Chapter 1

INTRODUCTORY; USE OF MATHEMATICAL MODELS

1.1. Aims and Means of Development Policies

1.11 In this book a number of mathematical models will be discussed which may be helpful to the design of development policy and more particularly to development planning. An increasing number of countries—both underdeveloped and developed—are pursuing a conscious policy of furthering development nowadays. This justifies a closer study of the mechanism of development with a view to finding optimum policies. For a proper understanding of the subject matter, some remarks must first be made about the nature of the problems and phenomena involved.

It is useful to distinguish between two broad classes of problems, sometimes called analytical and policy problems. Analytical problems, in this context, are the usual problems of economic analysis, whose objective is to explain the course of economic variables when a number of *data* are given. These data are, on the one hand, phenomena of an extraeconomic character, that is, natural, psychological, technical, or institutional phenomena. On the other hand, they may be economic phenomena or variables outside the geographical area considered—usually a country. The data can be such things as crop yields, tastes of the population, technological coefficients, or tax rates. An important subdivision of the category of data in the context of our problem is that which can be influenced by government policy, to be called *means* or *instruments of economic policy*, and data which cannot be influenced. Policy problems, in our context, are problems in which the logic of analytical problems is partly inverted. Those data which are means or instruments of economic policy are no longer considered as given, but rather as unknowns. Inversely, some things are supposed known about the economic variables

which are the unknowns in analytical problems. Assumed known are the *aims* of the policy considered; that is, either the precise values of some variables, to be called *target variables*, must be given or some function of them, to be called *social welfare function* or *social utility function*, must be a maximum. Thus, in development policy it may be that some fixed targets are set—a 20 per cent rise in national income and a 10 per cent rise in employment, say—or that the government aims at an optimum combination of national income, employment, and regional income distribution. The former type of problem, characterized by a set of fixed targets, requires that the number of instruments used be at least equal to the number of targets. There is less of such a condition in the case of the latter type of problem, but there must be at least 1 *degree of freedom*, that is, something to choose; otherwise nothing can be made a maximum.

1.12 Although models can be used for the solution of analytical problems as well as of policy problems, the emphasis in this book will be on their use in the solution of policy problems. One model can be used for the solution of a large number of different policy problems, however, and what we are going to say of these problems illustrates our main subject only. This book is not dealing with development policy in the first place, but with models that can be used in designing such a policy. Even so it is proper to say something about the aims and means which most frequently characterize development policy. We have seen already that such aims may be given the shape of fixed targets or of something more flexible, where a certain welfare function must be made a maximum. In fact there is no contradiction between these two ways of putting things. In principle the fixed targets should be chosen so as to lead to maximum welfare; they often represent what the policy maker intuitively thinks will maximize welfare. It is more correct, from a scientific point of view, not to consider them as given beforehand, that is, independently of the operation of the economic mechanism and more particularly independently of the instruments chosen. In fact they will often have been chosen on the basis of considerable knowledge with regard to these things. For practical purposes the setting of fixed targets is often attractive, especially for short-run policy problems. This is so because not much definite can be said about the shape of the social welfare function, meaning that the scientific adviser cannot easily replace the intuitive choice of the policy maker by something more precise. He can, however, with some reasonable accuracy, derive statements about the instrument values that will bring about a certain set of target values in a given economy.

In a more scientific treatment of problems of development policy it does make sense, however, to say something about the maximization process behind the choice of targets, especially if long-term targets are considered. Even if important clues for practical action cannot yet be

derived, some clarification about the logical structure of the problems at stake can be obtained.

The most general way of putting the problem of long-term development policy is to say that total welfare or social utility over a long period should be maximized, in principle even an infinitely long period. This welfare is dependent on a number of economic variables for all time units in the period. Among these variables, consumption stands out, but distribution of consumption over regions or groups, and variables like employment, as well as others, will also influence welfare. The problem therefore necessarily is a very complicated one, and the planner may have considerable need for simplification.

One important method of simplifying the solution of the problem is to break it down into steps or *stages*, which can be tackled in succession. More specifically, for development planning it seems appropriate first to deal with the problem of distributing consumption over time without entering into the composition with regard to individual commodities, and next to deal with the composition. This means that first a macroproblem is set in which the intricacies of distribution over time are given full attention, and that as a second stage a microproblem is solved. More precisely, the microproblem itself may be considered in a succession of stages, each referring to the proper allocation of investment between industries in a single year.

