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Review

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Econometric models for planning

Eduardo García D'Acuña

The use of models in planning is almost as old as formalized planning itself, initiated in Latin America in the 1960s. Planning models were developed and used at both government and international agency levels, generally as simple analytical structures derived from the Harrod-Domar growth equation. In some cases a degree of complexity was produced by the inclusion of input-output tables or two-gap models whose main purpose was to estimate the volume of domestic efforts and external savings necessary to guarantee a given product growth rate and to ensure some coherence in the intersectoral growth pattern, in order to avoid the formation of bottlenecks and the subsequent inflationary pressures. Until the 1970s the majority of the plans formulated used an array of macroeconomic projections as a technical support to guarantee their internal coherence.¹

In the 1980s we are faced with a different situation. This is a more complex decade in terms of the problems that must be solved (external debt, massive unemployment, extreme poverty, hyperinflation) and, at the same time, a richer one in terms of analytical methods, work tools and sources of information (advances in applied macroeconomics, in computer processing and in the supply of information), despite lags in some areas.

In these circumstances, to what beneficial use can econometric models be put, given the valuable human resources and scarce material means available? What methodological precautions should be taken to avoid misusing them? What technical problems do their estimations pose?

I

Use of models

In a brilliant paper Paul Dubois² outlines two main uses of models: a) short-term economic forecasting and b) the study of variables and the adoption of a strategy; to which we would add c) *ex-post* evaluation. Let us examine each of these uses.

1. Short-term economic forecasting

This is perhaps the field which has developed most in recent years, at both national and international levels.

At the national level, it seems essential, before formulating macroeconomic policies and plans for the following year, to have reasonable forecasts of the trends of the main variables in the international framework and of how they can affect domestic macroeconomic performance. Likewise, it is the very essence of planning to forecast the emergence of imbalances in the economy or the worsening of existing ones. In this function, the look-out role of a short-term forecasting model is fundamental.

This function has been gradually established among planning and economic management bodies, both in the more developed countries and in the less developed ones and in international agencies. In the former, there is the well-known pioneering work undertaken in France by the National Institute of Statistics and Economic Studies (INSEE), the Forecasting Department of the Ministry of Finance, and the French Moni-

¹One of the intellectual authors of this approach was Dr. Raúl Prebisch, who outlined it clearly in his famous programming technique published in 1953 in ECLAC, *Preliminary study of the technique of programming economic development* (E/CN.12/0292), Santiago, Chile, 1953.

²Paul Dubois, "Macroeconomic models and planning in the context of an uncertain future: the French experience", *CEPAL Review*, No. 31 (LC/G.1452), Santiago, Chile, April, 1987.

toring Office on the Current Economic Situation. In the United States and in other countries members of the OECD, as well as in some less developed countries, the practice of short-term forecasting has also become gradually institutionalized, in either public or private bodies.³ At the international level, mention should be made of the periodic studies done by OECD, UNCTAD, IMF and the World Bank. At the subregional level, the work begun by the Board of the Cartagena Agreement (JUNAC), using the MEGA model, constitutes a noteworthy effort.

2. Study of variables and adoption of the plan

Mere forecasting of the short-term future, although important, does not exhaust the scope of planning, particularly over the medium term where the aim is to establish specific development strategies.

The exploration of variables is probably the most useful—and at the same time the most difficult—technical application of planning models. And we say this because what is involved is an attempt to simulate the effects that specific economic and social policy options would have on a set of endogenous variables resulting from economic activity, given certain assumptions about international economic performance, and then, to compare these results with the objectives or goals regarded as desirable by the planning authority. Therefore, this means designing a recursive scheme in which—on the basis of preliminary definitions of policy options—the effects of these options on the resulting variables are studied and then compared with the desired plan profiles; the policy definitions are then repeatedly revised until policy options consistent with plan objectives are found. All of this, of course, within a given external framework of uncontrollable variables. The following figure illustrates this procedure.

Clearly, this procedure will depend decisively on two elements: a) the assumptions

regarding external framework trends and b) the estimation of model performance functions and parameters *that will be in effect during the plan period*.

