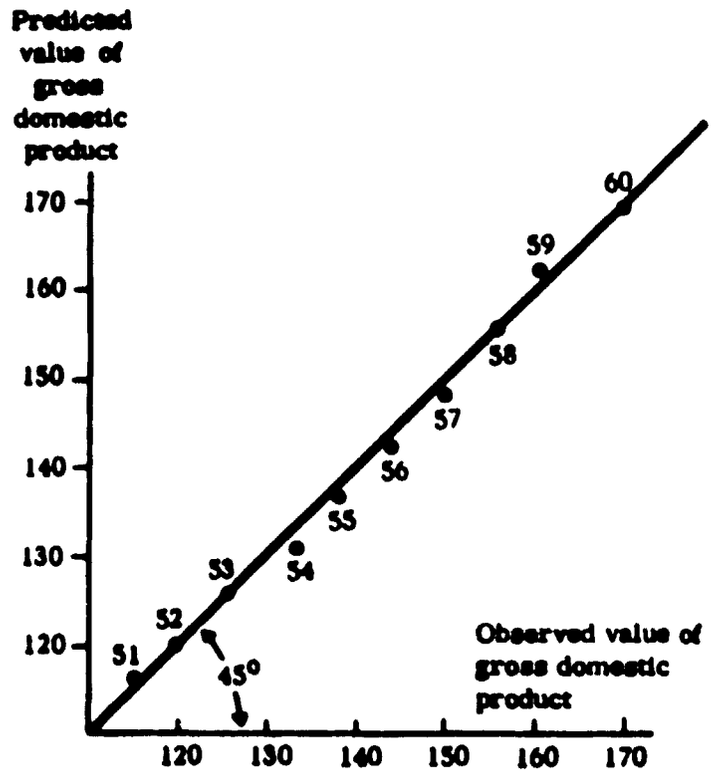
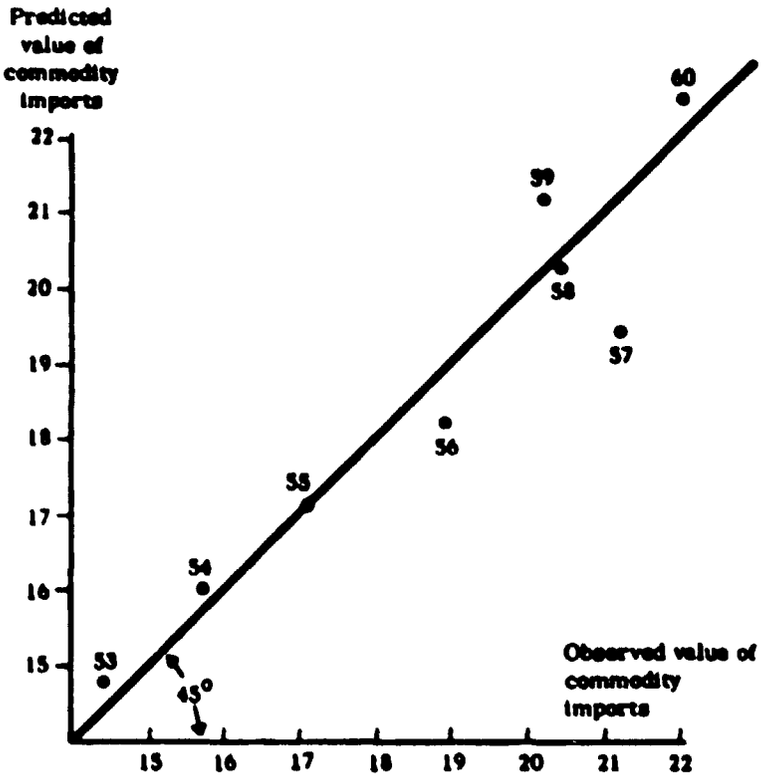


Diagram 3-2. Relationship between observed and predicted values of commodity imports

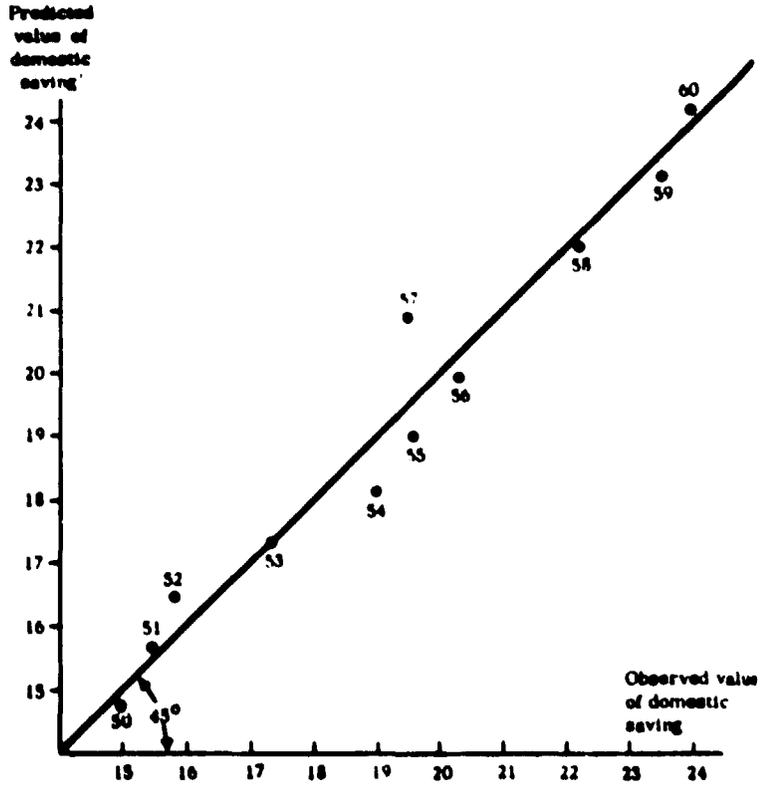
(Billions of dollars)



the end of the decade merely to maintain the trend rates observed in the nineteen fifties. The results of these preliminary projections of requirements to maintain the trend rate of growth are summarized in tables 3-11 and 3-12.

Diagram 3-3. Relationship between observed and predicted value of domestic saving

(Billions of dollars)



64. Under the specifications of the model, investment is assumed to increase at the same rate as output. Thus, under the assumptions made, the proportion of gross domestic product allocated to investment would remain constant at a level of 16 per cent. At the same time, if domestic saving were to increase in relation to gross domestic product in the same manner as in the past, there would be no need for an increase in external financing. In fact, since the marginal propensity to save (from equation I.15) is higher than the average propensity, a larger proportion of investment could be financed out of domestic saving. Thus while investment would account for 16 per cent of gross domestic product, domestic saving would account in 1975 for about 15 per cent of total income as against 14 per cent in 1960.

65. A review of trade prospects, however, gives strikingly different results. While imports increase proportionally faster than total output, export receipts lag behind the growth of output. If these trends continue, the gap in the balance of payments would become, under the assumptions made, of the order of $14 billion in 1970 and $18 billion in 1975 as compared with about $5 billion in 1960.

66. These hypothetical projections suggest that the transforming of saving decisions into actual investment might present a serious problem. In the absence of national or international policy measures, an increase in foreign capital inflow would be required not because additional domestic saving could not be generated out of the higher incomes of 1970 or 1975 but rather in order to finance excess import requirements. Because of the technical limitations on the supply side, the additional productive investment necessary to achieve the higher

Table 3-11. Developing countries: extrapolation of past trend of output [a] and hypothetical requirements for fixed investment, saving and foreign trade

(Billions of dollars in 1960 prices and exchange rates) [b]

Item	Observed 1960	Hypothetical	
		1970	1975
1. Gross domestic product	170	261	324
2. Gross domestic fixed capital formation	27	41	51
3. Assumed changes in stocks	2	3	3
4. Gross domestic saving	24	39	49
5. Foreign saving required to finance the excess of investment over domestic saving (rows 2 plus 3 minus row 4)	5 [c]	5	5
6. Long-term capital inflow required to finance excess import needs over export earnings [d]	5	14	18
7. Difference between hypothetical foreign exchange requirements and saving gap (row 7 minus row 5)		9	13

Note: The hypothetical projections shown above are based on the model described in table 3-2; the numerical values of the parameters used are shown in table 3-8.

a On the basis of data shown in table 3-3 the annual compound rate of growth of output during the nineteen fifties was 4.4 per cent.

b Figures rounded to nearest integer.

c Balancing item rounded to nearest integer. Estimated foreign saving in 1960 amounted to $4 billion. *See* table 3-3.

d For detailed derivation of figures, *see* table 3-12.

Table 3-12. Developing countries: hypothetical levels of imports and exports and of capital inflow requirements emerging from extrapolations of output and in the absence of policy measures

(Billions of dollars in 1960 prices and exchange rates) [a]

Item	1960		Hypothetical	
	Observed	Estimated	1970	1975
I. *Current payments in foreign exchange*				
I.1. Primary [b]	4.9	4.7	9	11
I.2. Manufactures and base metals [c]	17.1	17.8	29	36
I.3. Net services and investment income	3.3	—	7	9
I.4. Total current payments	25.8 [d]	—	45	56
II. *Current receipts in foreign exchange*				
II.1. Commodity exports to zone A, total	19.7	19.5	28	34
Of which:				
II.1*a*. Primary [b]	17.1	17.2	24	34
II.1*b*. Manufactures and base metals [c]	2.5	2.3	4	5
II.2. Commodity exports to zone B	1.3	—	3	4
II.3. Total exports of commodities (rows II.1 and II.2)	21.0	—	31	38
III. Long-term capital inflow requirements (row I.4 minus row II.3)	4.9 [d]	—	14	18

Note: The hypothetical projections shown above have been derived as follows: (i) commodity imports were estimated on the basis of import functions (group C) shown in table 3-8 and by using the target level of output; (ii) estimates of net services and investment income are largely conjectural, *see* para. 53 of the text; (iii) exports to developed countries were estimated on the basis of the regressions (group D) shown in table 3-8. As an exception projections of fuel were based on an assumed income elasticity of 1.40 (*see* para. 49 of the text). The output of the developed countries was assumed to grow at the historical rate of 3.7 per cent per annum; (iv) the exports to the centrally planned economies are based on the assumptions discussed in para. 51 of the text.

a Extrapolated figures have been rounded to nearest integer.

b It includes: foodstuffs, agricultural raw materials and ores and fuels.

c It includes: chemicals, machinery and transport equipment and other manufactures.

d Including short-term capital inflow.

incomes could not be realized and the associated level of voluntary saving could not, therefore, materialize without an increased inflow of foreign capital. Theoretically, this inconsistency could be resolved in two different ways. On the one hand, a part of the *ex ante* domestic saving could be transferred [25] to consumption in a manner implied in equation I.6′ of the technical note to the first section. In this case investment would fail to rise to the full potential level which could have been financed by domestic saving and the rate of economic growth would be accordingly impeded. On the other hand — and this is the approach required for the realization of the potential rate of economic growth — the structural restrictions assumed in the model could be gradually removed through further promotion of exports and of import substitution.

