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SOME ILLUSTRATIVE POLICY RUNS USING THE NIGERIAN AGRICULTURAL SYSTEM SIMULATION MODEL FOR DEVELOPMENTAL PLANNING

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Abstract

Economic planning in developing countries is very complex and fraught with uncertainties. To deal with the developmental planning problems, the paper presents a generalized system simulation model which has the capability of investigating the consequences of proposed government programs to modernize the agricultural sector of Nigeria.

1. INTRODUCTION

This paper is a summarized report of the research conducted by a team of agricultural economists and systems scientists in Michigan State University interested in developing a generalized system simulation model that can assist in the planning and evaluation of proposed government policies of developing countries.(1) While our concern was to develop system simulation computing features that are applicable to the analysis of the planning problems of other economies, because of the reservoir of information and expertise located at MSU (where the Consortium for the Study of Nigerian Rural Development(2) was headquartered), the specific country used in our model testing and validation was Nigeria.

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This paper presents the basic structure of the model and illustrates its potential usefulness by simulating the results of five agricultural policy alternatives for Nigeria which are evaluated by comparing their effects on Nigeria's gross national product (GDP) and annual agricultural income per worker (AAIW), only two of the over 70 different performance indices that are now incorporated in the model.

2. SYSTEM SIMULATION AS A TOOL OF DEVELOPMENT PLANNING

The allocation of resources for national development is very complex and the outcome is affected inevitably by the dynamic interactions and feedbacks of a multitude of environmental, social, and political variables. Furthermore, the development process is characterized by the need to attain a number of oftentimes conflicting goals such as the increase in gross national product, employment level, nutritional intake and price stability. Hence, policy makers need analytical tools that will make explicit and conveniently display the different outcome under a proposed set of policies and programs. Accordingly, a system simulation model which, given specific assumptions about the system structure--its causal and functional interrelationships, values and exogenous variables--would generate time paths of relevant endogenous and criterion variables needed by the policy makers to evaluate alternative development strategies.

3. THE NIGERIAN AGRICULTURAL SYSTEM SIMULATION MODEL

Our concepts of potentially relevant policy-making clientele and their problems determined the sectors, their interrelationships and the

level of aggregation of the model. As can be seen from Figure 1, our emphasis is on the agricultural sector since agriculture is dominant in the Nigerian economy as well as other developing countries.

4. EVALUATING NIGERIAN AGRICULTURAL POLICY ALTERNATIVES

Five agricultural policies were arbitrarily selected for evaluation and experimentally simulated from 1965 (the first year beyond the date used to estimate the model parameters) to 1993. These include (1) essentially a status quo agricultural policy, (2) increasing the marketing board producer prices, (3) introducing export crop modernization programs, (4) a combination of Runs 3 and 4, and (5) introducing a food crop modernization program in the Nigerian Middle Belt.

The general effects of the five policies can be seen in Figures 2 and 3. While all five simulated policies increase the GDP and AAIW, the increases are more rapid for Runs 3 and 4 with the export modernization programs. However, there is a difference in the increase of AAIW between the North and South since it takes another six to ten years before the perennials cultivated in the South come into production. The increase in the producer prices of the major export crops (Run 2) increase the GDP and AAIW in the first decade but soon tapers off after the major adjustments are made. The combination of improving producer export prices and introducing improved export production technology and management (Run 4) stimulated the greatest growth in GDP and AAIW. The complementarity of these policies instigated greater export crop acreages and yield increases than either policy did independently (Runs 1 and 2).