With regard to the first point, we can only stress the importance of having reliable studies on and medium-term forecasts of international economic performance, in particular in the country's main trade and financial partners. Given that it is often impossible to define a single profile of the international framework, we can choose to work with alternative scenarios that are contingent upon the occurrence of given economic and political phenomena, with a specific probability.

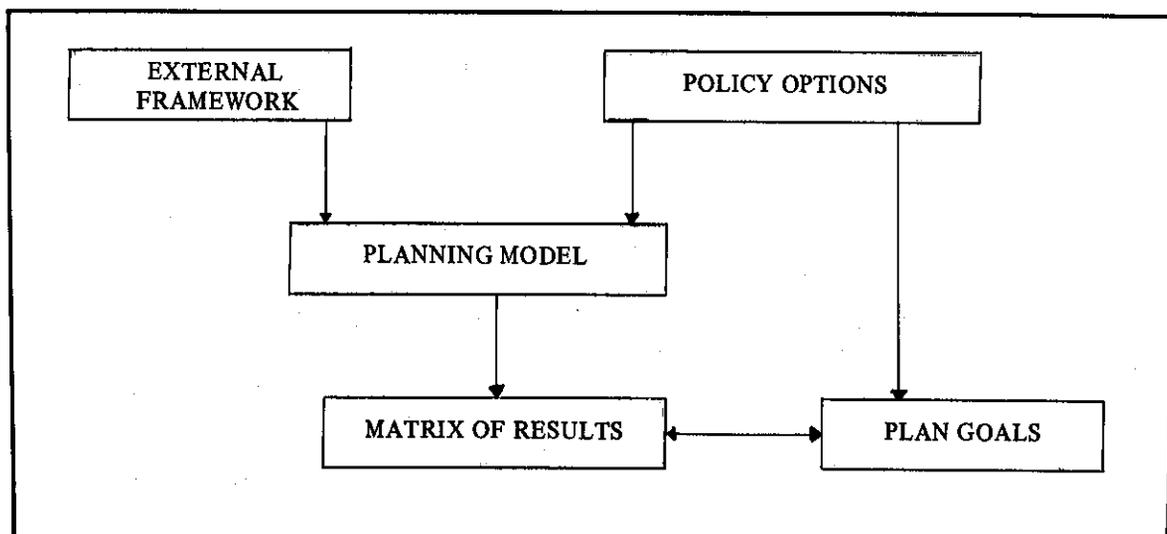
In section two we shall offer some methodological considerations about the estimation of the relevant functions and parameters.

3. Ex-post evaluation

Perhaps the field that has received the least attention in planning has been the retrospective evaluation of the recent past in order to determine objectively in what way the plan has or has not been implemented. Mere comparison of past records with plan goals is not enough. It is necessary to delve deeper and investigate the causes of the divergences between plan and reality. These may in principle be due to four factors: i) errors in forecasting the external framework; ii) errors in forecasting the performance of external private agents; iii) errors or defects in the application of policy instruments; and iv) unforeseen random factors, such as droughts, earthquakes, etc.

The identification of these causes can be greatly facilitated if a quantitative model is available. For this it would be necessary, first of all, to produce retrospective simulations, using alternately the forecast external framework and the real one; this will make it possible to evaluate the discrepancies due to the first cause indicated. Second, it would be necessary to identify estimation errors in the parameters that would have been recorded in the performance functions of the model, comparing the deviations in performance variables—in the absence of errors in the forecast of the external framework—in the application of the economic policy and of ran-

³See *International Journal of Forecasting*, published by ELSEVIER Science Publishers, Netherlands, which gives a quarterly account of macroeconomic forecasts for a broad sample of countries.



dom factors. This would make it necessary to re-estimate the parameters in order to incorporate changes in performance into the model. Third, deviations caused by errors or defects in applying the agreed policies would likewise

require simulations, maintaining the other factors constant. A comparison of the total deviations with those attributable to the three factors indicated would produce a balance imputable to unforeseen random factors.

II

Methodological questions

We shall deal with three important methodological questions: the relationship between the reality and the model, estimation problems and the data base.

