الجمهورية العربية المتحدة

معهد التخطيط القومى

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APPLICATION OF SOME MODELS FOR PLANNING

BY

The group of model building

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Preface

Since the beginning of the year 1965, a research group has been formed in the Operations Research Center of the INPC, with the aim of studing the problem of model-building for planning purposes. The final objective is to build up a series of models, each dealing with a specific number of development planning questions. For every model a full description will be provided, an analysis of its policy utilization made, and a system of programs prepared to enable direct running on the machines in each case.

The activity of model building has been in fact going on in the ORC for some time. Among the contributers is Prof. Frisch, with his highly elaborate models. Those experiments have indicated a lot of points envolved in the activity of mode-building:

1. The importance of the approach as a scientific way of answering fundemental questions in planning in a meaningful way.
2. The need for the collaboration of a large team, with a variety of back ground experience: economists, statisticians, mathematicians, technicians, etc.
3. The amount of effort and time usually envolved in building up asingle model.
4. The need for high speed machines to yield quantitive solutions relating to empirical situations.
5. The need for a large amount of data collected in a systematic way, which in many cases can be checked by the model itsefl, thus helping to improve the quality of the data itself.

This means that if we are to wait until a problem arises, before we start thinking about building a mode to solve it, some time would by necessity elapse before quantitative rsults would be available to the decision - taker. Therefore , a better "planning" of the activity would be to start thinking a head of the problems to prepare alternative systems of solution, so that the time lag accuring between raising a specific question and

obtaining an answer to it would be minimized to the period necessary to collect the relevant data, and running the already-set programs on the machines.

However, two major drawbacks have become already evident from past experience:

1. That the majority of decision-takers do not easily grasp the significance of such models, especially when, in an attempt to conform with reality, they are expressed in highly elaborate terms.

2. That if an attempt is made to start straightaway using such elaborate models, there is a possibility that alarge number of the members of the team would not fully grasp the essence of the operation, thus leading to the risk of decreasing the efficiency of their individual contributions.

One way of overcoming these difficulties is to introduce the approach through highly simplified models, then increasing their complexity step by step. Another way is to try to formalize the attempts already made by more familiar methods, and indicate the amount of gain to be obtained from the explicit way of stating formall models. The fundamental fact is that if a certain logic is used to determine a certain amount of quantitative results, it is always possible to express this logic in a mathematical way, hence testing its consistency(1). This would help to improve the logic and to suggest more efficient systems.

With this inmind, I have directed the group towards arather extensive discussion of models suggested by the ECAFE of the UN(2) for programming development in countries at an early stage of development. The following pages summarize attempts by

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(1) As an example see our memo. (No.255) on "models used in drafting the twenty-years plan 1959-1979.

(2) ECAFE: Programming Techniques for Economic Development.

members of the group to discuss the first model suggested in that work. Dr. M. Wahby has been helping in the preparation of these papers. Simple as it might be, the model has revealed certain interesting features of our annual plans, which are worth further study by means of more elaborate models. Attempts have been made to illustrate its uses by means of a brief discussion of a possible outline of a plan of doubling national income over the next 10 years. These attempts can be taken as an indication towards more elaborate approaches such as those suggested by Prof. Tinbergen and Prof. Frisch.

Although these attempts have been discussed by all members of the group; they are not yet in a finalized shape. The following pages are to be considered as a progress report, meant to keep on record the efforts of the group during the last few weeks. Series of these reports are to be expected in the near future, and they will be all written in English in order to facilitate reference to the various sources. In the final draft one might expect certain amendments and elaborations.

Dr. M. M. El-Imam

PART (I)

Model Building

(1-1) One of the important aspects of new techniques of planning for national development is the tendency to build up economic model. This is the usual way in which mathematical mode of reasoning is employed in economics.