Illustrative requirements for saving and foreign trade under hypothetical targets of accelerating economic development

67. The gap between assumed saving targets and import requirements cited in the preceding paragraphs relates only to the problem of maintaining in the future the same rate of growth as prevailed in the past. The problem is, of course, greater with respect to the attempt to accelerate the rate of growth so as to achieve a higher target such as that set in the United Nations Development Decade.[26] The Development Decade target calls for achieving " in each under-developed country a substantial increase in the rate of growth, with each country setting its own target, taking as the objective a minimum annual rate of growth of aggregate national income of 5 per cent at the end of the Decade ". Among the various alternatives which may be chosen within the spirit of this resolution, the example set out in table 3-13 is based on the assumptions that the developing countries as a group would increase at the average annual compound rate of 5 per cent during the nineteen sixties as a whole.[27] Such an average for the decade implies that the annual rate of growth of the developing countries would be raised to a terminal rate of 5.5 per cent in 1970. It was further assumed, again for purposes of illustration, that the terminal rate of growth would be maintained during the period 1970-1975. It was further assumed that the gains from this hypothetical acceleration would be distributed proportionately among the component regions. The implied levels of output in billions of dollars (rounded) for the total and the major regions are as follows:

	1960 observed	*Hypothetical*	
		1970	*1975*
Developing countries, total	170	277	362
Of which:			
Latin America	61	104	139
Africa	27	42	54
Far East	68	106	135
Middle East	11	20	27

68. Gross investment must now increase at a higher rate than output in order to keep the capital-stock output ratio constant as in paragraph 44. Thus, total investment would have to increase from 16 per cent of gross domestic product in 1960 to 20 per cent in 1975 while domestic saving would increase for the same period from 14 per cent to slightly above 15 per cent. As a result the capital inflow required to supplement domestic saving would amount to $12 billion and $20 billion for 1970 and 1975 respectively. While these figures reflect a substantial increase from the 1960 level, it should be noted that this order of magnitude is within the range of historical

Table 3-13. Developing countries: illustrative requirements in 1970 and 1975 for fixed investment, saving and foreign trade emerging from an accelerated rate of growth of output [a]

(Billions of dollars) [b]

Item	*1970*	*1975*
1. Gross domestic product	277	362
2. Gross domestic fixed capital formation	50	71
3. Assumed changes in stocks	3	4
4. Gross domestic saving	41	55
5. Gap in total saving needed to be financed through external forces (rows 2 and 3 minus row 4)	12	20
6. Current payments in foreign exchange	51	70
7. Current receipts in foreign exchange	31	38
8. Long-term capital inflow required to finance excess payments (row 6 minus row 7)	20	32
9. Difference between hypothetical foreign exchange requirements and saving gap (row 8 minus row 5) remaining to be covered by additional national and international policy measures	8	12

Note: The hypothetical requirements shown above are based on the model described in table 3-2; *see* tables 3-11 and 3-12 for explanation of the methods of derivation.

[a] The annual average compound rate of growth is assumed to be 5 per cent for 1960-1970 and 5.5 per cent for 1970-1975. *See* para. 67 of the text.

[b] Figures have been rounded to nearest integer.

[25] The adjustment of *ex ante* saving to the level of realized investment is likely to take the form of changes in the relative prices and thus exercise an additional pressure on the inflation-prone developing economies.

[26] General Assembly resolution 1710 (XVI).

[27] This example served also as a basis of a study entitled " Trade needs of developing countries for their accelerated economic growth " which was submitted to the United Nations Conference on Trade and Development as document E/CONF.46/58 and is reproduced in *World Economic Survey, 1963*. The effects of various alternatives upon requirements for foreign exchanges are also discussed in that paper.

trends and consistent with the General Assembly's target level of capital inflow of one per cent of the combined gross domestic product of the developed countries.[28]

69. As in the previous case, the structure of production and the export prospects impose more stringent conditions upon the financing of an accelerating rate of economic growth. As can be seen from table 3-13, the capital inflow requirements needed to finance net imports which emerge from consideration of such aspects are substantially higher than the required level of supplementary foreign saving.

70. It follows from a consideration of the limitations placed upon the rate of growth from the foreign trade sector that the national plans of development must incorporate, along with their primary goal of raising the standards of living, a number of associate targets aiming at changing the one-sided dependence of their economies upon external conditions. In theory, one could think of a number of permutations of policy measures which could make domestic development targets consistent with external conditions. The structural parameters listed in table 3-2 could, in fact, be changed as a result of concerted national or international policies designed to close the gap. Obviously, the choice of a set of policies lies not only beyond the analytical power of an aggregate model but even beyond the scope of economic analysis. Of course, the use of detailed sectoral models could advance this exercise further by making possible evaluation of the feasibility of the theoretically plausible measures; but even then the desirability of choosing a particular set among the feasible measures cannot be decided unless such choice is explicit in long-term development plans.

71. While it is impossible to assess the feasibility of specific policy measures within the confines of a rudimentary economic model, it may still be interesting to review the order of effort required in order to make the foreign saving requirements and the deficit in the balance of payments in 1975 shown in table 3-13 mutually consistent. As was noted in paragraph 68, the level of required supplement to domestic saving in 1975 is of the order of $20 billion. For purely illustrative purposes, it is assumed that an inflow of foreign capital would reach the target level of one per cent of the gross domestic product of the developed countries in 1975. This implies that the level of capital inflow could reach the level of $17 billion for the same period.[29] The scope of policy measures in the arbitrary confines of this hypothetical use is, therefore, to reduce the deficit in the balance of payments under the assumption that capital flow would be $17 billion. The following tables gives some hypothetical examples as to the means of closing this gap.

HYPOTHETICAL POLICY MEASURES FOR SUSTAINING THE LEVEL OF OUTPUT IN 1975 SHOWN IN TABLE 3-13

	Level of the hypothetical gap in foreign exchange required emerging from	
	Excess of investment over domestic saving	*Excess of foreign exchange payments over receipts*
1. Initial level of gap in the absence of policy measures	20	32
2. Contribution of long-term capital flow which is assumed to reach the target level of one per cent of output of developed countries	17	17
3. Gap to be covered through additional policy measures	3	15
4. Illustrative adjustment:		
a. Increase of the ratio of domestic saving to gross domestic product from 15 per cent to 16 per cent	3	—
b. Increase in exports resulting from acceleration of the rate of growth so as to reach the target of 4.2 per cent per annum	—	3
c. Additional import substitution to decrease the import coefficient in relation to gross domestic product from 0.193 to 0.175	—	6
d. Gap remaining to be covered by additional national and international policy measures	—	6

72. Although the level of initial requirements in foreign exchange viewed *per se* is large, it is not beyond the capacity of the world community to meet the challenge. Providing that the target rate of capital flow from the developed countries of one per cent of their gross domestic product is achieved, elimination of the foreign exchange gap emerging from the saving-investment approach is within the limits of feasible policy measures of the developing countries. For this — as shown in the above table — it would be sufficient that the relation of domestic saving to gross domestic product be raised from 15 per cent to 16 per cent.

73. The closing of the balance of payments gap based on projections of the import requirements presents a challenge of a much more significant order, but the task is by no means impossible provided the concerted effort to transfer international trade policy as an instrument of economic development which is reflected in the United Nations Conference on Trade and Development is carried to a successful conclusion. An acceleration of the rate of growth in the developed countries could, by 1975, stimulate further expansion of the exports of the developing countries to the order of $3 billion. Next, import substitution policies on the part of the developing countries could contribute significantly towards closing the gap. In the absence of structural changes, the import coefficient (including net services and investment income) would rise from 15.2 per cent in 1960 to 19.3 per cent by 1975. In the above table it was assumed that the

[28] For example, the indicated level of capital inflow required is slightly less than one per cent of the extrapolated gross domestic product of the developed countries.

[29] This estimate is based on the assumption that the output of the developed countries would reach the target rate of growth of 4.2 per cent per annum.

developing countries would be able to stabilize the level at 17.5 per cent, which corresponds roughly to the mid-point between the observed level of current payments in 1960 and the hypothetical level in 1970. Although the assumed coefficient is purely hypothetical, it should be noted that this effort — judged against the background of historical experience — does not seem implausible. Thus, for example, in the relatively more advanced region of Latin America, the import coefficient has decreased from an average 13.1 per cent in 1945-1949 to 10.8 per cent in 1960.[30]

74. Although the assumed import substitution policies could contribute substantially ($6 billion) towards closing the gap, there still would remain a gap of $6 billion to be covered through additional policies. Judged against the background of the United Nations Conference on Trade and Development, however, this gap could be covered through concerted national and international policy measures. Perhaps the most important contributing factor could be the possible expansion of new exports (mainly manufactures) to the developed countries. For such an expansion, however, apart from the industrialization of the developing countries, the goodwill and co-operation of the developed countries, especially with respect to policies of freer trade, will be required.

75. The fact that, in this illustrative example and under the assumptions made, import requirements are likely to pose a greater challenge to policy measures than will the domestic financing of investment does not imply that this is a general conclusion which emerges from this rudimentary model. On the contrary, it is conceivable that for sufficiently high target rates of development it would be the domestic financing of investment which might become the bottleneck factor. In order to illustrate this point the following table summarizes the gaps of foreign exchange on current account which emerge under alternative growth targets and by applying the same calculating methods as above.

HYPOTHETICAL TARGETS OF RATES OF GROWTH OF OUPUT IN 1975

(Billions of dollars)

	Target I. Terminal growth rate 4.4 per cent (trend)	*Target II. Terminal growth rate 5 per cent*	*Target III. Terminal growth rate 6 per cent*	*Target IV. Terminal growth rate 7 per cent*
1. Gross domestic product	324	335	352	371
2. Excess of investment over domestic saving .	5	14	26	40
3. Excess of export needs over export earnings .	18	25	34	43

76. The examples shown in the above table are based on the assumption that the annual compound rate of growth for 1960-1964 would be the same as the one observed during the period 1950-1960 [31] and would then accelerate gradually so as to reach the specified alternative " targets ". The interesting conclusion which emerges from this exercise is that while the gap is an increasing function of the acceleration target under both methods, the rate of change of the gap requirements is higher when calculated on the basis of the " saving-investment sub-model " (row 2) than in the case of the " foreign exchange limitations sub-model " (row 3). Thus, for a target rate of growth as high as 7 per cent, both methods lead to essentially identical results.[32]

77. Finally, it should be emphasized that the above figures are intended to show merely the sensitivity of the model to changes in growth targets under the extreme assumption that such targets are not linked to other policy measures. In reality, of course, the target rates of growth would and should be accompanied by appropriate national and international measures so as to reduce the " gap " to a figure consistent with saving targets, with import requirements emerging after structural changes have taken place and with a forecasted level of long-term capital inflow. Of course, if such measures fail to materialize, the target rate of growth will not be fulfilled.

78. In conclusion, this exercise points to the need for expanding the scope of the underlying rudimentary model in order to evaluate the quantitative relationships between over-all growth targets and possible policy measures at the country and sectoral level. Some suggestions for further work along these lines are made in appendix B.1.

[30] *See* United Nations, " The economic development of Latin America in the post-war period, volume I, Over-all trends and economic development by countries " (document E/CN.12/659), April 1963, page 5. The annual rate of growth of output during the corresponding period has been 4.7 per cent.

[31] This particular assumption is close to what seems to have been the actual performance of these economies during the period 1960-196?.

[32] This is because for high rates of growth, and consequently for high levels of income, domestic saving would tend to grow proportionately with income while fixed investment required to sustain an accelerated growth target would grow faster than output. Hence, for high growth targets the foreign exchange gap measured as a difference between fixed investment and domestic saving would tend to increase faster than output. On the other hand, the foreign exchange requirements emerging from the projections of imports would tend to increase, at the limit, roughly proportionately with output (*see* technical note at the end of the first section).

Appendix A.1

A TECHNICAL NOTE ON THE VERIFICATION OF THE MODELS: THE INEQUALITY COEFFICIENT *

The test for inner consistency between the observed *ex-post* relations of the variables and the predictions derived from a model theorizing on the behaviour of the system can be based on the second moment of the forecasting errors $\frac{1}{n}\sum_i (P_i - A_i)^2$ where P_i and A_i are, respectively, the predicted and actual series of a variable, and they are related by the following equation:

$$P_i = Y_1 + Y_2 A_i \qquad \text{(A.1.1)}$$

where i runs over the observations of the sample.