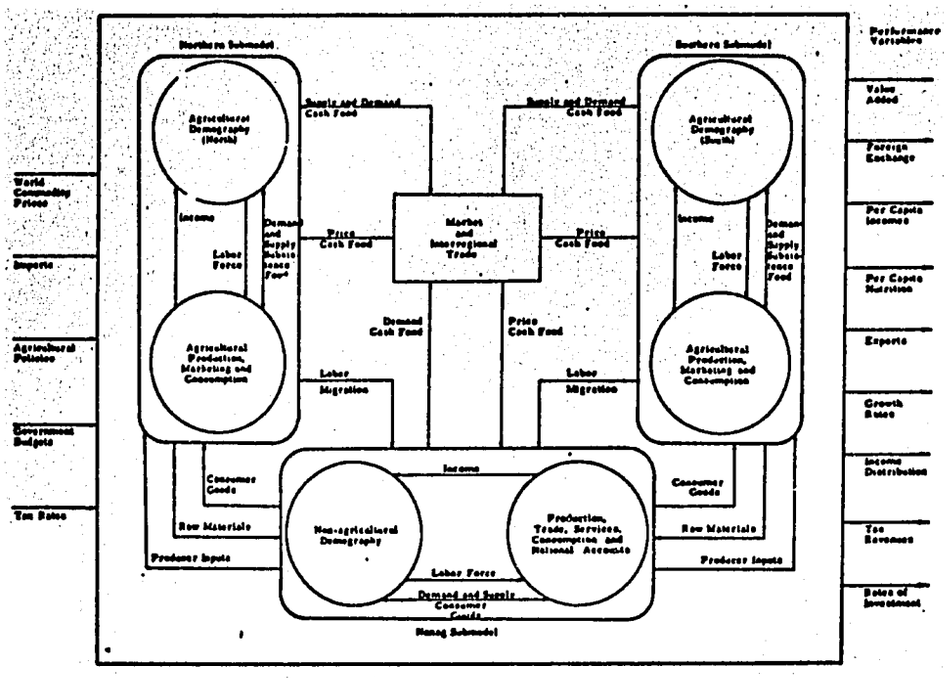

Figure 1. National model of interacting sub-models.

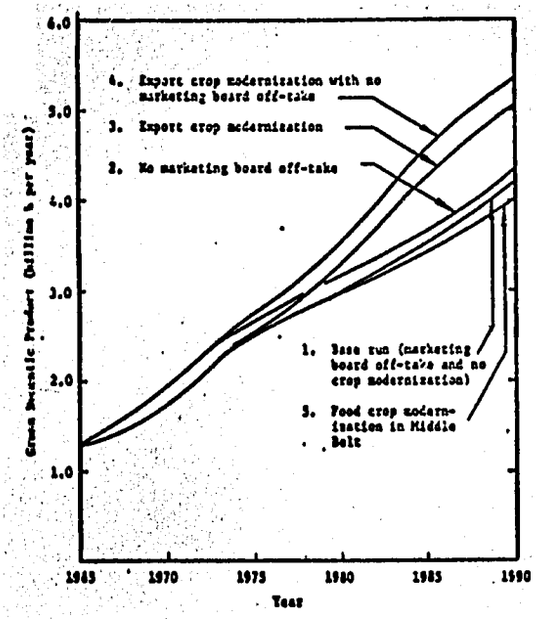

Figure 2. The effects of various agricultural development policies on the gross domestic product.

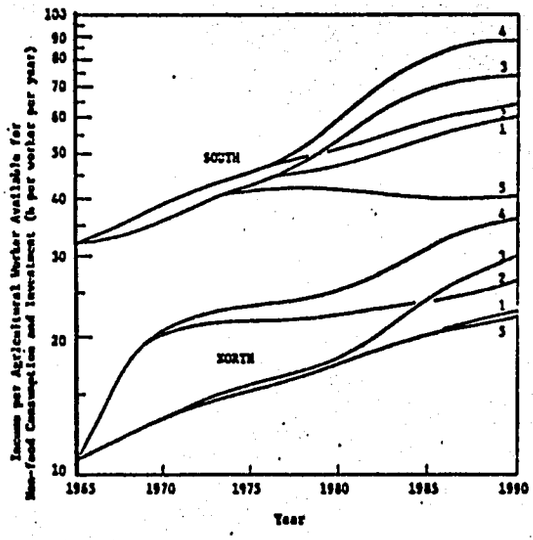

Figure 3. The effects of various agricultural development policies on the income available for each agricultural worker (North and South) to spend on non-food consumption and investment per year.

Food crop modernization in the Middle Belt (Run 5) especially seems to be comparatively much less advantageous for the South than for the North, as the program caused more resources to be productively used in the parts of the North where export crops are not feasible alternatives.

5. CONCLUSIONS

The illustrative policy runs demonstrate some of the advantages of a dynamic agricultural sector model. The differing responsiveness over time of perennial versus annual crop policies was particularly striking with the different rates of income increase. The complementarity of some policies (in this case, higher marketing board prices combined with introduction of new technology) was aptly demonstrated in one case; the search for this type of complementarity may be facilitated by experimentation with this type of model.

While the parameters used in this illustrative simulation procedure may be changed as we begin model implementation, these runs illustrate the type of results which can be obtained at very low cost once a simulation model is available. This plus the cost of development may be quite small compared to the price which society will pay for mistaken policies and programs in designing the development strategy.

6. BIBLIOGRAPHY

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