To be sure, the procedure may well be incorrect, and it has to be proved that, as a first approximation, it can be accepted. The authors believe that this proof is possible.

Other methods of simplification are to be found in the *choice of the variables*. Thus, consumption only, as the main variable, may be assumed to determine welfare. As a second approximation, one of the other variables only may be added, for example, employment. Instead of maximizing consumption over a long period, in certain circumstances, income may be maximized, where the amount spent on investment stands for additional consumption later.

1.13 The means of development policy applied in different countries depend very much on the preferences of their governments with regard to the *economic order*. In communist countries, where a much larger portion of the means of production is publicly owned, a much larger number of means of policy are available than in noncommunist countries. It would be inexact to say that all acts of the managers of publicly owned production units are themselves means of economic policy, since not all these acts can be controlled by the government. But clearly the grip of the government on such decisions is much tighter than in the case of privately owned production units. As a first approximation it may be said that investments in all industries in the public

sectors are instruments of policy, and these are less numerous, although by no means unimportant, in noncommunist countries. Further important instruments are the other well-known instruments of public finance, that is, public expenditure for other than investment purposes, taxes, and subsidies.

In most, though not all, communist and in some other countries, prices are an instrument of policy, including the "prices" of labor, wage rates, and the "prices" of capital, interest rates.

In smaller countries the instruments of trade policy (duties and quantitative restrictions) have a considerable impact on the economy.

1.14 Planning, or programming, of development is an activity which to a considerable extent is independent of the precise development policy pursued by a government, that is, independent of the means applied in such policy. Even a policy that relies only on indirect ways to influence production may be well served by advance planning that charts the most desirable course of production and its components. This is true wherever complicated and time-consuming processes are involved: inconsistencies can be at least partly avoided by advance planning.

Planning differs from pure forecasting in that it is based on the assumption that the future course of production and other economic variables can be influenced, and it aims at indicating the most desirable course. What constitutes the most desirable course depends very much, however, on the aims set and the means to be admitted.

Historically the desirability of planning has become clear because of the inconsistencies that may exist among measures designed by various ministries or departments and divisions if those measures are based on a partial analysis only. The assumptions made by an electricity board may be incompatible with those made by a department of agriculture or a board of trade.

Planning is an almost continuous process. At regular, fairly short intervals, plans have to be revised in the light of new information. This new information may consist of figures about external data of a random character such as crops or about systematic changes in the other data; it may consist also of figures about the economic variables which have materialized meanwhile and which may deviate from those expected, first, because the data deviated from expectations and, second, because the relationships assumed are different from the real relationships.

1.2. Mathematical Models as a Hard Core of Programming

1.21 Programming of development requires a number of different abilities and types of knowledge. As a rule the process consists in esti-

mating such a large number of figures that first of all considerable organizing abilities are needed. The way in which the large number of people necessarily involved in the process cooperate and the way their various acts succeed each other and fit into the general pattern are by no means arbitrary or unimportant. It is a common misunderstanding that activities can simply start at the bottom of the pyramid of agencies and that the coordinating role of the center comes in later. There is a certain optimum degree of centralized directives to be emitted first, so as to avoid the most primitive inconsistencies in the work done by the base. This example may illustrate the role of organization. Its role is also very important because an essential feature of efficient planning consists in planning in as short a time as possible.

But the work proper of calculating the figures also requires a number of different abilities, mostly not present in one single man. It requires, in other words, the cooperation of a large number of specialists, first of all, specialists in various technological fields. This is particularly true for the appraisal of investment projects in many different sectors. It is true also, but to a lower degree, for the estimation of future demand, if this is to a high degree dependent on technical development. Then, specialists in the economic field are needed, vested with knowledge of the prospects and peculiarities of a number of markets. They have to take care of the estimation of exports in the first place, but also of home sales. They often need the help of statisticians and econometrists. In the third place, specialists in the broader field of sociology and psychology have to play their part, more particularly if industrialization is extended to new areas, and if the way of life of formerly rural people is involved. Social and political experts may also be useful to judge the priorities in these fields when it comes to changing social insurance, wage systems, industrial democracy, and tax systems.

Finally there is a special role for those economists whom we nowadays call macroeconomists.

1.22 The task of macroeconomists is the one of coordinating much of the work done by the other experts, but not coordinating it in the sense of organizing it. The coordination meant here is of a more abstract nature. The macroeconomists have to see to it that no inconsistencies creep into the system of figures which ultimately constitute the plan.