Obviously, if $Y_1 = 0$ and $Y_2 = 1$, the correlation coefficient will indicate perfect forecast, but a perfect correlation coefficient does not necessarily imply perfect prediction. More insight can be gained if, instead, we utilize a different concept — the inequality coefficient — which is formed basically from the second moment of the forecasting errors. Indeed, if we take the square root of the latter and we divide by the expression

$$\sqrt{\frac{1}{n}\sum_i P_i^2} + \sqrt{\frac{1}{n}\sum_i A_i^2}$$

we have:

$$\mu = \frac{\sqrt{\frac{1}{n}\Sigma (P_i - A_i)^2}}{\sqrt{\frac{1}{n}\Sigma P_i^2} + \sqrt{\frac{1}{n}\Sigma A_i^2}} \qquad \text{(A.1.2)}$$

It is obvious, of course, that the inequality coefficient, μ, is confined to the closed interval between zero and unity:

$$0 \leqslant \mu \leqslant 1, \qquad \text{(A.1.3)}$$

where $\mu = 0$ indicates perfect forecast. Furthermore, if the forecast is not perfect, the errors may be attributed to bias of the means, μ^M, to differences in the variance, μ^S, or to differences in the co-variance, μ^C. If we decompose the square root of the numerator of the inequality coefficient and by writing $\bar{P}$, $\bar{A}$, $S_P S_A$ for the means and standard deviations we have:

$$\frac{1}{n}\sum_i^n (P_i - A_i)^2 = (\bar{P} - \bar{A})^2 + (S_P - S_A) + 2(1 - r) S_P . S_A \qquad \text{(A.1.4)}$$

Thus the inequality coefficient can be analysed in terms of differences in the means, standard errors and co-variance. It may be seen that the percentage distribution of total errors to these three factors is given by the following equation:

$$\left.\begin{aligned} &\mu^M + \mu^S + \mu^C = 1, \\ &\mu^M = \frac{\mu_M^2}{\mu^2}, \ \mu^S = \frac{\mu_S^2}{\mu^2}, \ \mu^C = \frac{\mu_C^2}{\mu^2}, \\ &\mu_M^2 = \frac{(\bar{P} - \bar{A})^2}{D^2}, \ \mu_S^2 = \frac{(S_P - S_A)^2}{D^2}, \ \mu_C^2 = \frac{2(1-r) S_P . S_A}{D^2}, \\ &D = \sqrt{\frac{1}{n}\Sigma P_i^2} + \sqrt{\frac{1}{n}\Sigma A_i^2} \end{aligned}\right\} \qquad \text{(A.1.5)}$$

From the above it becomes clear that, if the inequality coefficient is not zero, the most desirable distribution among its sources should be $\mu^M = \mu^S = 0$ and $\mu^C = 1$. As may be seen from table A.1.1, all the predictions give a low inequality coefficient, while the distribution of the error among its sources approximates the ideal one.

* SOURCE: H. Theil, *Economic Forecasts and Policy* (North Holland Publishing Company, Amsterdam, 1958).

Table A.1.1. Means, standard deviation, correlations, inequality coefficients and proportions for predicted and observed series

	Mean of predicted values (millions of dollars)	*Mean of observed values (millions of dollars)*	*Standard error of predicted values*	*Standard error of observed values*	*Correlation coefficient (predicted on observed values)*	*Inequality coefficient*	*Bias proportion*	*Variance proportion*	*Co-variance proportion*
Predicted values	$\bar{P}$	$\bar{A}$	S_P	S_A	r	μ	μ^M	μ^S	μ^C
Gross domestic product (Q)	141,033	141,031	17,170	17,204	0.998	0.004	0.000	0.001	0.999
Imports of commodity (M)	18,717	18,744	2,482	2,563	0.949	0.022	0.001	0.048	0.951
Domestic saving (D^S)	19,229	19,228	2,959	3,023	0.979	0.016	0.000	0.010	0.990

Appendix B.1

SUGGESTIONS FOR FURTHER IMPROVEMENTS OF THE METHODS FOR LONG-TERM ECONOMIC PROJECTIONS

The presentation and empirical testing of the aggregative model have identified three broad and largely inter-dependent problems which call for further study as part of the future work programme for global economic projections.

The first and probably most important problem arises from the observed heterogeneity of the developing countries. This calls for an operationally feasible sub-division of the total into more or less homogeneous groups.

The second problem arises in connexion with the aggregate nature of the variables. While the model introduced in this paper has indicated the basic problems of economic development of the developing countries, the degree of aggregation is of such a high order as to obscure important phenomena with respect to sectoral patterns of growth and the degree of inter-dependence of industrial activity. Disaggregation by major economic sectors will be required in future work on projections.

Finally, improvements in methods need to be accompanied by progress in the collection and standardization of statistics. Since the implementation of projections at the regional and sectoral level requires information not yet available for a number of countries, further progress in this direction seems essential.

Sub-division of the developing countries into homogeneous groups

In presenting projections for the total, it is important to ensure maximum possible consistency between the statistical macro-relations [a] on which the projections are based and the micro-relations referring to each individual country. If all constituent countries were exactly alike, the sum of projections for each individual country would be identically equal to projections derived directly from the macro-system referring to the zone total. However, the total consists of such a diverse group of countries that the conditions of perfect aggregation cannot be met. One way to avoid bias resulting from improper aggregation would be to provide projections for each individual country separately. Such an extensive work programme, however, will not be attainable on a comprehensive basis until some time in the future. It may nevertheless be possible to derive unbiased projections for the zone total, by summing up projections for a small number of groups consisting of more or less homogeneous countries. In order to provide a workable framework for this method two questions must be answered satisfactorily: the first refers to the choice of criteria for classifying countries into various groups, while the second arises in connexion with the use of appropriate techniques by which similar but not identical economies can be aggregated into a group unit.

With respect to the first question, a necessary condition of homogeneity of an economic group is that the limitations implied in the working model should be valid in each one of the constituent countries. Since rigidities in the structure of the production constitute, by definition, a common feature of all developing countries, it follows that this condition refers to the restrictions which a limited supply of foreign exchange may impose on economic development. Indeed, it is intuitively obvious that no meaningful aggregation can be achieved between a country whose behaviour corresponds to the assumptions of the foreign exchange limitations sub-model and another country which operates under foreign exchange restrictions described by the simple saving investment sub-model. In this case, the differences are not only in degree but also in kind, so that the projections based on sums of the country variables – no matter what aggregation method is used – will be not only biased, but also inconsistent with the postulated behaviour in each of the two countries.

It seems reasonable to assume, therefore, that the first step for the delineation of groups is to classify the developing economies according to their relative achievements in export markets. Since, by and large, differences in the relative levels of foreign receipts are due to differences in the commodity structure of exports, this work might proceed by classifying the developing economies according to their major export commodity. It is possible that such a classification may not necessarily coincide with division of the total by geographic regions. In view of the fact that substantive aspects of projections will eventually have to be worked out at the regional level, where features particular to certain countries can be more easily examined, it would seem useful for the regional projections to employ a common approach in subdividing the countries of the regions into groups. In this way, projections for the zone total could be obtained by aggregating countries of similar export experience and of different regions.

While export experience is an obvious and necessary condition for an operationally functional subdivision of the zone total, there may well be additional qualifying criteria. In general, these criteria refer to differences in the degree of dependence of the economies on foreign trade. In fact, the narrower these differences among the components of a group, the more efficient and unbiased the aggregation will be. The establishment of permissible limits within which differences with respect to the degree of industrialization and with respect to policy variables can vary within a given subset of countries is essentially an empirical question which deserves separate study.

Use of sectoral models in economic projections for developing countries

The high degree of aggregation utilized so far has been dictated by the paucity of comprehensive statistics referring to the totality of the group. None the less, data of more detailed nature are available for a fairly large number of countries and it seems possible to proceed with the use of sectoral models in selected countries. This experimentation may prepare the ground for the replacement of the aggregate models by detailed sectoral analysis covering all developing countries, when the required statistics become available.

For implementation of projections on the basis of sectoral models, it will be necessary to introduce, in explicit form, intersectoral transactions of intermediate goods. Ideally, what is required in

[a] The term macro-relation is used here to denote a functional relationship between variables referring to the zone total and whose magnitude is derived by simple summation of the respective values for each constituent country.

this respect is a complete input-output matrix of commodity and factor transactions; while such matrices are available for a small number of countries, it will still take some time before they become available in sufficient number and in standardized form. Instead, for purposes of experimental research, the building of sectoral models may be based on the following sources which are readily available for about thirty countries, covering *roughly* 80 per cent of the total production of the developing countries: [b]

(*a*) National income accounts: Industrial origin of gross domestic product.

(*b*) National census of production.

(*c*) Volume indices of production of major industrial sectors, and

(*d*) Exports and imports by commodities. Data in these items on a comparable basis are available in Statistical Office of the United Nations, *Commodity Trade Statistics, Direction of International Trade, Monthly Bulletin of Statistics, Patterns of Industrial Growth, Statistical Yearbook, Yearbook of International Trade Statistics,* and *Yearbook of National Accounts Statistics.*

The number of activities into which an economic system may be divided will vary slightly from case to case, depending upon the available statistics and special characteristics of each economy. In general, the economy may be divided into the following sectors:

I. *Agriculture, forestry, hunting and fishing* (major group 0 of International Standard Industrial Classification of All Economic Activities (ISIC)).

II. *Mining and quarrying* (ISIC, major group 1) with possible further sub-division:

II.*a*. Coal mining, crude petroleum and natural gas (ISIC groups 11 and 13).

II.*b*. All others.

III. *Manufacturing of mainly consumer goods* (ISIC major groups 20-24, 26, 28-30, 31 except 311, 39 and group 333) with possible further sub-division:

III.*a*. Food, beverages and tobacco (ISIC groups 20-22)

III.*b*. Textiles and wearing apparel (ISIC major groups 23-24)

III.*c*. Furniture and fixtures, printing and publishing, leather and leather products, rubber products, miscellaneous chemical products excluding basic industrial chemicals and pottery, china and earthenware and miscellaneous products (ISIC major groups 26, 28-30, 31 except group 311, 39 and group 333)

IV. *Manufacturing of mainly intermediate goods* (ISIC major groups 25, 27, 32, 33 and group 311). If possible, this sector might usefully be subdivided into the following branches:

IV.*a*. Manufacture of paper and paper products (ISIC major group 27)

IV.*b*. Manufacture of industrial chemicals, including fertilizers (ISIC group 311)

IV.*c*. Manufacture of products of petroleum and coal (ISIC major group 32)

IV.*d*. Manufacture of cement (ISIC group 334)

IV.*e*. All other activities included in sector IV

V. *Manufacturing of mainly producer goods* (ISIC major groups 34-39 except, if possible, group 384 — Repair of motor vehicles) with further subdivision into the following branches:

V.*a*. Basic metal industries and manufacture of metal products, except machinery and transport equipment (ISIC major groups 34-35)

V.*b*. Manufacture of machinery and transport equipment (ISIC major groups 35-38 except, if possible, group 384).

VI. *Construction* (ISIC major group 4).

VII. *Electricity and gas* (ISIC group 51).

VIII. *Transport and general services* (ISIC major groups 6-9 and groups 384 and 51). Although a further breakdown of this sector is desirable, the detailed classification of services among the various countries varies so widely that international comparability of such branches of activity is not attainable at present.

On the basis of time series for each economic activity, a sectoral model may be constructed where the available supply from each sector is described in a production function. The demand for intermediate and final commodities may also be divided into groups corresponding to the postulated economic activities. Further, among the new problems which present themselves for analysis are the following:

(*a*) As was seen earlier, the measurement of the growth generating capacity of total investment is extremely difficult, unless the sectoral allocation of resources is specified. By dividing the economic system into sectors, it becomes possible to estimate the growth of the economy under stipulated distribution of total investment among the various sectors.

(*b*) While the level of total investment may be determined essentially in the same manner as in the aggregative model the structure of investment and consequently its sectoral distribution must be introduced explicitly. In the developed economies where the functioning of a capital market is a permissible assumption, the sectoral allocation can be taken as a function of the differential returns on assets. In the developing economies, however, the compartmentalized structure of the productive sectors is usually accompanied by sectoral immobility of financial resources, and imperfect capital markets. At the level of preliminary research, it may be assumed, as a first approximation, that the sectoral allocation of investment is a function of the capacity of each sector to expand, which in turn depends upon the availability of other factors of production (skilled labour, intermediate commodities and general economic conditions). The capacity to expand, which determines the pattern of growth, may be evaluated on the basis of both past experience and announced government plans. In this respect, cross-country studies may also reveal general sectoral patterns in the process of development.[c]

(*c*) While in the aggregate model economic development is measured solely by the growth of final demand, in sectoral models the process of development will be viewed also as a change of the production structure. Thus, the import functions equations (I.2 to I.5) of the model become a central point of the study. As a result, the development achievements in countries with equal rates of growth of total gross domestic product will not be considered equivalent, unless the pattern of growth is also identical.

(*d*) Finally, intermediate commodities should be introduced explicitly into the sectoral models. As the economy advances to higher stages of development the inter-dependency of the sectors increases. Thus the growth of a sector is determined not only by the income elasticity of the corresponding final demand but also by the broadening of the economic structure. In addition, a failure of the domestic sectors producing intermediate goods to keep pace with demand may bring along additional pressure on the demand for imports, a possibility which is not encountered in the aggregate models employed in this paper.

[b] For use of information at the sectoral level *see* United Nations, *World Economic Survey, 1961* (Sales No.: 62.II.C.1), part I.