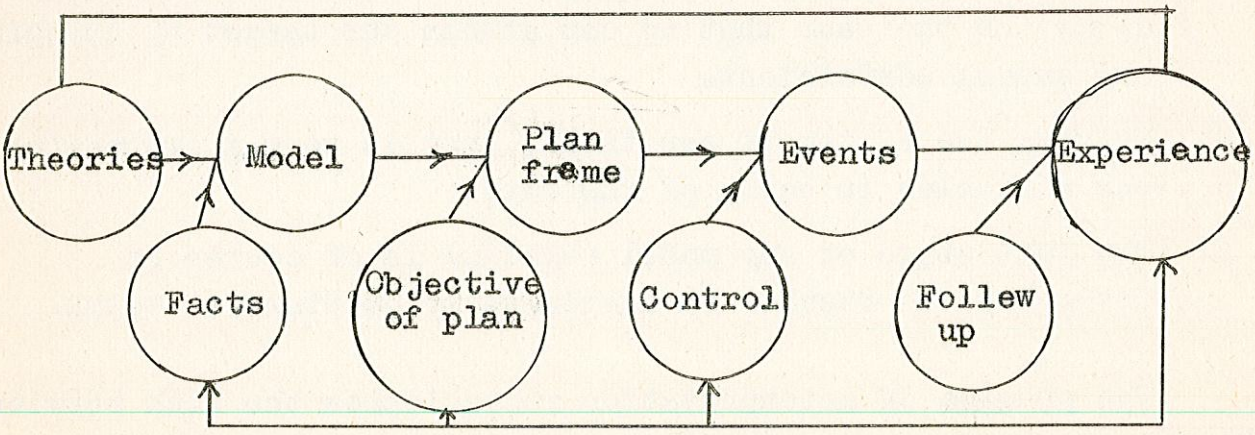
The economic (planning) model is an analytic mean which shows the inter-relationships between the economic variables as aspects involved in planning procedure. It is a mean to derive conclusions as projections based on certain assumptions we take.

The model is also a tool to check validity consistency and perhaps the optimality of our national objectives of planning. In other words the economic model is one of the important instruments which help us to prepare a plan frame.

(1-2) Economic models and planning:

Models are one of the main operations used in the preparation of a national plan frame. Hence it is very useful for planners to construct precise and elaborate models at any early stage before beginning to prepare the economic plan.

The following is a diagrametic form which illustrates how models are envolved in planning procedure



Theories of planning and development are combined together with the existing facts to set up a model. A model suplemented with the objective of the plan constitutes what is known by a plan frame. A plan frame supplied with a control produce events. Events with a follow up give experience.

(1-3) Stages used in building models

The usual stages involved in building up a model[1] are as follows:

1. Defining the variables of the model; classifying them into given and unknown variables. The given variables are called the data in our model. The unknown variables refer to certain economic phenomena which we seek to explain from within the model.
2. Indicating the level of abstraction on which the discussion is to be carried out by specifying the set of assumptions.
3. Shawing the quantitative relationships between the variables with the help of equations. In constructing such a system of equations there will be certain coefficients. These coefficients are assumed to be constant, but sometimes in certain problems, the change of these coefficients may be of great importance. For example, in many economic problems, it may be the case that we can attain our target by changing the saving coefficient.
4. Solving the system of equations, that is to say, expressing the variables in terms of the data.
5. The last stage of any model building is of course to interpret the results in economically meaningful terms.

The process of interpretation restablishes the link between the set of assumptions with which we started and the set of

implications that logically follows from it.

In order to understand what any model implies we must watch earefully the meaning of the various parameters and variables used in this model.

Classification of different models

Economic models can be classified according to different criteria. The following criteria [2] can be used in order to present in a systematic way the different types of models.

1. Formulation of a model

(1-1) Its approach

Determinestic models There are two main approaches:-

(i) Mathematical; where method of solution uses algebra and analysis. It can be subdivided into unsepecified and specified according to whether the explicit form of the functions is specified or not.

(ii) The analogue; where the method of solution uses engineering construction. It deals with more complex formulations and its merit lies in the fact that it can lead to quick solution of systems which are either insoliuble or prohibitive when treated by ordinary mathematical tools.

Stochastic Models: These allow for the unsystematic types of errors of differences between theory and practice. Instead of speaking about numerical determination of the characteristics of the model, we speak of statistical estimation. Econometrics has been especially designed in such a manner as to deal with problems of formulation and estimation of this type of models. Another new development in the field of model building is the use of analogue process in order to bring into existence models which would take care of the stochastic

nature of actual life.

Thus the approach aspects leads to the following subdivisions:

Deterministic:

a) Mathematical: (1) unspecified
(2) specified

b) Analogue numerical

Stochastic (1) Econometric
(2) Analogue.