1. *Appropriate representation of the reality*

The need is obvious for a model to reflect faithfully the economic structure of a country. However, when constructing models there is a risk of implicitly or explicitly adopting the prevailing view of the economic structure in the more developed countries. This may be due not to the deliberate intention of the researcher but to the form in which information is available.

In this respect we wish to point out four aspects that should be closely analysed.

a) *Heterogeneity of the economy*

It is a fact that the economies with an intermediate degree of development do not have the production and technological homogeneity of the industrialized countries. Production units coexist in such countries in each branch of activity (agriculture, industry, services, etc.), with very diverse technological levels and forms of organization; this has a significant impact on productivity, employment and income distribution, on the one hand, and on the structure of goods and factor markets, on the other. To put it more simply, there is a traditional or primitive stratum, an intermediate stratum and a modern or advanced stratum in each economic activity.

We believe that it is essential for the model to incorporate these structural differences in its

equations in order to permit policy-making differentiated by strata, if employment and income-distribution goals are part of the plan.⁴

b) *Demand structure*

The structural heterogeneity of Latin American economies necessarily has an effect on the social structure and on the kinds of economic performance of the various strata. This fact has great influence on the structure of demand by type and quality of goods. Notable qualitative differences are often added to the difference in the composition of consumption, as a result of Engel's law, in particular between urban and rural strata.

The model should incorporate these structural differences into its performance equations, for they are often closely interrelated with the functioning of the production apparatus. Such a design of model would permit a quantitative evaluation of the effects of a strategy intended substantially to increase productive employment levels, reduce underemployment and improve income distribution to the most deprived sectors.

c) *External sector*

The strong link between Latin American economies and industrialized centres is well known, particularly in terms of the inputs dependence caused by the trickle-down effects of exports variations on the domestic economy and by debt servicing. This interdependence can be adequately incorporated in a planning model by the technological matrices of imported inputs and capital goods and by certain institutional equations that deal with the income and service flows involved. Besides these effects, we would like to point out three points that are becoming increasingly important. First, the models should capture the domestic effects of variations in the terms of trade in all their magnitude, in particular in those countries that are highly dependent on imported energy inputs. The recent deterioration of the terms of trade is not only an impor-

tant determinant of domestic inflation but also affects, because of its negative effect on real domestic income, the various performance functions, such as the domestic savings rate, and by these and other means the process of capital formation.

Second, the actual presence in the economy of a sector made up of transnational corporations or of their subsidiaries warrants explicit treatment in equations dealing with production structure, income generation and distribution, and saving and investment processes.

Lastly, the high speed at which some countries have acquired external debt in recent years certainly justifies the inclusion in the model of equations that explain the dynamics of this debt and its effects on the capacity for future growth.

d) *Public sector*

The public sector, has been considered in various planning models, in particular through income and expenditure variables. But one increasingly important function of the State has rarely been made explicit: the production of goods and services that are sold through the market.

The sector of State production and services enterprises must be clearly distinguished in the model for several reasons. First, it is the only sector in a mixed economy in which the State can operate mandatory planning. Second, it seems imperative to bring out the links between the State enterprise sector and the rest of the economy, both domestic and external. The relationship with the domestic private sector seems essential as a means of identifying the interrelationship between the production activities of the two sectors, for this would make it possible to evaluate the effects of expansions or contradictions of the first on the second. Identification of the relationship with the external sector would facilitate evaluation of the net impact of the State sector on the balance of payments and the financial system, with obvious benefits for economic policy-making.

Lastly, the identification in the model of gross investment by State enterprises would make it possible to quantify their impact on the creation of capacity. Since this sector normally develops projects which necessarily take a longer time to mature in terms of capacity than the

⁴The research undertaken by the World Employment Programme and the Regional Employment Programme for Latin America and the Caribbean (PREALC), both subsidiary bodies of the International Labour Organization (ILO), points in this same direction.

average for private projects, although their impact on effective demand is similar to that of private projects, the proposed sectoral separation would indicate the proportions in which State investment should be linked with private investment in order to prevent inflationary or recessionary pressures.

In summary, in this section we have argued for the construction of a model that faithfully reflects the structural characteristics of the country of the region where it is applied. Indeed, this is no easy task and not lacking in serious difficulties of implementation, owing in particular to the absence of some of the data.