[c] For discussion of the subject, *see* United Nations, *World Economic Survey, 1961*, part I.

Appendix B.2

DESCRIPTION OF A SECTORAL MODEL

The model which is sketched here has been constructed for testing in selected under-developed countries. The degree of aggregation will necessarily vary from country to country depending upon the availability of data, and indeed data limitations may impose substantial modifications during the course of the work. For the estimation of the parameters of the structural equations, time series for each country covering a period of ten to fifteen years may be used, but some hypotheses of the model may also be tested on the basis of cross-country analysis for a specified period. Depending upon the degree of homogeneity of the sample, estimation of the parameter may also be attempted on a mixed cross-country time series basis, where each variable of the model will have two dimensions, one in the time space, and another in the region space. For clarity of exposition all subscripts run from 1 to n, although in many cases the entries are zero. Some assumptions of more or less technical nature are omitted here; for example, the treatment of non-competitive imports does not appear in this brief sketch.

I. Accounting identities

The economy is divided into n activities. The domestic production of goods of the i^{th} sector can be divided into consumption, $Y_i^{(C)}$, investment goods, $Y_i^{(I)}$, exports, $Y_i^{(X)}$, and deliveries of intermediate commodities to the n sectors of the economy, $\sum_j Y_{ij}^{(T)}$. Imported goods of the same kind as those of the i^{th} sector, M_i^Y, are divided into similar categories. We get therefore the following two expressions of $2n$ equations:

$$Y_i = \sum_j Y_{ij}^{(T)} + Y_i^{(C)} + Y_i^{(I)} + Y_i^{(X)} \qquad (i = 1, \ldots, n) \qquad \text{(B.2.1)}$$

and

$${}_M Y_i = \sum_j {}_M Y_i^{(T)} + {}_M Y_i^{(C)} + {}_M Y_i^{(I)} \qquad (i = 1, \ldots, n) \qquad \text{(B.2.2)}$$

The total available resources of the i^{th} sector is the sum $\hat{Y}_i$ of domestic production and imports:

$$\hat{Y} = \sum_j \hat{Y}_{ij}^{(T)} + \hat{Y}_i^{(C)} + \hat{Y}_i^{(I)} + \hat{Y}_i^{(X)} \qquad (i = 1, \ldots, n) \qquad \text{(B.2.3)}$$

where

$$\hat{Y}_{ij}^{(T)} = Y_{ij}^{(T)} + {}_M Y_{ij}^{(T)} \qquad (i, j = 1, \ldots, n) \qquad \text{(B.2.4)}$$

$$\hat{Y}_i^{(C)} = Y_i^{(C)} + {}_M Y_i^{(C)} \qquad (i = 1, \ldots, n) \qquad \text{(B.2.5)}$$

$$\hat{Y}_i^{(I)} = Y_i^{(I)} + {}_M Y_i^{(I)} \qquad (i = 1, \ldots, n) \qquad \text{(B.2.6)}$$

Furthermore, the total investment of the i^{th} type is equal to the sum of same investment allocated in the n sectors:

$$\hat{Y}_i^{(I)} = \sum_n \hat{Y}_{hi}^{(I)} \qquad (i = 1, \ldots, n) \qquad \text{(B.2.7)}$$

The identities introduced so far provide simply a detailed sectoral breakdown of the fundamental accounting identity that gross domestic product, Q, is equal to total domestic production of final goods minus total imports of intermediate commodities. Thus we have:

$$Q = \sum_i Y_i^{(C)} + \sum_i Y^{(I)} + \sum_i Y_i^{(X)} - \sum_i \sum_{(M)} Y_{ij}^{(T)} \qquad \text{(B.2.8)}$$

Finally, the difference between total imports and total exports must be equal to the sum of long-term private (C_p) and public (C_o) capital inflow and change in foreign assets (E).

$$\sum_i {}_M Y_i - \sum_i Y_i^{(X)} = C_p + C_o + E \qquad \text{(B.2.9)}$$

II. The supply functions

The domestic supply of the i^{th} sector Y_i (measured as gross market value in constant prices) is taken as a function of the labour force supplied, L_i, of capital stock of various categories, K_{hi}, and of an autonomous factor, A_i, which reflects non-specified forces such as technical progress, economies of scale, external economies and policy decisions. For the n sectors of the economy, we have, therefore, n production functions:

$$Y_i = F_i[A_i^{(t)};\ L_i,\ K_{hi}] \qquad (i, h = 1, \ldots, n) \qquad \text{(B.2.10)}$$

Each category of capital stock (buildings, machinery, etc.) existing in each sector is given by the accumulation of total gross investment ($\hat{Y}_{hi}$) minus depreciation which is assumed to be a constant (ε_{hi}) proportion of available capital stock. These n^2 relations are given by the following expression:

$$K_{hi}(t) = \int_{\infty}^{t} [\hat{Y}_{hi}(\xi) - \varepsilon_{hi} K_{hi}(\xi)] d\xi \qquad (i, h = 1, \ldots, n) \qquad \text{(B.2.11)}$$

The supply of labour is assumed to be perfectly elastic so that the demand equation (B.2.13) determines solely the level of employment in each sector. This is certainly an oversimplification of the actual situation where in many instances the supply of skilled labour is limited. However, in view of the paucity of relevant statistics, it seems that a supply-demand analysis of the labour force cannot be attempted in the near future. In cases where there are indications that the supply of a certain labour skill is limited, equation B.2.13 will have to be replaced by a supply determined function.

III. The demand functions

(a) *Demand for intermediate commodities*

The demand of the i^{th} sector for intermediate goods of the j^{th} sector is assumed to depend upon the level of production of the i^{th} sector.

$$\hat{Y}_{ji} = \psi_j(Y_i) \qquad (i, j = 1, \ldots, n) \qquad \text{(B.2.12)}$$

(b) *Demand for labour force*

Finally, the demand of the i^{th} sector for working force is taken as a function of real wages W_i and the capital stock available in the same sector $\sum_h K_{hi}$:

$$L_i = \varnothing_i [W_i, \sum_h K_{hi}] \qquad (B.2.13)$$
$$(i = 1, \ldots\ldots, n)$$

(c) *Demand for final commodities*

The demand for exports is assumed to depend in part upon the ratio of export prices, p_D, to international prices of the same commodity, p_f; and in part upon a time trend.

$$\hat{Y}_i^{(X)} = f_i \left(t; \frac{P_{Di}}{P_{fi}} \right) \qquad (B.2.14)$$
$$(i = 1, \ldots\ldots, n)$$

The demand for consumer goods is a function of gross domestic product, Q, the prices of all commodities and income distribution, R.

$$\hat{Y}_i^{(C)} = D_{1i}(Q, p_1 \ldots\ldots p_n R) \qquad (B.2.15)$$
$$(i = 1, \ldots\ldots, n)$$

The demand of the i^{th} sector for capital goods depends upon the planned level of production and upon the capacity to finance expansion plans. While the first variable can be substituted, as a first approximation, by the level of output of the same sector (Y_i), the exact specification of the second variable will need more empirical work on the subject of investment decisions in the developing countries. As a first step towards this direction, the demand of the i^{th} sector for investment of the h^{th} type can be taken as a function of the level of output, Y_i, the historical rate of expansion of the sector, λ_i, and the historical share of the sector in the financial sources of the economy, S_i.

$$\hat{Y}_{hi}^{(I)} = D_{2ih}(Y_i, \lambda_i ; S_i) \qquad (B.2.16)$$
$$(i, h = 1, \ldots\ldots, n)$$

In the light of the results which may be obtained from empirical studies of the above relation, the investment functions will have to be improved so as to take explicitly into account other factors such as rate of profits, institutional structure of the capital market, government plans, etc. Undoubtedly, the derivation of reliable investment decision functions will be one of the most difficult and basic problems in the empirical analysis of sectoral models.

IV. The indeterminacy of the system

Equations B.2.14 to B.2.16 have determined the total demand for each commodity. Furthermore, the domestic supply for each commodity is given by the equations in B.2.13. Since, at equilibrium, supply should be equal to demand, it follows from the accounting identities in B.2.1 to B.2.3 that excess demand should be covered by imports. The supply of imports is not unlimited, however, and as is shown in equation B.2.9, the level of permissible total imports in the long run is uniquely determined. Indeed, as can be seen from the following table, we have introduced $10n+4n^2+1$ unknowns and the number of equations exceeds the unknowns by one. The system is thus overdetermined. In the short run, changes in foreign assets (E) may be assumed to be an unrestricted variable so that the number of unknowns becomes equal to the number of equations. In the long run, however, the level of (E) must be assumed as given, and the model must therefore be adjusted to allow for foreign exchange restrictions much in the same manner as in aggregate model discussed in the main text. In this model, however, the sectoral adjustments must be shown and therefore the effect of foreign exchange restrictions must be specified, not only on the rate of growth but also on its pattern. At the first stage of work, these adjustments may be treated as a purely empirical question, whose solution varies from country to country depending upon policy decisions. At a later stage when prices may be introduced as endogenous variables, it might become possible to bound the feasible range of policy decisions with limits imposed by the interaction of production and relative prices.

Predetermined or exogenous variables		*Unknowns*		*Equations*	
Symbols	*Number*	*Symbol*	*Number of unknown*	*Index of equation in text*	*Number of equations*
$A_i^{(I)}$	n	Y_i	n	(B.2.1)	n
W_i	n	L_i	n	(B.2.2)	n
$p_{D/pf}$	n	K_{hi}	nxn	(B.2.3)	n
p_i	n	$\hat{Y}_{hi}^{(I)}$	nxn	(B.2.4)	nxn
R	1	$Y_i^{(C)}$	n	(B.2.5)	n
S_i	n	$Y_i^{(I)}$	n	(B.2.6)	n
C_p	1	$Y_i^{(X)}$	n	(B.2.7)	n
C_o	1	$MY_{ij}^{(T)}$	nxn	(B.2.8)	1
E	1	$MY_i^{(C)}$	n	(B.2.9)	1
		$MY_i^{(I)}$	n	(B.2.10)	n
		$\hat{Y}_i$	n	(B.2.11)	nxn
		$\hat{Y}_{ij}^{(T)}$	nxn	(B.2.12)	nxn
		$\hat{Y}_i^{(C)}$	n	(B.2.13)	n
		$\hat{Y}_i^{(I)}$	n	(B.2.14)	n
		Q	1	(B.2.15)	n
				(B.2.16)	nxn
Total $4+5n$		Total unknowns $10n+4n^2+1$		Total equations $10n+4n^2+2$	

ANNEXES

Annex I[a]

PROPOSALS OF A GROUP OF EXPERTS FOR A WORK PROGRAMME ON LONG-TERM ECONOMIC PROJECTIONS

Acting Secretary-General's preface

This report was prepared by a group of experts appointed by me to assist in the evaluation of techniques of long-term projections in accordance with Economic and Social Council resolution 777 (XXX) and, in connexion with the recent establishment of the United Nations Economic Projections and Programming Centre, to advise on a co-operative work programme on long-term projections to facilitate the formulation of plans and programmes for economic development, in accordance with General Assembly resolution 1708 (XVI).

Suggestions about how projections for the world economy might be made were submitted by the experts in a number of working papers for the Secretariat. The present report contains the unanimous recommendations of the group of experts concerning the work programme on long-term economic projections. The experts acted in their personal capacities and their observations and recommendations were put forward on their own responsibility.

The members of the group of experts were: Mr. Sadok Bahroun, Chief, Statistical Office, State Secretariat on Planning and Finance, Government of Tunisia; Professor Francis Bator, Massachusetts Institute of Technology, United States; Professor E. S. Kirschen, University of Brussels, Belgium; Mr. Jacques Mayer, Office for Economic and Financial Studies, Finance Ministry, Government of France; Professor Józef Pajestka, Director, Economic Research Institute, Planning Commission, Government of People's Republic of Poland; Mr. Pitambar Pant, Chief, Perspective Planning Division, Planning Commission, Government of India; Mr. A. I. Petrov, Chief, Department of Perspective Plans and Economic Problems, State Economic Council of the Union of Soviet Socialist Republics; Mr. Jan Sandee, Assistant Director, Central Planning Bureau, Government of the Netherlands; Mr. Christopher T. Saunders, Director, The National Institute of Economic and Social Research, United Kingdom. Mr. Jacob L. Mosak, Director of the Bureau of General Economic Research and Policies of the Secretariat, served as Chairman.