(1-2) Form of equations that the models involve

In mathematical approach, there are some cases where the forms are specified and others are unspecified. In the specified forms, we may have linear or non-linear functions. In the unspecified forms, we have non-linear models. These contain one or more linear equations but at least one non-linear

2. Purposes

These fall into

(i) Exposition (ii) Description
(iii) Forecasting (iv) Projection & Policy-evaluation.

(v) Decisional

The first two types might be considered as analytical models while the last two can be considered as decisional in the broad sense.

3. Goverages

(3-1) Degree of Completeness: Complete models are those which give an interpretation of all magnitudes which can be considered

as variables in the system. Incomplete models give only a part of the picture.

(3-2) Scope or degree of generality: Here we are interested with the width of the market covered. There are three categories of partial models:-

(i) Those relating to individuals e.g. models of consumer's or producer's behairour.

(ii) Those relating to markets dealing with the interaction between both the supply and the demand.

(iii) Those relating to sectors, i.e., summarizing the total activity of groups of individuals belonging to a certain type.

Partial models need not be incomplete. On the other hand, we have the so-called general models which attempt to explain what they consider to be the key variables of the whole economy. Such models may vary in detail, they might be even incomplete.

(3-3) Range or degree of closeness: It expresses the degree of autonomy in the model. In closed models all the variables introduced are explained within the model itsefl. This is of an important interest in studying dynamic process. Usually analytical models started by being formulated in a general open manner but they are reduced to closed ones in the highest stages of analysis.

(3-4) Spatial Coverage:-

(i) Intra-regional type: models interested in tudying the relationships within a certain economy considered as one single entity.

(ii) Inter-regional types: models concerned with international trade problems.

(4) Type of interdependence

Physical, financial, degree of sector break down.

5. Time; which contains:-

(5-1) Continuity: In econometric models, the usual way of measuring variables is to consider them as discrete functions of time. This definition is implied in static models, since time does not appear explicity. For dynamic models we can still measure the variables discretely with difference equations as a tool of analysis. If the variables are assumed to be continuous differential equations take place. Frequently both discrete & Continuous approaches are mixed together leading to mixed models.

(5-2) Time specifications:- A model is said to represent a static picutre when its solution holds irrespective of time. On the other hand a dynamic model would lead to a solution which defines a time-path for each of its variables.

(5-3) Time duration: In dynamic problems one becomes concerned with the determination of the duration to which the analysis holds. Short run problems relate to deviations from equilibrium or fluctuations around what can be considered as a systematic time-path. Long run problems relate to the dynamic theory of growth.

(5-4) Time units: From econometric point of view, we differentiate between annual and sub-annual models where the main factor to be considered is seasonality. Aside from econometric problems, some authors define time unit as the period sufficient for one complete process of a specified type, e.g., production. In mechanical models, we have the non-seasonal type of units.

6. Variables

(6-1) Origin of measurements:- The lst possibility is to use variables in their absolute magnitudes i.e. the origin is their zero point. This leads to large variations which might render the linearity assumption untenable. To overcome this difficulty we have two alternatives.

(i) the variables might be measured as deviations from same equilibruim path or time trend

(ii) the variables might be measured as first differences.

(6-2) Degree of aggregation:- The passage frome micro-analysis to macro-analysis involves a process of aggregation. To construct a macro model we have either one of the following:-

(i) to build directly the model in an aggregated form

or(ii) to consult the bassic micro relations and derive from them the appropriate macro-ones

(6-3) Variable specification:- In economic theory it is usual to distinguish between flow-variables & stock-variables. The flow-variables are measured as flows per unit of time. The stock-variables are considered as magnitudes standing by at any point of time.

(6-4) term of measurements: Some fields of economic theory emphasize the monetary side of the economy. Others are occupied with the real side of the problems. In planning models, the concentration on real terms is obvious. But if we plan with the purpose of raising productivity, reducing costs, and improving the technological structure, we have to take account of these changes in our models. It follows that we have to use a more elaborate technique by introducing many non-linearities in the problems. The real-financial approach becomes the most suitable for the purpose.

PART (II)

Macro-economic model

By

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Model (1)

and its application to 1st five year plan.