LAMENT FOR POLICY-ORIENTED RESEARCH:

Observations on a Research Project to Formulate a Computer Model for Regional Rural Planning in the Kosi Region, Bihar, India[1]

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For five years I have been engaged in research concerned with formulating a regional computer programming model which could project the effects of different rural policies on output and income distribution. In this short paper I shall attempt to draw some conclusions for policy research and planning which are based upon my Kosi experience but may have wider application.

The main conclusion is that complex computer models and certain academic criteria can be counter-productive for applied planning and policy making. This is especially so if a pragmatic problem-solving approach is not maintained throughout the work and if the on-going needs of local planners are not kept in mind.

Planning Models

To anyone working in the area of rural planning it soon becomes clear that the subject is very complex, especially in situations where institutional structures are changing, population growth rates are high, and formal government is making important decisions about the investment of funds in new technology such as seeds, tractors, irrigation etc. Being interested in quantitative economic planning, I first turned to the conventional planning models of quantitative economists, namely, the multi-sector input/output model and the resource allocation models which were so often used in the development planning literature of the sixties.[2]

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[1] A number of research projects have been conducted in the Kosi Region from IDS. These observations relate to the work funded by the UK Social Science Research Council. Title of grant: "An Agricultural Development Model: Kosi Region, Bihar, India", Reference No. HR931/2. A full account of the research is given in the papers cited at the end.

[2] Most frequently these were different applications of linear programming. Input/output analysis is a special case of that technique.

Although these overall planning models included important concepts of consistency (whereby various parts of an economy have to fit together) and dependency (whereby one industry depends upon another for goods and services) the models were quickly dismissed for a number of reasons: First, most of the models were only classified by output, e.g. agriculture, manufacturing. In rural societies, decision-making is not specialized in this way: individual households often produce the whole range of goods and services. Secondly, previous models were not concerned with income distribution between groups of people in rural society, who may show a complex mixture of capitalist, rentier and labourer interests; but, at best, the models were concerned with income distribution between industries, regions, countries, and consumption today as opposed to tomorrow. Thirdly, in these models, agriculture was often treated as one big aggregate sector. Besides the inaccuracy and under counting this involved (e.g. household processing of goods being totally omitted), transactions of goods and services between households within this very large sector were apparently of no interest. This is surprising when in most LDCs most people are involved in rural occupations, most GNP is generated there, and transactions of goods and services between rural households are very high. The characteristics of these transactions may be of crucial importance for income distribution and social planning. Thus, it would seem important that the determinants of the existing economy are understood before planners start to project how that system would change under different policies. Many of the conventional models offer little guidance to such an understanding.

Finally, although these previous models stressed interdependency they did not emphasise just which group (or sector) had the upper hand in the interdependency situation. In the extreme case, in the input/output model, every industry, even the smallest, could hold back aggregate production.

Because of these and other limitations it seemed totally inappropriate to follow the conventional path. However, it appeared that linear programming could still be used for planning purposes to handle the complex set of interdependent variables, as long as the model defined sectors by resources rather than by output and was capable of projecting how the economy might behave over time under different types of policies. One of the advantages of this

approach was that its results could always be used to formulate a conventional input/output table, if desired.

Interestingly enough, farm management economics has placed emphasis on land and other resources controlled by a farmer when answering the question what should (and sometimes, would) his behaviour be in order to make sound management decisions. Unfortunately, although correctly identifying ownership of assets, control over resources and possible production activities as being crucial to household income, the methodology was not taken further to analyse the question of how the behaviour of one group affects other groups over time. This is especially important when the welfare of rural landless households is taken into account – something which has traditionally eluded the interests of farm management and agricultural economists. This lack of attention to the rural landless may be fair for some developing regions where most households have some land; however, for regions such as Kosi where there is great inequality in control of land, where much of the total labour force is hired labour and where the industrial sector is minimal, the omission leads to poor analysis.

To answer this type of question and meet some of the limitations of the quantitative models I developed a highly abstract algebraic model (Biggs, 1968). However I did not follow this avenue of research for long, because, although academically interesting, it was not related to the actual planning problems faced by a government in a specific region. Of course it would have been possible to extend the dimensions of the model to accommodate, on the one hand, a great number of possible patterns of asset distribution, physical and socio-economic environments, and, on the other hand, encompass numerous government policies. But, for applied policy research, there seemed little point. The results would still be abstract, algebraic presentations, logically consistent but devoid of empirical content. Furthermore the algebraic models would take a great deal of computer programming, not to mention unreasonable demands for computer time and data.[3]

It was decided that the only way to continue was to undertake field work in a particular region, build a model for that area and

[3] A single equation in an algebraic model may require a large number of equations in the corresponding computer model.

accept the pragmatic realities of limited money, staff time, computer facilities, etc. – realities which have to be faced up to by actual planners as opposed to theoretical planners. Furthermore a decision was made to include some of the ideas of comparative social anthropologists. It seemed that they, like the overall planner, see society as a system which includes output distribution but are less inclined than their economic counterparts to impose models generated for the analysis of developed economies. They are more interested in observing, interpreting and understanding the characteristics of different societies and noting the different types of transactions within and between households (such important items as wage payments in kind, and tenure systems).