Representatives from the following specialized agencies of the United Nations and other inter-governmental bodies engaged in work on projections participated in the meeting in a consultative capacity: Food and Agriculture Organization of the United Nations, General Agreement on Tariffs and Trade, International Bank for Reconstruction and Development, International Labour Organisation, Organization for Economic Co-operation and Development. The United Nations Secretariat was represented by staff members from Headquarters and from each of the regional economic commissions.

On behalf of the United Nations, I wish to thank the experts for their valuable contribution on the subject of long-term projections, and to thank the institutions with which the experts are associated for releasing them from their normal duties so that they might be free to undertake this important task.

U THANT
Acting Secretary-General

[a] Report submitted to the thirty-fourth session of the Economic and Social Council as document E/3668.

Letter of transmittal to the Acting Secretary-General

We have the honour to submit herewith our report, United Nations Economic Projections and Programming Centre: Proposals for a Co-operative Work Programme on Long-term Projections, pursuant to General Assembly resolution 1708 (XVI).

We are happy to be able to present, for your consideration, a unanimous report setting forth our recommendations concerning the work we believe should be done in the field of projections to facilitate the formulation of plans and programmes for economic development.

We wish to acknowledge the help and guidance given to us by members of the Secretariat from United Nations Headquarters and from the regional commissions as well as by representatives of specialized agencies and other international organizations who participated in the meeting in a consultative capacity.

Respectfully yours,

(Signed) Sadok BAHROUN
Francis BATOR
E. S. KIRSCHEN
Jacques MAYER
Józef PAJESTKA
Pitambar PANT
A. I. PETROV
Jan SANDEE
Christopher T. SAUNDERS

United Nations, New York
29 June 1962

United Nations Economic Projections and Programming Centre: Proposals for a Co-operative Work Programme on Long-term Projections

1. The purpose of this report is to recommend methods by which the United Nations Economic Projections and Programming Centre and the regional centres, if established, might carry out a programme of work on long-term projections to facilitate the formulation of national economic plans, in accordance with the resolution of the General Assembly (1708 (XVI)).[b] We understand that it is

[b] The resolution requested the Secretary-General:

"To establish an Economic Projections and Programming Centre, with sub-centres, as appropriate, in the regional economic commissions or institutes of economic development and planning:

"(*a*) To intensify the activities already initiated in this field and to prepare, as soon as practicable, in co-operation with the international agencies concerned, long-term projections of world economic trends in order to facilitate the formulation of national economic plans;

"(*b*) To provide studies of planning techniques under various economic and social systems which would be helpful to national and regional institutes of economic development and planning."

intended to organize this work in collaboration with the regional commissions and national governments, and that the specialized agencies, other international organizations and private research institutions will also participate. We are concerned with the whole range of work to be done and would not wish to prejudge the question of which agency should do it.

2. Almost everywhere, governments are now concerned with the problems of long-term strategies for economic growth in their own countries; in many under-developed countries, in particular, planning and programming have become increasingly important instruments for accelerating economic development. Development strategies are being formulated in varying degrees of comprehensiveness. Some are little more than the general expressions of intention. In many countries, comprehensive plans are being elaborated. The centrally planned economies have been operating with annual and five-year plans and have recently undertaken the formulation of longer-term perspective plans. In addition to national governments, international organizations, both within and outside the United Nations, are engaged in studying long-term prospects and policies for groups of associated countries, or for groups of commodities. In certain cases, the international organizations are providing Governments with technical help in the formulation of plans. Various official, industrial and academic organizations throughout the world are concerned with similar work. Every one of these individual attempts to look ahead depends, to a greater or less extent, on a view about future developments in the rest of the world economy, and particularly on a view about the future course of international trade.

3. All members of the Committee are convinced that the formulation of co-ordinated national and international policies for economic development could be facilitated by the work proposed in the General Assembly resolution referred to above. Not only would this create a better basis for national plans to promote economic and social progress in the countries concerned; it would also emphasize the great opportunities for bringing national economic policies into closer accordance with international objectives and for shaping these policies with greater awareness of common interests. These views are confirmed by the representatives of the specialized agencies and intergovernmental organizations who have helped the Committee with their advice and experience. The Committee was greatly assisted by working papers prepared by Mr. E. S. Kirschen, by Mr. J. Pajestka and by the United Nations Secretariat.

4. The general object of our recommendations is, then, that the United Nations and other international agencies should be enabled to play an increasingly active part in assisting the improvement of national plans and programmes for long-term economic development. Our views about the future work are set out under the following heads:

I. Projections and their policy implications;
II. Methodological studies and data requirements;
III. Collection, dissemination and discussion of data, plans and policies.

I. Projections and their policy implications

5. We would urge that the United Nations, in co-operation with the international agencies concerned, should as soon as possible prepare and publish long-term projections for the world economy. This is a very considerable task, and essentially a continuous one; the projections will need to be repeatedly refined and revised as their usefulness extends, and full opportunity should be given for discussion of them. Some suggestions about how such projections might be made are contained in a number of working papers for the Secretariat.

6. Such projections would explore the problems that will arise in achieving more rapid growth throughout the world economy and especially in the under-developed countries. The projections would therefore be an attempt to spread understanding of the quantitative implications of certain general economic and social objectives, and, in particular, of the objective of a rapid rise in living standards, accompanied by early elimination of poverty and by progress towards greater equality of opportunity. To achieve this objective requires the most effective use of human resources and productive capacity and means that Governments will keep demand rising in line with increasing potential output.

7. The purposes of the projections should be:

(*a*) To provide national authorities and other organizations with a coherent international background for the framing of plans and policies for particular countries, associated groups of countries, and sectors;

(*b*) To explore by quantitative illustration the international compatibility of national plans and programmes, and the quantitative implications of alternative national and international strategies, in particular of adequately high target rates of growth in the under-developed countries. Quantitative projections have been found to be a most powerful analytical instrument to display the less obvious implications of trends and policies, to show clearly the relative importance of the various elements in complex situations, and to demonstrate the possibilities and limits of alternative courses of action;

(*c*) To assist in the formulation of international policies concerned with the economic relationships between countries.

8. To serve these purposes, we believe that the work to be done should meet the following requirements:

(*a*) Analysis on a world scale must necessarily begin from analysis of broad tendencies affecting a wide range of countries, but to be useful, the implications of these broad projections must be brought out in sufficient detail to permit the specific problems of individual countries to be identified within the general framework, and the general projections to be tested against the plans and programmes of individual countries.

(*b*) The projections must be based on study of the *interrelationship* of growth rates between countries, operating, in particular, through international trade and payments. Special attention should be paid to the effects of flows of capital and aid, and of factors and policies affecting the terms of trade, on relative income levels and on relative rates of growth. An example of work already done on one aspect of international trade is the projection of long-term demand and supply factors for agricultural products. We have had this study before us and hope that this work will be vigorously continued.

(*c*) The projections should display those elements in the economic structure of nations which are regarded as strategic for growth. In the underdeveloped countries, these basic features of the economy might be regarded as including:

(i) The rates of investment and the capacity to increase investment;
(ii) The levels and rates of development of primary and industrial output and productivity in relation to gross national product;
(iii) The distribution of the growing labour force by major economic sectors;
(iv) The import content of different forms of final expenditure.

Growth policies would be considered in the light of how far or how quickly these basic features of the economy can be changed, taking into account the problems arising from, for example, shortages of qualified manpower at various levels, deficiencies of technical organization, balance of payments deficits, income distribution, land ownership systems and population trends. The work pro-

gramme should include continuous exploration of the factors, internal and external, determining the maximum feasible acceleration of economic growth in the under-developed countries.

II. Methodological studies and data requirements

9. The United Nations should be able to make a valuable contribution by stimulating and co-ordinating the collection of data and the study of methods of analysis and projection, including the construction of input-output tables and of mathematical models.

10. One basic need is the improvement and extension of national statistics and of their comparability (particularly for national accounts). There has been great progress in this area, in which the international organizations have played a large part; we need only say that the feasibility and usefulness of the programme which we are considering depend very heavily on the accuracy, comparability and completeness of the statistical data available. In most under-developed countries, a considerable additional effort is needed to set basic data for comprehensive planning.

11. A major statistical problem is the difficulty of comparing and aggregating in a meaningful way economic magnitudes in different countries. We would urge, as a long-term proposition, the further development of data on income distribution, expenditure patterns and price structures in different countries. This is needed for many purposes, including (*a*) clearer evaluation of progress in raising standards of living and economic potential and (*b*) comparisons of the purchasing power of currencies. We welcome the intention of the Statistical Office of the United Nations to study possible solutions of the highly complex problem of purchasing power comparisons.

12. We feel, further, that it would be desirable to develop a new range of data about important economic and technical relationships which are not now systematically put together. In particular, it should be possible to assemble or to collect comparative technical and statistical data, for particular lines of production, about labour, material and investment inputs. The dissemination of such data for a range of countries would greatly assist those concerned with planning and programming in countries where the information is lacking.

13. One field for international co-operation is the comparative study of methods of factual economic analysis and of economic development models. It seems to us essential that the United Nations should be equipped to advise on analytical methods, with full knowledge of the work being done in individual countries, whether in official planning organizations or in academic institutions.

14. Studies should also be made, as experience accumulates, of the methodological problems of models for groups of countries or for the world economy as a whole. This calls for much further research into the changing structural patterns of international economic relationships.

15. This field of work should extend to the analysis of the effectiveness of various methods of modifying a country's economic structure. It is important to study, for example, the extent to which a country in a particular situation can achieve growth by import substitution. This kind of exercise requires both theoretical reasoning and intensive analysis of actual experience in individual countries.

16. Such methodological studies, by distilling international experience, will be helpful to experts in all countries. But they will be especially useful for experts in countries with limited resources for conducting this kind of work on their own account.

III. Collection, dissemination and discussion of data, and policies

17. To allow the United Nations Projections and Programming Centre to perform the tasks laid down by the General Assembly in resolution 1708 (XVI), Governments must, clearly, be prepared to co-operate by readiness to make available to the United Nations the fullest possible information about their long-term plans and programmes. The dissemination of this information among national planning authorities should itself do much to encourage the technical improvement and greater coherence of national long-term policies. We attach importance to the Secretariat's intention to give greater emphasis to the discussion of national long-term plans in future international economic surveys in accordance with the General Assembly's resolution on this matter. The very process of studying national long-term plans and programmes in relation to each other, which implies viewing the problem as a whole, will offer new and meaningful insights into the problems and feasibilities of development. This could make a genuine contribution to a better balanced and speedier development of the world economy.

18. A task which the Centre might undertake immediately is the preparation of a comprehensive directory containing (*a*) a list of agencies, organizations and individuals engaged in research on development activities; (*b*) a bibliography of relevant studies in the field of development; [c] (*c*) a list of major development projects carried out in developing countries during, say, the last 10 years and (*d*) an index of technical information and data relevant for planning.

19. It is, however, in our opinion desirable, and practicable, to go further than the simple dissemination of information. It seems to us that it would be useful if Governments were prepared to take part in reasonably detailed discussion of their long-term economic prospects, both with each other and on a wider international level. One of the functions of the Economic Projections and Programming Centre should be to promote such discussion (in collaboration with the regional economic commissions, specialized agencies, and other inter-governmental organizations) with a view to the gradual convergence, in the mutual interest, of national economic policies. The proposed work on projections of the world economy would afford a useful background for such discussions. The United Nations "family", moreover, should be in a position to help member countries, when required, to study the wider implications of their own plans and programmes.

Conclusion

20. It is not suggested that the programme suggested above — for projections, for methodological studies, and for dissemination and discussion of national plans — should proceed in any particular order of priority. These are not neatly separated compartments of study, but interdependent aspects of a single and continuous operation. The need is to develop thinking and action on a broad front.

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[c] Reference was made to the international "Bibliography on Demand Analysis and Projections" published by the FAO (with annual supplements).

Annex II[a]

WORK PROGRAMME FOR THE ECONOMIC PROJECTIONS AND PROGRAMMING CENTRE OF THE BUREAU OF GENERAL ECONOMIC RESEARCH AND POLICIES OF THE DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS

Introduction

1. This report is submitted in response to two requests of the Economic and Social Council: first, by resolution 916 (XXXIV), the Council requested a report on progress made in the fields of economic projections and economic planning towards achievement of the goals envisaged in General Assembly resolution 1708 II (XVI). Secondly, by resolution 924 (XXXIV), the Council requested a report on activities in the field of economic projections.