In principle there is only one way to take care of this task; in practice there are more, since we have to work with approximations and trial-and-error procedures. In order, however, to give at least a sharp theoretical description of the task, let us take the ideal method for a while. It is essentially of a mathematical or, if that term is preferred, of a

logical character. The complete operation, in all its details, of an economy and the human beings populating it can be described by a mathematical model of a much more complicated and sophisticated nature than anything we know in reality. To deny this is equivalent to denying the possibility of the scientific treatment of the operation of society. It does not imply the assumption of determinacy in the old sense, since we have the tool of stochastic variables, representing—in physics as well as economics, to cite only two examples—those elements of "freedom" sometimes invoked against the assumption of determinacy. The essence of a model is precisely that of an orderly and, in a sense, complete administration of knowledge. It is for this reason that the model supplies us with the tools of coordination.

A model consists of a number of elements, now to be considered from the formal side only. The economic contents will be discussed in Sec. 1.5. A model consists of (1) a list of variables, to be subdivided into known and unknown or exogenous and endogenous variables in the analytical sense used above; and (2) a list of relationships or equations specifying the links of any type that exist between the variables, to be subdivided into definitions, balance equations, technological and institutional equations, and behavior equations. Each equation represents a set of *links* or *reactions* with a causal direction, sometimes symbolized by arrows directed toward the variable affected. The links represented in one equation are those meeting in one variable at one point of time and together responsible for the size that variable will take at that time. In each equation, therefore, those variables occur which influence the variable in which the links meet. There are other elements too in the equations, representing a third element of the model: (3) coefficients. They describe the intensity with which one variable affects, through one particular link, another variable. (Additive constants will be considered coefficients too.) They are typical of what is sometimes called the structure of the mechanism or organism.

The elements of a hypothetical ideal model of society can be used to analyze the process of planning and the coordinating task of the macroeconomist in it.

1.23 The figures which ultimately are to form the plan are the values of a number of the variables, more particularly the endogenous variables of the model. These variables are the outcome or, mathematically speaking, the solutions of the system of equations, given the exogenous variables, some of the endogenous variables at earlier time periods, and the coefficients. Since, in principle, they are interdependent, it cannot be that the variables referring to the agricultural sector are calculated by the agricultural experts, those of the textile sector by the

textile experts, and so on. They can be calculated only by one man who solves the system of equations, perhaps helped by a machine.

This does not mean, fortunately, that this man has to unite in himself all the knowledge incorporated in the whole model. Both other elements, the equations and the coefficients, can be established one by one, and open up the possibility of decentralization and specialization of jobs. Also, the choice of variables that should be included in the list is a matter that can be decided upon in a joint discussion. The establishment of an equation describing the supply of agricultural products—or of one of them—not only can be left to the agricultural specialist, but definitely should be undertaken by him. Similarly, the establishment of other relations must be the task of other specialists. In the light of modern statistical methods, our statement has to be qualified: the choice of the variables and the mathematical shape of each equation are typically the tasks of the specialist in the field concerned. The actual determination of the coefficients may sometimes be a problem requiring centralized work. Yet the so-called a priori estimation of coefficients as well as the judgment of coefficients obtained by a centralized simultaneous-equations approach is profitably left to the specialist.

This, then, would constitute a reasonable division of labor between the coordinating macroeconomist and the specialists: the list of variables to be included should be based on suggestions from all specialists, discussed together; nature of equations and variables to be included, a priori estimation of coefficients, and a posteriori judgment of coefficients determined by simultaneous-equations method are tasks of the specialists, each in his own field; simultaneous determination of coefficients, as far as necessary, and the solution of the system of equations are typically the tasks of the macroeconomist. The latter is a specialist not in any material field but in interdependency problems.

1.24 It is the contention of the authors that this task, in fact, and not only in theory, can best be accomplished with the aid of a mathematical model. It does not follow from this statement that it could not be done otherwise. In fact, most development plans have been made without such a model, by methods of trial and error at different levels. Nor is it the opinion of the authors that the coordinating macroeconomist should aim at establishing this ideal model, which was the basis of their reconnaissance-in-principle, at least not in the short run. As will be set out in Sec. 1.4, the authors are in favor of approximative methods to be called *planning in stages.*

Yet the authors feel that the core of a development plan should be formed by some type of mathematical model. Such a model, or a combination of them for various stages, has clear advantages typical of sys-

tematic treatment. Outstanding general advantages are clarity and consistency, that is, the avoidance of inner contradictions. But there are more. As already set out in the previous subsection, a mathematical treatment yields a natural subdivision of the work into well-defined separate tasks that can be tackled in succession. In addition, a mathematical treatment offers some of the advantages of roundabout production: at relatively little extra cost, alternative calculations can be made which enable us to judge at least some of the *confidence intervals* or *limits of reliability* and to judge the effects of alternative policies.