There are, however, two important limitations to their work: First, the lack of quantitative measurement, not of qualitative things such as social prestige, but of quantifiable items such as food paid as kind for different agricultural operations. For an economic planner, it is only if these items are measured, albeit roughly, that one can get some idea of magnitudes and the relative importance of different transactions for the distribution of output (income). The second limitation is a reluctance to even attempt to answer questions about how society might change under different government programmes – for example, the introduction of big tractors as opposed to small-scale hand tillers. This is indeed a most unfortunate limitation because their 'wooly' projections may well be better than the work of the quantitative economic advisor.

A Theoretical Model

The first stumbling block in the research, and one which persisted throughout, was the necessity to have an empirically-based theoretical model *before* constructing a computer programming model. This is a step which, in the world of computer model builders, is often glossed over. There are two reasons which might account for this: First, the most common macro planning model, the input/output model, contains no assumptions concerning economic theory or behaviour. It is an accounting framework which may be used to determine the implications for all interrelated sectors of a given level and composition of national consumption. The most common planning model therefore, besides having the limitations cited earlier, also has no theoretical or behavioural assumptions – a

fundamental ingredient for any social study. It is not surprising then that the technique is used only very cautiously by experienced applied planners and only in conjunction with a mass of additional assumptions concerning behavioural relationships. However, as soon as one discards the safe confines of this conventional model and introduces behavioural relationships, a theory is required. In addition, with the concern for policy, the theory must be relevant to a specific society.

The second reason for glossing over this difficult, time-consuming stage, is that conceptual model builders often succumb to the temptation to hold their options open, with respect to what they are going to put in and *leave out* of the numerical model. They also tend to relegate the building of specific empirical computer models to a lower level of academic endeavour. Indeed much of the work, after the initial algebraic formulation, is subjective, pragmatic and dull!

Limitations of Computer Methodology

Although most planning problems are extremely complex, the answer to analysing them and making policy decisions is not in building large complicated multivariate models as some would have us believe. This 'bigger and better models' type of attitude may suppress other simple, but thoughtful analysis which goes quickly to the heart of the problem and enables planning decisions to be made.

An experienced applied economist will diagnose a problem and suggest a solution[4] in a few weeks just as adequately as a group having a computer, data collection and considerable back-up facilities. Those economists who state 'make the model bigger', who start with a simple model and modify it depending upon its predictive power or on the validity of its structural characteristics, miss the point. It will be found that more and more relationships need to be included. Furthermore, as any one who has been involved in computer processing knows, there are finite computer facilities. The addition of a few more equations has implications for data requirements and computer time that could mean another year's work. Surely policy research should assist with answering at least some of the everyday problems for which the planner has to find solutions rather than repeating old ones or merely raising new ones;

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[4] The diagnosis and solution will depend of course upon his idealogical leanings.

yet all too often those who cry 'we need more time facilities, more data etc.' manage to contribute very little to the job of planning.

Finally, for social science students involved in using computer models, the technique has serious limitations. Although it is sometimes an interesting occupation it is often learnt at the cost of wider economic reading and dialogue with social scientists and practising planners. Fortunately, there are many experienced economists in applied policy making who have not been over awed by the 'new rigour' of computer models.

Reports and Publications

One of the problems associated with applied policy research is the conflict between academic objectives and those of policy makers. The neat concise 'original' article may come out five years after the data was collected though the ideas may have been 90% formed while still in the field. The lag for checking ideas and cleaning up the data could have a high social opportunity cost for applied planning. For big model builders the conflict is even worse, for the model is the focus of attention and the research is not written up until the final model is constructed and solved. Attention then is given to the results of the exercise while the detailed descriptive and statistical material, on which the assumptions of the model are based, may be relegated to a small appendix. For many regions even the working notes and tables of the secondary studies, if made available as the work is in progress, may be of more use to applied planners and social scientists than the model and its results.

Place of Computer Models

Finally, in relation to computer models, I would like to define three areas where they may be *fruitfully* applied: First, as conceptual analytical tools for diagnosing situations and thinking through the implications of different government policies. It is useful to define (government) objectives (both quantitative and qualitative), then work out the alternative ways of achieving those objectives given the resource cost of each method and the amount of recources available. The second area concerns the use of computer models to generate numerical illustrative examples for demonstrating the implications of the conceptual model. In many situations a numerical illustration helps. As models do not, and should not, evolve in a vacuum the

numerical example may also give further information about where the diagnostic framework may be relevant. The third area is the use of very simple aggregate planning models – models for which a computer is hardly required. This type of model is seen merely as an aid to the planning process. The classical, simple input/output model is a model of this type and will continue to be one of the important aids in the planning process.