2. The present document sets forth a continuing work programme for the Economic Projections and Programming Centre (EPPC), which was established at Headquarters in accordance with General Assembly resolution 1708 II (XVI). In the context of this work programme, a report is made on the recent activities of the Centre.

3. The proposed work programme indicates the major lines along which it is planned to carry out the assignments of the Centre. It has been designed to intensify and co-ordinate the work of the United Nations in the field of projections and planning and, thereby, to contribute to the aims of the United Nations Development Decade. The programme takes into account the recommendations of a group of experts (see annex I) whose report (E/3668) was submitted to the thirty-fourth session of the Council and was commended in Council resolution 924 (XXXIV).

4. Activities closely related to those of the Centre are included in the terms of reference of the regional economic commissions and of the regional development institutes associated with the commissions. The regional secretariats have undertaken work in economic projections and programming for some years. Recently, following the establishment of the EPPC and in accordance with the same General Assembly resolution, 1708 II (XVI), regional economic projections and programming centres have been established in the Economic Commission for Africa (ECA), the Economic Commission for Asia and the Far East (ECAFE) and the Economic Commission for Europe (ECE); and a regional centre for projections has been established in the Economic Commission for Latin America (ECLA). In accordance with the proposal made by the General Assembly in resolution 1708 I (XVI), a Latin American Institute for Economic and Social Planning has been established and plans are well advanced for organizing similar institutes in Africa and in Asia and the Far East. Appendices A and B include pertinent resolutions of the General Assembly and the Economic and Social Council, as well as statements of the terms of reference of the EPPC at Headquarters and in the regional secretariats.

5. As one of the primary functions of the Centre is to co-ordinate the work done on projections and planning by the various units at Headquarters and in the regions, the work programme for the Centre, submitted below, refers to closely related activities of these units and of the regional development institutes. Further information concerning related work of the regional secretariats and of activities with regard to the regional development institutes is available to the Council in the annual reports of the Commissions.[b] The proposed work programme for the Centre also refers to closely related activities of the specialized agencies and other inter-governmental organizations.

Work programme

6. This covers the work undertaken or to be undertaken in the United Nations Secretariat at Headquarters in co-operation with the regional secretariats, the regional development institutes, the specialized agencies and other intergovernmental organizations. The activities of the Centre may be classified into five major categories:

(*a*) Studies on planning and programming;

(*b*) Projections of world economic trends;

(*c*) Technical assistance support activities;

(*d*) Dissemination of information;

(*e*) Organization of meetings and seminars of experts.

The subsequent paragraphs broadly describe the scope and objectives of each of these activities.

Planning and programming studies

7. Studies in the field of planning and programming will be of two types:

(*a*) Periodic reviews of the experience gained in development planning by countries with different economic systems and at different stages of economic development;

(*b*) A series of manuals dealing systematically with the techniques of planning.

The intention of these studies is to shed light on the main problems of development planning commonly encountered by developing countries and to help build a factual and analytical body of knowledge that could be used in designing effective development plans. It is hoped that these studies will also prove useful as teaching material in the regional development institutes.

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[a] Progress report submitted to the thirty-sixth session of the Economic and Social Council as document E/3764.

[b] The following references are especially pertinent. For ECA (E/3727): paragraphs 16-19 (projections and programming); paragraphs 123-127, 216-237, and part III, resolutions 71 (V) and 72 (V) (African Institute), and part V B, sections I and VII (work programme). For ECAFE (E/3735): paragraphs 108-112, 116-119, 173 and 282-286 (research, planning and projections); paragraphs 113-115, 282-286, and part III, resolution 43 (XIX) (Asian Institute), and part V, sections I and II 2 (work programme). The Economic and Social Council will also have before it work programmes of the ECE and ECLA.

8. A number of the studies proposed below are already under way in various units of the United Nations Secretariat. Nevertheless, such projects have been included here for completeness of presentation and in order to indicate the scope of the co-operation involved.

Section 1. General surveys

9. Included in this section are the following projects:

Project 1.1. Report of the group of experts on planning for economic development. Under resolution 1708 (XVI) of the General Assembly, a group of experts was convened to assist the Secretary-General in preparation of " a study summarizing the experience gained and the techniques in use in the planning of economic development by different countries ". This group is expected to finish its work in August 1963.

Project 1.2. Special chapters on economic development planning in the " World Economic Survey " and the " Economic Survey of Europe ". By the same resolution, the Secretary-General was also requested " to prepare a special chapter on questions of economic development planning in one of the forthcoming issues of the *World Economic Survey* ". In fulfilment of this request, part I of the *World Economic Survey, 1963*, which is to be submitted to the thirty-eighth session of the Economic and Social Council, will be devoted to the subject of planning in the developing countries. In addition, the *Economic Survey of Europe, 1962*, presented to the present session of the Council, contains a general study of planning techniques in European countries.

Project 1.3. Periodic survey of development plans and their fulfilment. It is intended that the special chapter in the *World Economic Survey, 1963*, will be followed, at intervals, by periodic surveys on development planning. Such surveys might consist of two parts. The first part would describe and analyse those plans published or ratified within the preceding twelve months. The second part would deal with those plans which have been completed within the preceding twelve months. This would compare plans with actual experience during the plan period; it would seek to identify the main difficulties encountered and to point out the lessons for the future. The survey might also, from time to time, contain special articles by experts or the Secretariat on some current topics in the field of planning.

Section 2. Special studies on appraisal of progress toward realization of the objectives of the development decade

10. In response to resolution 916 (XXXIV) of the Economic and Social Council, a survey of progress in the economic and social fields towards the targets set for the Development Decade will be prepared for issue in 1965, which has been designated as International Co-operation Year by General Assembly resolution 1844 (XVII). The work is to be carried out co-operatively by the Bureau of General Economic Research and Policies, the Bureau of Social Affairs, the regional secretariats and the specialized agencies.

Section 3. Macro-economic planning

11. The following projects are included in section 3:

Project 3.1. Aggregate models. This project will cover: (*a*) the uses and limitations of aggregate models in development planning in countries with different economic systems and at different stages of development; (*b*) the problems encountered in the application of models; and (*c*) statistical requirements of different models.

Project 3.2. Macro-economic balances. This study includes: (*a*) problems in the estimation of macro-economic balances, including an estimation of investment requirements and the supply of saving; and (*b*) problems of internal and external stability.

Section 4. Allocation of investment

12. This section comprises the following projects:

Project 4.1. Sectoral allocation of investment. Included in this project are: (*a*) economic considerations relevant to allocative decisions; (*b*) analysis of the patterns of resource allocation most likely to accelerate development; and (*c*) specific problems in investment requirements, such as determination of the investment requirements in power and transport generated by industrialization.

Project 4.2. Criteria for the selection of projects. This covers: (*a*) practical problems in the choice of techniques, including choices between domestic production and foreign trade; (*b*) the use of accounting prices; and (*c*) means of implementing projects in the private sector.

Section 5. Planning of the external sector

13. This topic includes: (*a*) analysis and appraisal of foreign exchange resources and requirements in the formulation of medium-term plans; (*b*) policies and procedures for the implementation of foreign trade plans; and (*c*) problems and methods in the adjustment of plans to short-term fluctuations in foreign exchange receipts.

Section 6. Planning and mobilization of saving for economic development

14. This project would aim at a comparative study of programmes for the creation, mobilization and channelling of domestic saving for the productive investment embodied in national plans. The problems encountered and the measures required for their solution would also be discussed.

Section 7. The use of inter-industry analysis in planning

15. The research would be focused upon the experience gained in using input-output techniques and commodity balances in national planning and also upon the applicability of these methods to countries at different stages of economic development.

Section 8. Aspects of planning at the industry and project level

16. The studies indicated above generally deal with the interrelationships among major sectors of the economy. Fulfilment of planned targets, however, requires study of the links between sector targets and the conditions prevailing in the component industries. Studies of this nature are being carried out by various units in the United Nations Secretariat, both at Headquarters and in the regional economic commissions, and by the Food and Agriculture Organization of the United Nations (FAO). The following projects are included in section 8:

Project 8.1. Aspects of planning at the industrial level. This deals with both macro and micro aspects of industrial development programming. The activities include: (*a*) analysis of government replies to a questionnaire on industrial planning and development; (*b*) studies on techniques of industrial programming; (*c*) pilot studies on pre-investment data; and (*d*) assessment of operating characteristics of industry. These are being carried out by the Centre for Industrial Development (for further details, *see* document E/3600/Rev.1, chapter V, sections A and B).

Project 8.2. Aspects of planning of infrastructure. Studies will focus on problems of assessment of techniques, of estimation of capital requirements, of methodology of project appraisal, and of organization with regard to water, mineral and energy resources and transport development. In addition, through synthesis of inter-country experience, these studies will provide a basis for promoting international standards.

Project 8.3. Aspects of planning in agriculture. Arrangements will be made with the FAO regarding integration of the studies on planning in agriculture within the framework of the Bureau of General Economic Research and Policies.

Section 9. Educational and manpower planning

17. This study is to be carried out in collaboration by the United Nations Secretariat, the International Labour Organisation (ILO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). It will be focused on methods and problems in the assessment of educational requirements for economic growth, particularly of skill requirements for fulfilment of medium- and long-term plans; and it will include an analysis of the means of evaluating the extent of under-employment and of achieving fuller utilization of available manpower.

Section 10. Social aspects of planning for development

18. The following projects are included in this section:

Project 10.1. Studies of social aspects of planning for development. A number of these studies, which analyse the expenditure on various social sectors and its impact on development, have already been undertaken.

Project 10.2. Methods of determining social allocations.

Project 10.3. Institutional factors affecting the supply and productivity of labour with different types of skills.

Project 10.4. Public administration in relation to social development. Under resolution 903 B (XXXIV) of the Economic and Social Council, the Bureau of Social Affairs, in co-operation with the Division of Public Administration, is preparing a study "summarizing the experience of various organizational arrangements for social planning in relation to economic goals". This study is scheduled for completion in early 1964.

Section 11. Interrelationships between social and economic targets in development planning

19. This study is to be undertaken by the Bureau of General Economic Research and Policies in collaboration with the Bureau of Social Affairs. While, at the preparatory research stage, social and economic aspects of development planning lend themselves to a more or less separate evaluation and analysis, the establishment of an integrated development plan should bring together social and economic targets into a consistent set of objectives and emphasize their mutual interdependence. It is hoped that, as experience is accumulated with respect to the implementation of the projects listed above, some general methods for constructing and implementing balanced socio-economic development plans will eventually be developed. It may be noted that under resolution 830 A (XXXII) of the Economic and Social Council, a series of country case studies of planning for balanced social and economic development has already been initiated.

Projections of world economic trends

20. During recent years, it has been increasingly recognized that long-term economic projections have a definite role to play in national and international planning for economic development. In the report by a group of experts that met in June 1962 to evaluate the techniques of long-term projections, the purposes of projection work are regarded as twofold. "Not only would this create a better basis for national plans to promote economic and social progress in the countries concerned; it would also emphasize the great opportunities for bringing national economic policies into closer accordance with international objectives and for shaping these policies with greater awareness of common interests" (see annex I).

21. It is in relation to the second purpose that the availability of a consistent set of projections of world economic trends has become an urgent task. In more concrete terms, such global projections could assist individual countries, particularly the developing countries, in their planning work by: (*a*) furnishing realistic ranges of the trends in external economic forces; (*b*) bringing into focus the degree of complementarity of national plans and the possibility of promoting regional co-operation, and (*c*) providing background information for consideration of appropriate international measures to improve the external economic environments of the developing countries.

22. Furthermore, global projections will also play an important role in the work relating to the United Nations Development Decade and the United Nations Conference on Trade and Development. In both cases, the expansion of world trade and the acceleration of economic growth in the world economy have been primary aims. Moreover, in the case of the Development Decade, a target rate of growth of 5 per cent has been set for achievement by all the countries. Global projections will serve to indicate, in quantitative terms, the basic requirements for achievement of these objectives and also to estimate the probable impact of various national and international measures that might be taken.

23. To meet these needs, the Centre will organize its work on projections around three broad aspects: (*a*) developing the techniques for long-term projections; (*b*) making actual projections for major economic and social variables; and (*c*) appraising the basic requirements for achievement of target growth rates in the developing countries during the Development Decade.