1.3. Conditions of Practical Applicability

1.31 The mathematical models to be used in development programming and to be discussed in this book have to satisfy a number of conditions which distinguish them from the vaster category of all conceivable models and which limit the degree of their complexity. They must be applied practically, "here and now," above all in underdeveloped countries. It is perhaps not each of the conditions separately but the combination of them that sometimes causes much trouble or limits their scope. Therefore, it goes without saying that the models to be used must be *complete* in the sense that they cover the whole economy and do not overlook phenomena of vital importance. They must be *correct* also in that they use coefficients which are in reasonable agreement with reality. By themselves these conditions are self-evident and common to all serious models. It is the combination with other conditions which we must now discuss.

1.32 The coefficients we are using must be more or less known, that is, no extensive or novel research, not yet generally recognized as pertinent, must be needed to determine the coefficients. Some of the more theoretical models presented in recent theoretical literature contain a host of relations of which we have not the slightest knowledge. Such models must be excluded from a practical program and from this book. Of course, work on them must go on in the universities and research institutes. These models may bring out features of vital importance which we are not yet aware of. It may well be that some of our policies of today will have no success because we did not know enough about these features. But we cannot base calculations on unknown relations.

1.33 Another condition our models must satisfy is that they must be manageable, and, more particularly, manageable by those who have to handle them. In part this is a question of the quality of the staff available to planning agencies. The models should not be too

difficult and too elaborate. Both terms are very vague, to be sure, and leave much to the question of taste. We do not believe in models with hundreds of variables, at least for the time being. For the rest, it depends on the country concerned; some of our models may be useful to the more advanced only, others to a large number of less advanced countries—in the sense of having less specialized planners.

1.34 To a certain extent the models must also be understandable to those who have to use the results of planning. This is even more vague an idea than the one of manageability. Almost none of the models here presented will appeal as such to the politicians whom they have to serve. They will have to be explained to them by the planners. Much will depend then on the didactic abilities of the latter. The general tendency of this part of the argument imposes a further restriction on the use of complicated concepts. What matters more perhaps is that no model should be made unnecessarily complicated. Often there are elegant ways of representing the main features of a mechanism or organism in a relatively simple way. In modern economic language our recommendations are: never use unnecessary boundary conditions or unnecessary input-output relations.

The choice of the proper model in any situation remains very much a question of taste. In a way, therefore, the reader will have to have a look at our collection of models in order to find out what we mean by the preceding conditions. The proof of the pudding is in the eating.

1.4. Successive Approximations as a Method

1.41 As has been said in the preceding sections (see Sec. 1.24), we are in favor of a method of development programming to be called *planning in stages*, which stands at variance with the more ambitious method of establishing one very complicated model for a simultaneous solution of all problems. In a general way, planning in stages is an attempt first to determine a few of the most important ("strategic") variables and later to determine others, thus coming to greater detail and gradually covering a longer period. Before going into some of the concrete features of the method, we may present a general argument in favor of it. The method is a special case of the well-known and old mathematical—and general scientific—method of successive approximations (or "decreasing abstraction"). This latter constitutes not only a semiscientific procedure for purely applied calculations but also, in many cases for lack of better, the only way out for scientific research. This is true in such cases where a more direct or precise method does not or does not yet exist. Since in many cases the accuracy of the approximative method can be increased

at will, it can be used in general proofs of scientific statements. Its scientific "rank" should not therefore be misunderstood.

1.42 What matters more for the practice of planning, however, is that in order to reach a certain numerical result the method of successive approximations often requires less effort than the exact method, where it exists. In practice, numerical results need not be absolutely exact, but have to have only a margin of error below a certain prescribed limit. Thus, if we have to calculate the figure 1.003^4 up to three decimal places, there is no need of the complete "correct" calculation; the approximative answer $1 + 4 \times 0.003 = 1.012$ suffices. The gain of time and effort is considerable. As is well known, development in power series is a general and frequently used device to which the preceding remarks apply.

1.43 A few remarks may be added already on the concrete *stages of development planning* which we recommend. More will be said in Chap. 8, after the techniques have been discussed.