Nevertheless, we believe that this is the direction in which we should move in order to design an instrument that is not only technically efficient but also politically and socially relevant.

2. Problems of econometric estimation

The advent of microcomputers and statistical estimation "packages" has greatly simplified the task of estimating parameters and calculating statistical significance and self-correlation tests. Despite these instrumental advances, at least three caveats must be made with respect to the estimation of parameters.

The first relates to the necessary and warranted inclusion of dummy variables in equations, in order to reflect the effects of special exogenous events that are common in Latin America, such as drastic changes in government or in economic policy, or natural disasters such as droughts, floods or earthquakes, all of which imply a one-time change in the main economic series.

Second is the well known question of the estimation of simultaneous equations, very per-

tinent in the case of macroeconomic models with a large number of endogenous variables. Here it is very appropriate to use methods such as squared minimums in two stages on the basis of instrumental variables.

Lastly, there is the incorporation of partial adjustment mechanisms according to the Koyck format, to adequately reflect the distributed lags that tend to occur in dynamic models.

3. Data base

It is a commonplace that statistical information in Latin America suffers from serious deficiencies. However, when we embark on the task of estimating a macroeconomic model, we generally note that it is not so deficient. There is, of course, great dispersal and, at times, contradictory figures on the same variable.

In any case, the compilation of a coherent data base is an important first step. To ensure this coherence it is advisable to use national accounts systems as a baseline for the construction of complementary subsystems of balance of payments and the external sector, employment and income, the public sector, prices and wages, and the monetary and financial sector. It is important, before beginning the estimation work, to undertake a macroeconomic coherence analysis for a selected number of years among these various subsystems.

A data base constructed in this way and organized in a computer file constitutes an important byproduct for the routine information and analysis tasks of a planning agency. In addition, when it is duly updated, it becomes a systematic and permanent source of information for the public information functions that such agencies usually carry out.

III

Conclusion

Despite the existing methodological difficulties, the construction of macroeconomic models is a great help to planners and economic policy-makers in analysing the current economic situation.

However, there are some caveats that users should bear in mind.

First, a model is not a "black box" capable of providing magical answers to all questions asked of it. A good model should be a transparent box

that clearly shows its structure and its operating mechanisms. It can then be a powerful aid in the logical analysis of economic processes and not a substitute for such analysis. In actual fact, the results delivered by a model should always be questioned, especially if they contradict common sense. Sometimes, it is common sense that is mistaken, when it takes into account only the direct effects of a policy and not the side or cumulative effects. This interaction between analyst and model generates a valuable learning and model-improvement process.

Second, models represent economic theories and hypotheses that do not always interpret reality in an exclusive way. That is to say, it is perfectly possible to validate two contradictory theories with the same data base. Thus, econometric methods do not always yield conclusive results in terms of proving the scientific validity of a theory. Strictly speaking, they only show that reality does not contradict a hypothesis. This indeterminate situation demands more thorough theoretical work that would lead to more accurate and precise theories and models.

Third, there is a clear conservative bias in a model, since it is a representation of the past. This obviously does not bother conservatives, but it is an obstacle for proponents of social

change. For them the difficulty could be partly overcome through sensitivity analysis that examines the effects of variations of the main parameters and exogenous variables. Tax reform may demand a hike in taxation rates. However, drastic changes in economic structure, such as those resulting from agrarian reform or nationalization of a major portion of industry, can hardly be accommodated in a conventional econometric model.

Finally, it is useful to remember that models only express an economic rationality, which, although important, does not exhaust the theoretical field of decisions and planning. As Linstone³ has indicated, there are multiple perspectives in planning, one of which is based on technical and economic rationality. Others are based on political, institutional, organizational and psychological factors. The economic planner must be aware that his rationality is only one part of the final decision. For this reason, a good dose of modesty should accompany the use of this tool, if it is to be set up as an infallible instrument.

³Harold A. Linstone, "The need for multiple perspectives in planning", *CEPAL Review*, No. 31 (LC/G.1452), Santiago, Chile, April 1987.