Section 21. Manuals on techniques for projections of interrelated economic variables

24. The aims of the projects included in this section will be: (*a*) to survey techniques currently used in long-term projections; and (*b*) to develop standard techniques and models to be employed for country, regional and global projections. The results of the research will be published in a series of manuals. Section 21 includes the following projects:

Project 21.1. Aggregate models. Under Economic and Social Council resolution 777 (XXX), a group of experts was convened in June 1962 and its report contained proposals for a co-operative work programme on long-term projections (see appendix B). Three papers concerning aggregate models used for projections in countries with different economic systems and at different stages of development were submitted to this group for discussion. They were: "A projection model of the developed private economies" (EPPC/LTEP/R.1), "Economic models for under-developed countries" (EPPC/LTEP/R.2) and "Methods of long-term projections for the centrally planned economies" (EPPC/LTEP/R.5). These papers will be published shortly, after account has been taken of the comments at the meeting.

Project 21.2. Sectoral models. As a complement to aggregate models, sectoral models will examine the implications of results obtained from aggregate models on the structure and growth of major economic sectors. The work on developing countries has already been initiated. It is planned that a meeting of experts will be convened in 1964 to evaluate the results and to discuss other related problems.

Section 22. Extrapolation of economic growth rates

25. This consists of simple extrapolations of past trends in economic growth on a world, regional and country basis. Its purposes are: (*a*) to evaluate the target growth rates implied in national development plans in the light of historical trends; and

(*b*) to compare perspective economic growth and population growth among countries as well as among regions in the framework of the Development Decade. A preliminary study entitled "World population and gross domestic product: Extrapolation of historical trends for the years 1965, 1970, 1975" (EPPC/LTEP/R.3) was prepared and made available to the meeting of experts on projections. This document will also be published shortly.

SECTION 23. PROJECTIONS OF BASIC REQUIREMENTS FOR ACHIEVEMENT OF TARGET GROWTH RATES IN THE DEVELOPING COUNTRIES

26. In this, as well as in the subsequent sections, the techniques obtained from section 21 will be employed for actual projections. The various projects included in this section are designed to assess the basic requirements for realization of major economic targets, as well as to evaluate the progress towards their achievement, in the developing countries. Such assessment and evaluation will be made not only in relation to the targets given in national plans but also to those given in the frameworks of the Development Decade and the Conference on Trade and Development. The following projects are included in section 23:

Project 23.1. Projections of the trade needs of developing countries. A preliminary study entitled "Expansion of international trade and its significance for economic development" (E/CONF.46/PC/13) has been issued for use by the Preparatory Committee of the Conference on Trade and Development. This project centres upon trade needs of developing countries for their accelerated economic growth.

Project 23.2. Projections of total output by major productive sectors. This includes evaluation of the sectoral rates of growth implied in over-all growth targets, actual sectoral projections on the basis of past experience and perspective plans of individual countries.

Project 23.3. Projections of investment requirements. This project is composed of projections of the aggregate level of investment required to achieve target rates of growth in individual countries and in the developing countries as a whole, and of investment requirements by type.

Project 23.4. Projections of domestic saving. Projections of household, enterprise and government saving in individual countries by detailed analysis of the major determining factors and of policy measures and projections of regional saving on the basis of past experience and long-term development plans of constituent countries are included in this project.

Project 23.5. Projections of domestic demand for major commodities other than capital goods. This includes projections of demand for these commodities as a function of the level and distribution of income, size of families and relative prices; commodities to be included correspond to the sectoral break-down of output used in project 23.2.

Project 23.6. Projections of export earnings. This project will also be carried out in co-operation with specialized agencies: (*a*) projections of exports of primary and manufactured commodities of developing countries to the rest of the world as a function of domestic and foreign economic conditions and policy measures; (*b*) projections of intra-trade among developing countries; (*c*) projections of the terms of trade; and (*d*) projections of invisible receipts and payments.

Project 23.7. Projections of import requirements. This includes projections of import requirements of major commodity groups, as implied by the results of projects 23.2 to 23.5.

Project 23.8. Projections of the inflow of long-term funds. The research will be linked with the annual surveys of long-term capital movements, which are now undertaken by the Bureau of General Economic Research and Policies.

Project 23.9. Projections of balance of payments gap. This project will present a consolidated account of the results of projections in projects 23.2 to 23.8, in order to assess any possible gap in the balance of payments that might arise in the developing countries in their effort to realize growth targets. Studies of the impact of alternative national and international measures to deal with any expected gap will be included.

SECTION 24. PROJECTIONS OF MAJOR ECONOMIC VARIABLES IN THE DEVELOPED COUNTRIES

27. This section includes the implications of growth under full employment conditions on sectoral problems, as well as domestic and import demand for major commodities. Such projections will also serve as a background study for evaluating the export prospects of the developing countries.

SECTION 25. PROJECTIONS OF MAJOR ECONOMIC VARIABLES IN THE CENTRALLY PLANNED ECONOMIES

28. Such projections are generally given in the perspective plans of most countries. These will serve as a basis for estimating their demand for imports from the developing countries.

SECTION 26. PROJECTIONS OF COMMODITY PRODUCTION AND TRADE

29. While aspects of commodity projections have already been covered in the previous projects, this section is intended to review the trends of individual commodities on a global basis. The projections are intended to serve as background material for the Commission on International Commodity Trade (CICT) or other international bodies in considerations of commodity agreements or other international commodity policies. This section includes the following projects:

Project 26.1. Projections of agricultural commodities. In response to General Assembly resolution 1517 (XV), a preliminary study entitled "Agricultural Commodities — Projections for 1970" (E/3628) was prepared by the FAO.

Project 26.2. Projections of primary non-agricultural commodities. In response to the same resolution, a preliminary study entitled "Prospective demand for non-agricultural commodities: Problems of definition and projection methodology" (E/3629) was submitted to the thirty-fourth session of the Economic and Social Council. A progress report on the subject of "Prospective supply of non-agricultural commodities" (E/CN.13/L.74) was submitted to the eleventh session of the CICT.

Project 26.3. Projections of manufacturing commodities. In conjunction with project 23.5, such projections will concentrate on the demand for steel, machine tools and other manufactured capital goods. In addition, the trends of world trade in steel and iron ores will be analysed.

Project 26.4. Projection of the commodity composition of world trade. This includes detailed projections of direction and volume of commodity trade, as implied in projections of the over-all economic growth of trading countries.

SECTION 27. PROJECTIONS OF POPULATION AND LABOUR FORCE, AND OF REQUIREMENTS FOR EDUCATION, LABOUR TRAINING, HOUSING ETC. IN INDIVIDUAL COUNTRIES

30. These studies consist of: (*a*) the preparation of technical manuals on methods for projections in these fields; and (*b*) their application to actual projections. A set of recommendations for national standards on population projections is also to be established. Work in the United Nations Secretariat is being undertaken by the

Bureau of General Economic Research and Policies and the Bureau of Social Affairs, in co-operation with the specialized agencies concerned.

SECTION 28. IMPROVEMENT AND STANDARDIZATION OF DATA REQUIRED FOR ECONOMIC PROJECTIONS

31. This section includes the following projects:

Project 28.1. Standardization and collection of data. The basic data that have been used for projections are partly based upon those collected by the Statistical Office of the United Nations and compiled according to the standards established by the Statistical Commission, such as the *Standard International Trade Classification*, the *International Standard Industrial Classification* and the *System of National Accounts*. The future tasks will be: (*a*) to provide, from time to time, arrays of the basic data of the global projections for use by countries and regions in making related projections; and (*b*) to assist the countries, wherever necessary, to assemble data conforming as closely as possible with the international standards.

Project 28.2. Comparison of purchasing power of national currencies. This consists of the development of meaningful conversion factors for comparing and aggregating economic magnitudes in different countries.

Technical assistance support

32. The expansion of operational activities concerned with projections and development planning will be pursued along the lines indicated by the General Assembly in resolution 1709 (XVI) on the decentralization of economic and social activities and the strengthening of the regional commissions, i.e., with heavy reliance on the regional establishments. Projections and programming centres, as well as development institutes are now being created in Africa, Asia and Latin America. Therefore, the role of Headquarters — apart from the functions it has to perform in places where regional services are not available — should gradually be thought of in terms of " the policy guidance functions " mentioned in resolution 1709. These could be adequately performed if the very small staff of the projections and programming centres were reinforced by the provision, under the United Nations Regular Programme of Technical Assistance, of a few high-level advisers in development planning and projections, whose services would be available as needs arise in the regions or at Headquarters.

Dissemination of information

33. The publication of a periodic survey on planning, as indicated above, would serve, *inter alia*, as a major instrument for disseminating information on substantive matters. It may, however, also be advisable to consider the publication of an information bulletin at regular intervals. Such a bulletin would contain:

(*a*) Reports on the progress of work on planning and projections at Headquarters and in regional secretariats, as well as in other United Nations agencies;

(*b*) To the extent feasible, summaries of important developments and results of research work in these fields in different countries;

(*c*) Notification of conferences, experts' meetings and seminars, and their agendas;

(*d*) Lists of books and articles on planning and projections published in the preceding twelve months, with brief descriptions of their contents.

34. The Centre would also act as an " international clearing house " in collecting and transmitting information about research and practical work in planning and projections. It would maintain contact with the national planning agencies as well as with private institutions and individuals currently engaging in research in these fields. In this way, the Centre would be able to extend information to them about the progress of work of the United Nations family and, at the same time, to receive from them the same kind of information as well as the results of their current research.

Organization of meetings and seminars

35. To help implement the research programme described above, it is deemed useful for Headquarters and the regional secretariats to organize regular and *ad hoc* meetings of experts. The experts may be requested to prepare reports on specific projects in the work programme or to assist the secretariats in carrying out studies. As the need arises, their views and recommendations may be sought in connexion with revision of the work programme of the Centre.

36. Since its inception, the Centre has organized meetings of two groups of experts — one on long-term economic projections and the other on planning for economic development. In the regional secretariats, meetings of experts on similar topics have also been held in recent years. However, it is the intention of the Centre to organize future meetings on a more flexible basis. The form and composition of the meetings will vary according to the nature and requirements of particular projects. When a project is of particular interest to a regional secretariat, joint meetings will be held.

37. In the field of long-term economic projections, the urgent tasks are to determine the appropriate methodology to be used for future work on projections and to evaluate the implications of the results of any regional and global projections. To advise the Centre in carrying out these tasks, it is thought that regular meetings in the form of a small group of government experts of high standing would be most fruitful. Such a group would be expected to prepare its own technical report and to make recommendations.

38. In the field of planning, the main form of meetings would consist of regular seminars. Participants would be government officials — drawn from countries with different economic systems and at different stages of development — who are actually involved in the day-to-day operations of planning in national governments. Each of these seminars would be devoted to a specific problem of planning, to be chosen from the groups of projects listed under planning and programme studies (paragraphs 7-19). The discussion would be focused on a review of the actual problems faced by individual planners and on the means of their solution. The actual proceedings of such seminars would be released for public use. At the same time, it is hoped that the Centre would then be in a position to analyse and synthesize the experience gained and to publish the results in operational terms in a series of planning manuals. Moreover, it would also be useful to hold occasional meetings of senior officials occupying policy-making positions in national governments, in order to discuss broad policy issues in planning.

Annex III

GENERAL ASSEMBLY AND ECONOMIC AND SOCIAL COUNCIL RESOLUTIONS ON PLANNING AND PROJECTIONS

General Assembly resolution 1708 (XVI) on planning for economic development

(Extract)

" *The General Assembly,*

" . . .