As a rule the first stage may consist of a macroeconomic study of the general process of production and investment, along the lines suggested by Harrod-Domar models or by similar, somewhat more complicated models. The aim of this first stage should be to determine, in a provisional way, the rate of savings and the general index of production. A second stage may consist then in specifying production targets for a number of sectors over a fairly long period. A third stage, if needed, may go into more detail for a shorter period, giving figures for a larger number of smaller sectors. A fourth stage may consist in "filling the plan out" with individual projects. Intermixed with this succession there may be stages of revision of the previous stages. Thus, the figures of the second stage may already enable the planner to revise some of the coefficients used in the first stage and to re-do, therefore, the first stage. After a fixed interval of time, new data will be available and this may lead to another revision, combined or not with shifting the period of the plan.

1.44 This was an example only. Other stages may be called for by the situation. There is no need for fixed rules; adaptability is one of the virtues of the planner. In a slightly different sense, "stages" come in also by what could be called "partial" models, designed to highlight a detail. Market analyses for separate export products, especially the smaller ones, are good examples. So are models about locations conditions in some big individual project.

1.5. Main Elements of Models

1.51 The models to be discussed in this book have been selected with a view to the purposes they must serve and to the conditions dis-

cussed in the preceding section. They have been selected to give a picture of the process of development, above all, and to meet the needs of planners for development. As economic models they emphasize the phenomena of production in the first place, that is, the material side of the phenomenon of development. The side of training and education has been disregarded; it is assumed that the problems in that realm will be solved.

Accordingly, the two basic phenomena to be found in the models are those of the factors of production and of products. Among the factors of production only the scarcest have been considered: very often only capital is considered; sometimes capital and labor are both considered. Land does not need so much attention in a study of development, which is essentially a process in time, because in time the quantity of land proper hardly changes.

Central importance for the production and development processes must be attached to the relationship between the quantity of product and the quantities of production factors used, the production function. In most models the production function has been assumed to be one of proportionality between inputs and outputs, which in its simplest form—with capital the only production factor—comes to the assumption of a constant capital coefficient. In some of our models more complicated relationships have been assumed, for example, the well-known Cobb-Douglas function.

1.52 For planning purposes it is often desirable to distinguish a number of different industries or processes, corresponding with different products. We shall speak of different *sectors* in this context, a sector being characterized not only by the figures for production, but also by the figures for imports and exports of the same product and by the figures for the uses made of the product, that is, final consumption, investment, or use as an input in current production of some other product.

The number of sectors will be assumed to be large in several models, and simple methods are discussed for dealing with such models. The number of producing sectors will sometimes also be assumed to be changing, which seems a natural thing for the process of development. A sector without production—but possibly with all other items except exports—will be called an *empty* sector.. A sector without foreign trade will be called a *national* sector. In models showing a number of regions as parts of a national economy, sectors without interregional flows will be called *regional* sectors.

1.53 Since the phenomenon of *investment* is crucial to the process of development, no model will be without this economic variable. In many models, however, investment goods will not be distinguished from consumer goods, meaning that a commodity can be used either way. If

stock accumulation of goods of any kind is considered investment, this is only natural. We shall discuss models with only one sector as well as models with many sectors where the assumption just formulated is made. We shall also discuss, however, models in which investment goods are a different type of goods not used for consumption purposes. As the simplest case, we consider, in this class, a model with only one capital good. This is permitted, of course, only if no appreciable differences in price development among different capital goods need be assumed to exist and if no import difficulties occur with some types of capital goods, while not occurring with other types. The *specificity* of capital goods can be carried one step further by distinguishing between capital goods of the first and of higher orders, as will be done in a few models.

In the process of investment a vital role is played by the *capital-output ratio*, as already observed. This will be assumed to be different for different sectors as a rule; it is interesting to note, however, that, if capital were the only scarce factor of production, prices of the various products would tend to equalize capital-output ratios. Assuming different capital-output ratios in a country in which capital is the only scarce production factor therefore presupposes economic intercourse with countries of a different structure.

1.54 A phenomenon of considerable practical relevance is the diversity of the *periods of gestation* in different sectors, meaning that the investment process in one industry may take a much longer time than the investment process in another industry. In the models in this book, unlike current literature, more attention has been given to the consequences of the existence of different gestation lags.

