2-1-1967

Cautionary Remarks on Choice and Maintenance of Large Scale Economic Models

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Not for Quotation or Publication February 1967

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The technique - or should I say, the art - of building and using economic models has passed the stage of laboratory tests and has reached by now the stage of pilot plant operation. The two prominent public servants who invited us to be here today made it very clear in their opening that they count on our help in the solution of the complex planning and operational problems that will be confronting their departments in the coming years.

The list of twenty-five models compiled recently by Professor Nerlove[2] comprises only so-called econometric systems in which the numerical values of most parameters have to be determined by means of indirect statistical inference - statistical inference from time series describing the past behavior of the economic variables that such systems are ultimately expected to predict. To these, one has to add the input-output and related models incorporating structural constants obtained through direct empirical observations of institutional, technical and other

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1 Introduction to the "Symposium on the Role of Economic Models in Policy Formulation," held in Washington in October 1966.

2 Nerlove, M.A., "Tabular Survey of Macro-Econometric Models," International Economic Review, Vol. 7, #2, May 1966

structural relationships that govern the capabilities and the operations of a particular economy and of every part of it at any given time.

A potential user - whether he selects any of the existing prefabricated models or decides to have one custom made - will have to choose among a great variety of standard performance characteristics and optional features.

A closed model of an economic system is supposed to be capable of explaining its actual, observed state or, if the model is dynamic, of projecting unconditionally its movement from the present to some future state. For practical decisions - as contrasted to detached explanations - it is more helpful to use an open model. An open model is designed to enable the policy maker or the administrator to assess in concise, quantitative terms the consequences of any one of several possible alternative courses of action. In mathematical language, it can be said that a closed model contains exactly as many equations as unknowns, while an open model is a system containing fewer equations than it has variables.

Optimizing models are automated: they are intended not only to ascertain the consequences of each one alternative courses of action, but also to choose at once and without

intervention of human hand, or, should I say - of a political or administrative mind - the very best of them. To be capable of doing this, such a model must have built into it a so-called optimizing function. This is an appropriately chosen mathematical formula that automatically reduces all the many different effects of each possible course of action to a single, unequivocal measure of success. The annual profit is, in this sense, an objective function of a private enterprise; when computed according to some standard rule, it is supposed to measure the success of all decisions taken by its management, at least insofar as they affect the difference between the gross revenue and total costs in that particular year.

In the case of a relatively simple public enterprise - such as the design of port facilities or a set of flood control dams - an objective function can be easily agreed upon and an optimizing model - however many variables it might contain - can consequently be easily applied. In attacking much more complex decisions such as are involved in problems of metropolitan development planning, in choice between alternative policies in respect to transportation - not to speak of public education, or research and development - it might be possible to construct an open model capable of anticipating in great detail the different repercussions of any given course of

action, but it would be quite impossible to ask the administrator or politician to abide in his assessment of their comparative advantages and disadvantages by some rigidly defined mathematical formula. The model builder like Hertz or at least like Avis can in such a case provide the driver with a reliable vehicle that will respond obediently to the steering wheel, the throttle, and the brake, but he should not ask and certainly not tell his clients where they should want to go. Confronting such large problems, the policymaker - before committing himself to fixed objectives and set priorities, will first of all want to know what the ramifications of several alternative courses of action might actually be. But even after he has made the final choice, he often will be unable or unwilling to spell out his reasons in so many words or in so many X's, Y's, and Z's.

Another choice the user has to face is the one between general and special purpose models. A special purpose model takes into account only the factors most immediately involved in the particular problem at hand. It can be expected to be simpler and cheaper than a more general model. The latter containing a much larger number of variables, but potentially capable of serving several users and serving each of them better, naturally will be also more expensive. However, there is an economy of scale in model building too. Moreover, serving simultaneously several different users, a general model will

reveal whether and to what extent these independent policy-makers - each in pursuit of his special objective - actually operate at cross purpose. Anyone familiar with our system of public administration will agree that this happens very often.

In contrast to the impression occasionally created by descriptions of abstract theoretical models found in professional economic journals, the construction and a working application of an economic model is a slow, laborious process. It is not an elegant gadget, but rather a big machine, expensive to acquire and costly to maintain. But the pay-off from effective application of a well-designed and fully implemented economic model can nevertheless be very great.

Of the three principal components that go into its construction - theory, factual data, computation - the first and the last are comparatively cheap, but the second will in most instances prove to be expensive; it might account for 90-95% of the total cost. Many would-be model builders, particularly of the academic type, concentrate all their effort on mathematical or statistical methodology and expect the tedious data gathering task to be performed by someone else. Hence, models seem to be piling up everywhere, but very few are suitable for practical use.

The construction and effective use of a large scale economic model will require not only a substantial budget, but also support and understanding cooperation on the part of many people - particularly at the data gathering end. Economic data are perishable goods. Provision of a constant flow of current information that must conform, in many instances, to quite exacting specifications is bound to tax the capabilities of even an experienced statistical organization.

Adaptation of an economic model to practical use is, because of this, to a large extent a pedagogical task. Not only the final user, but also the supplier of the primary data must understand the inner logic of the proposed analytical approach. An economic model un-intelligible to ordinary not overly sophisticated minds has little chance of being actually used as a base for policy decisions or as a practical guide for administrative action.

The increased interest in large scale economic models - as contrasted to small bits and pieces of specialized operation research - shown by managements of some large corporation represents, in this connection, a favorable omen. Without understanding and support from private business, the use of such new tools by public agencies cannot succeed - at least not in the United States.

I began these remarks by observing that some economic models have passed several laboratory tests and have already entered the stage of pilot plant operations. In deciding which model can serve best his present and future needs, a potential user would be ill-advised, however, to show preference for one that has been tested, adjusted, and readjusted for so many years that it has reached the limits of its potential capabilities. Construction and adaptation of a model commits him to a large initial investment. Since the model building technique and, what is more important, the availability of primary data are advancing very rapidly it is better to choose a model that can be expected to be perfected as time goes on and, in particular, that will be able to absorb and utilize effectively an ever increasing flow of primary information. The early models were designed to exploit with greatest possible effectiveness a very limited amount of factual data. Like a person brought up on a starvation diet who cannot digest richer food, these old, well-tried econometric models are, as a rule, incapable of making efficient use of the large mass of detailed information which will become available in the coming years. Anticipating such growth, a discriminating user will choose a more modern model that, with relatively small adjustments or extensions, will absorb efficiently and without undue waste all the new data that private and government sources will begin to provide very soon.

FOOTNOTES

[1] For purposes of this study the Northeast is defined as the six New England states plus the three Middle Atlantic states: New York, New Jersey, and Pennsylvania. Later in the paper, however, Pennsylvania is "shifted" to the South Atlantic region when certain comparisons are made. The reasons for doing this will be obvious from the discussion in the text.

[2] In non-technical terms this means that the value of a "bundle" of goods and services produced for export to other regions was greater than the value of the bundle of goods and services imported.

[3] This led to some unwarranted complacency in the region because it was widely believed that the displaced textile workers were finding jobs in the expanding electronics firms. An empirical study of six major textile producing centers (17) showed that this was essentially not the case, and that the manufacturing base of the Northeast was weakened by the loss of its textile mills.

[4] The relevant literature is cited in (17, p. 1).

[5] For a graphic illustration see (6, p. 15).

[6] I am indebted to my colleague John Stasney for a stimulating discussion of this issue and for directing me to much of the literature discussed in the

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Unpublished.