" I

" 1. *Invites* the Governments concerned, acting as appropriate through the regional economic commissions or their appropriate subordinate bodies to be established for this purpose, to submit requests to the Special Fund for assistance needed for the establishment of economic development and planning institutes which will be closely linked to the respective regional economic commissions with a view, *inter alia*, to giving prospective trainees the benefits not only of theoretical but also of practical training and an acquaintance with the important work carried out by the secretariats of the regional economic commissions in their regions;

" 2. *Invites also* the Economic and Social Council at its resumed thirty-second session to recommend that the Economic Commission for Africa, the Economic Commission for Latin America and the Economic Commission for Asia and the Far East consider this matter at their forthcoming annual meetings and that the Economic Commission for Europe consider the expansion of its in-service training programme to include a substantial number of fellows from less developed regions;

" 3. *Expresses the hope* that the Special Fund will give prompt and sympathetic consideration to the establishment of the institutes referred to above;

" 4. *Expresses the hope also* that the Special Fund will give prompt and sympathetic consideration to the establishment of similar institutes which may be proposed by a group of Member States that are not members of any regional economic commission, such institutes to be open to participation by developing countries which are at present members of regional economic commissions;

" II

" *Requests* the Secretary-General to establish an Economic Projections and Programming Centre with sub-centres, as appropriate, in the regional economic commissions or institutes of economic development and planning:

" (*a*) To intensify the activities already initiated in this field and to prepare, as soon as practicable, in co-operation with the international agencies concerned, long-term projections of world economic trends in order to facilitate the formulation of national economic plans;

" (*b*) To provide studies of planning techniques under various economic and social systems which would be helpful to national and regional institutes of economic development and planning;

" III

" 1. *Invites* the Secretary-General, with the assistance of a group of experts composed with due regard to their familiarity with various planning techniques under different economic systems and in co-operation with the appropriate institutions of different countries, to prepare a study summarizing the experience gained and the techniques in use in the planning of economic development by different countries, and at the same time expresses the hope that the Governments of Member States will help to carry out that study;

" 2. *Requests* the Economic and Social Council to examine the study at its thirty-sixth session and to submit to the General Assembly at its eighteenth session its recommendations concerning the utilization of experience of economic planning in the interests of developing countries;

" 3. *Further invites* the Secretary-General to prepare a special chapter on questions of economic development planning in one of the forthcoming issues of the *World Economic Survey*."

Economic and Social Council resolution 777 (XXX) on projections

(Extract)

" *The Economic and Social Council,*

" . . .

" 1. *Takes note* of the preliminary report of the Secretary-General on the evaluation of long-term economic projections [a] including the replies of Governments, specialized agencies and other intergovernmental organizations to his questionnaire on these projections; [b]

" 2. *Requests* the Secretary-General to intensify his activities in the field of economic and social projections, including work on the collection, standardization and processing of the relevant data, and on the development of techniques for making medium- and long-term projections, drawing so far as practicable upon the services of experts at present available in the United Nations, the specialized agencies and other competent international bodies;

" 3. *Authorizes* the Secretary-General to convene such meetings of experts from representative groups of national Governments as he deems appropriate for the purpose of further evaluation of techniques of medium- and long-term projections, particularly in the economic field;

" 4. *Recommends* that the regional economic commissions continue their activities in this field in particular by encouraging and facilitating the preparation and supply by their member States of information relating to projections, and by arranging for appropriate technical advice and the collation of data;

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[a] *Official Records of the Economic and Social Council, Thirtieth Session, Annex*, document E/3379.

[b] E/3379/Add.1-6.

" 5. *Invites* States Members of the United Nations and members of the specialized agencies to co-operate with the Secretary-General, the specialized agencies, and the regional economic commissions, by taking measures to improve their techniques of projection, by providing information on the methods, assumption and projections used in their respective countries, and by participating in seminars and other meetings designed to improve the utility and availability of national and international economic and social projections."

Economic and Social Council resolution 924 (XXXIV) on work programme on long-term projections

(Extract)

" *The Economic and Social Council,*

"...

" 1. *Takes note with appreciation* of the progress report of the Secretary-General [c] and of the report submitted by a group of experts entitled 'United Nations Economic Projections and Programming Centre: Proposals for a Co-operative Work Programme on Long-term Projections'; [d]

" 2. *Considers* that implementation of the work programme on long-term projections recommended by the group of experts would be an important help, particularly in the light of the objectives of the United Nations Development Decade, in formulation of development programmes of developing countries;

" 3. *Looks forward* to the intensification of the work of the United Nations Secretariat, including the secretariats of the regional economic commissions, in co-operation with the specialized agencies already working in the same field, as a means of increasing understanding of the quantitative as well as the qualitative implications of the acceleration of the rate of economic development;

" 4. *Requests* the Secretary-General to submit to the thirty-sixth session of the Council a progress report on the activities of the United Nations Economic Projections and Programming Centre and the activities of the regional commissions in this field, as well as on the implementation of the work programme recommended by the group of experts."

[c] *Official Records of the Economic and Social Council, Thirty-fourth Session, Annexes*, agenda item 2, document E/3661.

[d] *Ibid.*, document E/3668.

Economic and Social Council resolution 979 (XXXVI) on economic planning and projections

" *The Economic and Social Council,*

"...

" *Noting* the work programme for the Economic Projections and Programming Centre.[e]

" 1. *Looks forward* to the submission of the report of the Expert Group on Planning for Economic Development, to the completion of the study on economic planning techniques in Europe in the *Economic Survey of Europe, 1962* [f] and to the publication of a study on economic planning in the developing countries in a forthcoming *World Economic Survey* [g] in accordance with General Assembly resolution 1708 (XVI);

" 2. *Requests* the Secretary-General to proceed with the implementation of the work programme of the Economic Projections and Programming Centre at Headquarters and in the regional centres in co-operation with the specialized agencies for meeting as effectively as possible the requests of Governments in the fields of economic planning and projections;

" 3. *Expresses the hope* that the regional economic commissions will give great emphasis to the consideration of the problems of planning in their work programmes;

" 4. *Recommends* an intensification of the exchange of information on experience in the field of planning and planning methods among regional commissions and other regional bodies of the United Nations, through their respective secretariats;

" 5. *Recognizes* in this connexion the especial value of seminars and symposia with participants from one or more regions;

" 6. *Urges* States Members of the United Nations or members of the specialized agencies to provide co-operation and assistance to the Secretary-General in developing the activities of the United Nations in the fields of economic planning and projections;

" 7. *Decides* to inscribe the problem of economic planning and projections as a separate item on the agenda of its thirty-seventh session."

[e] *Official Records of the Economic and Social Council, Thirty-sixth Session, Annexes*, agenda item 2, document E/3764.

[f] United Nations publication, Sales No.: 63.II.E.1.

[g] *Ibid.*, Sales No.: 63.II.ECA.C.1.

Annex IV

TERMS OF REFERENCE OF THE CENTRES AT HEADQUARTERS AND IN THE REGIONS

Economic Projections and Programming Centre

(Extract from a Memorandum dated 11 June 1962 by the Under-Secretary for Economic and Social Affairs)

"...

"The Projections and Programming Centre is established as a unit in...the Bureau of General Economic Research and Policies. The Director of the Bureau will *ex officio* be the Director of the Projections and Programming Centre. It is intended that the activities of the Bureau shall be increasingly focused on the problems of projections and programming, both in their research and operational aspects, and that, in so far as possible, staff for the Centre should be drawn from the establishment of the Bureau. The Centre may also draw upon the resources of the other units of the Department through temporary loans of staff, or in forming task forces for the implementation of specific projects.

"The Centre will have the following terms of reference:

"(*a*) To develop and carry out, in close co-operation with the secretariats of the regional economic commissions, a continuing and integrated programme of long-term projections in world economic trends, designed to facilitate the formulation of national economic plans, and to assist in the efforts which might be undertaken towards the determination of prospects and targets for various sectors of the world economy;

"(*b*) To co-ordinate the work done on projections and planning by the various units of the Department of Economic and Social Affairs at Headquarters and in the regions, in order to ensure a unified methodological approach as well as an optimum utilization of resources in the conduct of such work;

"(*c*) To initiate or undertake specific studies on the problems and techniques of planning and programming under various economic and social systems, as may be helpful to national or regional institutes, particularly those established under the auspices of the regional commissions;

"(*d*) To give substantive support to United Nations technical assistance operations related to the problems and techniques of planning and programming, in co-operation with the units concerned at Headquarters and in the regions, including regional development institutes;

"(*e*) To serve as a focal point for consultation and co-operation with the specialized agencies and the IAEA, on questions or projects involving economic projections and programming;

"(*f*) To promote and maintain contacts with intergovernmental agencies outside the United Nations family, as well as national agencies, or institutions, both public and private, active in the same area of work."

Regional Centres

Economic Commission for Africa

In accordance with General Assembly resolution 1708 (XVI), a regional Centre for Economic Projections and Programming was established within the Division for Economic and Social Development. This regional Centre, which will co-operate closely with the world-wide centre organized within the Department for Economic and Social Affairs at Headquarters, has initiated systematic analyses of African development plans as well as experimental work on long-term projections of African economic trends, as a part of the projections of world economic trends, in order to facilitate the formulation of national economic plans. Steps are being taken to establish and maintain close contacts between the regional Centre and the central planning agencies of African Governments.

Two project descriptions, illustrative of the work of the Centre, are as follows:

(*a*) Planning and programming. Research in methodology and techniques of planning and programming applicable under African conditions, to be carried out in co-operation with the EPPC at United Nations Headquarters and with other regional commissions. Topics to be covered include the adaptation of over-all models of growth for planning in African countries, capital output ratios and related subjects, income elasticity of consumption, the applicability of input-output analyses to African economies, investment criteria and methods of international co-ordination of development planning;

(*b*) Projections. Projections for African countries or groups of countries as well as for the continent as a whole, to be undertaken within the framework of the United Nations programme for projections carried out by the Centre at United Nations Headquarters in co-operation with the regional economic commissions.

Economic Commission for Asia and the Far East

A regional Centre has been established within the ECAFE secretariat, along the lines of General Assembly resolution 1708 (XVI). The following extract from the Commission's programme of work and priorities is illustrative of the work on projections and programming undertaken by the ECAFE secretariat:

"Studies of techniques of programming economic development, including methods of economic projection, adapted to the conditions of the countries in the ECAFE region. Previous work: the Working Party on Economic Development and Planning dealt with the problems and techniques of economic development planning in 1955; the First Group of Experts on Programming Techniques in 1959 dealt with the general aspects of these techniques; the expert group organized jointly with the FAO considered selected aspects of agricultural planning in Asia and the Far East in 1960; the Second Group of Experts on Programming Techniques dealt with the techniques of applying industrial

cost data and related coefficients to economic programming in 1961; the Third Group of Experts dealt with projections techniques for long-term economic planning in 1962. Preparatory work in 1963 for the Fourth Group Meeting in 1964.

"Studies of long-term prospects of economic development in the ECAFE region, in co-operation with governments and research institutes concerned. It is proposed to convene in 1964 the Fourth Group of Experts on Programming Techniques to consider the long-term prospects of economic growth of the countries of the ECAFE region as well as of the region as a whole."

Economic Commission for Europe

A regional Centre for Projections and Programming has been set up within the ECE secretariat, with the Director of the Research and Planning Division as the *ex officio* Director of the Centre. The functions of the Centre will include:

(*a*) Research on methodology and techniques of economic planning and programming, including economic projections, and the making of such projections for the European region as these may be required by the general work programme of the Commission or of the United Nations generally;

(*b*) Co-operation in this field with the Centres at Headquarters and in the other regional economic commissions;

(*c*) Maintenance of close contacts with the planning agencies of European countries;

(*d*) Lending support to technical assistance operations in the planning field in European countries, and the provision of such assistance as may be requested to similar activities in the areas of other regional commissions;

(*e*) Dissemination of information on the development of techniques of economic planning and programming in European countries;

(*f*) Organization of occasional expert meetings on planning and programming techniques, in co-operation as necessary with other regional centres, with participation by planners, etc., from underdeveloped countries inside and outside Europe.

Economic Commission for Latin America

A regional Centre for Economic Projections has been established in ECLA. It will have the following primary functions:

(*a*) To formulate — in a systematic and permanent manner — projections for the Latin American economies in general and for particular countries or groups of countries;

(*b*) To investigate the techniques and methods in the field of projections in order to propose and use those which are considered most adequate for the conditions prevailing in Latin American countries;

(*c*) To examine statistical and technical information that is necessary for making the projections;

(*d*) To compile and analyse the projections that have been prepared by other international and national organizations for the world economy and for Latin America — especially in those fields and for those countries of greatest interest — for an appreciation of the perspectives and process of economic development in our countries.

The Centre for Economic Projections will maintain close co-operation with the Latin American Institute for Economic and Social Planning in the analysis of and research on techniques of projections and will prepare joint studies in accordance with their respective programmes of work. The Centre will co-ordinate its work with the EPPC at United Nations Headquarters. It will establish relations with international and national organizations, governmental or private, that are active in this field and will maintain permanent contact with them.