Models used in the above three ways will continue to be useful in pointing to important areas where detailed empirical work necessary for planning needs to be done e.g. household surveys, irrigation technology, etc. However, by keeping models in their appropriate place planners will not then allocate scarce resources to big model building and thereby, perhaps, effectively prevent decisions from being made and morcimportant studies from being carried out. Complex computer programming models are not the answer to planning problems and they may be disfunctional if they displace other less sophisticated techniques. A model is, after all, only a model and should be built for a specific purpose. If the purpose of policy research is kept in mind the practical realities of planning must be kept to the fore. In these situations computer models will take their place as tools to be used judiciously in very specific geographic situations where time, money and skills are available at low opportunity cost and where other socio-political conditions are suitable.

As far as my own work is concerned I hope that anyone reading the second part of the final report (Biggs, 1973) would see why and how an agricultural system behaves differently depending upon the specific distribution of assets, different types of agricultural machinery and various modes of transactions. The approach requires one to examine how, in the context of specific local conditions, government objectives of output and income distribution are affected by different policies. This is what the model is constructed to demonstrate. I would thus use the model as a teaching tool and be very disappointed if any developing country or region devoted scarce resources to a more elaborate model with the idea that the projection for planning would be more accurate or worthwhile.

The research also makes some contribution to social theory and to the planning model literature. A theory for rural society was developed which shows how modes of transactions have evolved

to maintain social stability in a situation of great inequality of asset (land) ownership, of labour intensive technology, and of great uncontrollable fluctuations in the level of aggregate output (Biggs and Burns, 1973 and 1973a). This theory was then included in the computer model (Biggs, 1972 and 1974). As regards the contribution of the theoretical model, I do not feel that we have added substantially to the perceptions and projections of local planners (Bihar Government, 1969) nor to those of people such as Ladejinsky who made a short visit to Kosi (Ladejinsky, 1969). As for the computer models, they contain two advances: They investigate the issues of income distribution; and they include important anthropological characteristics such as the distribution of land and modes of transactions. In so much as these aspects have been omitted in the past, a contribution has been made. Now, hopefully, those mathematical economists who only talk with their other mathematical colleagues can no longer avoid facing some of the issues that have been raised by other social scientists and planners for years. However, when all is said and done, I do not feel that the computer model building has helped very much the multitude of impoverished landless labourers and small cultivators in Kosi, nor has it helped the applied planners in the region.

Some Research Papers:

Biggs, S.D., 1968: *A Programming Model to Demonstrate Regional Agricultural Development by Land Settlement. (A Research Essay)*, mimeo, Dept. of Agricultural Economics, University of California, Berkeley, July. (Also an IDS Discussion Paper), 16pp.

Biggs, S.D., 1972: *A Regional Agricultural Planning Model to Investigate Output and Income Distribution Implications of Rural Policies.* IDS Discussion Paper, Dec., 22pp.

Biggs, S.D., 1973: *A Programming Model for the Agricultural Socio-Economic System to Investigate Output and Income Distribution Implications of Rural Policies: Kosi Region, Bihar, India.* (Final Report to SSRC part 2), IDS, Dec., 232pp (draft). Also a PhD thesis for the University of California titled "A Multi-Sector Model for the Agricultural Socio-Economic System: Purnea District, Bihar, India".

Biggs, S.D. and C. Burns, 1973: *Agricultural Technology and the Distribution of Output in a Traditional Rural System.* IDS Discussion Paper No. 21, Sept., 39pp.

Biggs, S.D. and C. Burns, 1973a: *The Changing Rural Economy of North Eastern India (A Case Study of the Distribution of Productive Assets and Traditional Modes of Transactions in a Changing Agricultural Socio-economic System, Kosi Region, Sihar).* (Final Report to SSRC part 1), IDS, Nov., 240pp+.

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Bihar, Government of, Dept. of Agriculture and Animal Husbandry, 1969: *Problems of Small Farmers of Kosi Area (Purnea and Saharsa Districts).* Secretariat Press, Patna, Bihar.

Institute of Development Studies Library, 1974: *A Guide to the Research Materials from the SSRC Kosi Project,* IDS Forthcoming, Spring.

Ladejinsky, W., 1969: 'The Green Revolution in Bihar. The Kosi Area: A Field Trip'. *Economic and Political Weekly,* Vol. IV: Review of Agriculture, September.