1.55 In a considerable number of models, *prices* have been assumed to be constant and given; they can then conveniently be put equal to one, meaning that value figures and volume figures are identical. This is rather common practice in development programming. There are several reasons for it. As far as the general price level is concerned, it is not so very relevant to the physical side of long-term development. The nature of development was not so very different in times of a rising price level—say between 1850 and 1873 or between 1895 and 1913—and in times of a falling price level—say between 1873 and 1895. As long as such price rises or falls are slow, the economy can adapt itself to them relatively easily. Price rises of a catastrophic character are less easy to overcome, but they are unforeseeable anyhow. Relative price movements are more relevant to the structure of the economy, but for the majority of cases they are not outspoken and cannot be calculated easily. Even so, this side of the problem is sometimes relevant to development programming, especially when relative prices must be expected to move

as a consequence of the expansion of certain lines of production. It seems useful, therefore, to formulate a bit more precisely the circumstances under which the *assumption of fixed prices* is appropriate.

In the first place, the assumption of fixed prices seems motivated when price levels are determined to a large extent by the world market and therefore cannot be influenced much by the program of the country considered. This will be so if (1) the country's supply of the relevant commodities is small in comparison with the world market and (2) free exchange possibilities exist. For commodities with high costs of transportation this will not apply; nor will it apply if there are serious restrictions to free transactions.

In the second place, a motivation for not assuming important relative price changes may be that it is the very objective of planning to maintain equilibrium between supply and demand and that in a way therefore price changes are assumed not to be necessary. Clearly this argument does not apply, however, when considerable economies of scale can be reaped as a consequence of the process of development.

Therefore, in some of our models, prices have been introduced explicitly as variables, in order to deal with cases in which clearly the program itself may be responsible for changes in relative prices.

1.56 A feature in need of some general comment is the phenomenon of *substitution*, so central in economic science. In some of the models, few possibilities of substitution have been explicitly or implicitly introduced. These models may well be somewhat rigid in comparison to reality; their value is sometimes of a didactic nature. As a rule, however, one or more forms of substitution have been assumed to exist. It seems useful to mention them in a systematic way.

One form of substitution is at the basis of the whole phenomenon of development and therefore is present everywhere in the book: the substitution possibility between present and future consumption, or *intertemporal substitution*. In models, however, in which the rate of saving is assumed given, this possibility has been disposed of.

The second type is substitution between factors of production. Substitution between labor and capital will be dealt with in Chap. 3, in a general way, and in Chap. 5 in more specific cases, which may arise in individual sectors (for example, factory versus cottage industry).

A third type of substitution is made possible by international trade. Since this aspect of planning has been neglected, considerable attention will be given to the methods applying to this type of substitution.

Finally, a fourth type of substitution occurs at the level of final consumption. Usually this form of substitution is induced by changes in

relative prices. Prices as variables are introduced into the models in Chap. 6.

1.6. Arrangement of Subject Matter

1.61 Since this book deals with models rather than with specific policy problems, the subject matter has been arranged according to the type of models discussed. Various policy and planning problems can be treated with the same model and, inversely, a practical problem can be discussed with the aid of various models. By and large, the models have been arranged according to their degree of complexity: simpler models are discussed first, more difficult ones later. Planning agencies and students of planning not acquainted with the more complicated techniques may prefer to use only the simpler models. A larger role must be played then by trial-and-error and intuitive methods, which have to supplement the simpler models to a higher degree than the more complicated ones. Planning agencies equipped with a number of specialists may prefer to use the more complicated models.

The problems treated in this book must be seen mainly as examples illustrating the models. In actual programming, considerable attention must be given to the choice of aims and means of economic policy. For this subject the reader must be referred to other publications.[1] An example of the variety of problems which can be treated with the same model is given in Sec. 3.5.

1.62 The arrangement of the subject matter will be clear from the table of contents. Chapters 2 and 3 deal with what can be called macromodels, whereas the remaining chapters deal with micromodels in the sense that if one so wishes the number of sectors can be made large. Even so, some of the models in these chapters can also be kept small, that is, macromodels, the boundary being arbitrary. Chapters 2 and 4 deal with the more rigid models, within the categories just mentioned; 3 and 5 to 7 deal with the more flexible types, introducing one or more additional elements of choice by some form of substitution. Chapter 7 deals with sectors, a geographical subdivision into regions, and covers some new ground.

Chapter 8 finally formulates some critical remarks on models presented by others and adds some practical suggestions about the use to be made of the various categories of models.

[1] See Hollis B. Chenery, Development Policies and Programmes, *Econ. Bull. for Latin America,* vol. 3, p. 51, 1958; J. Tinbergen, "Economic Policy; Principles and Design," Amsterdam, 1956; "The Design of Development," Baltimore, 1958.