# National Development Policies for Developing Countries

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ABSTRACT

The work described in this paper is an extension of earlier work by the same authors on analysis of national development planning. A brief description is presented here of the system dynamics model developed for this earlier work as a basis for explaining its recent application to development policy design. A taxonomy of development policies is presented and the results of analysing seven policies, within an adaptive model framework, are presented, which are aimed at improving and achieving both growth and equity. Each policy is examined under conditions of continuous proportional control and discrete control based on a sector criticality.

## INTRODUCTION

The governments of developing countries today are in no better a position in real terms than they were half a centruy ago in dealing with the control of the development process. In spite of a considerable success in generating economic growth for developing economies, the picture on income distribution remains as gloomy as it was in the 1950s (Chenery, et al, 1981). One apparent reason for this uneven economic and social development, arguably the most difficult one, suggested by the planners, has been the difficulty in "the determination of the weights to be assigned to growth of income on the one hand and to creation of employment and attainment of a more equitable distribution of income on the other" (Meier, 1976, p.802). There are severe problems associated with finding suitable methods which can provide an insight into the appropriate weights to be attached to growth and equity to achieve balanced development. This requires a multidimensional and holistic approach to development, and the formulation of suitable quantitative methods of policy analysis.

The work presented in this paper is related mainly to the development of methods of achieving more comprehensive and quantitative analysis of development than has been achieved in the past. Here, an attempt is made to throw light on the issue of maintaining growth and equity, under various exogeneous influences, in a typical developing economy. To build up a clear understanding of the experimental results, some background work has been presented. This includes a brief presentation of the underlying model used in the work and a classification of various policy options to be analysed by the model.

## THE SYSTEM DYNAMICS DEVELOPMENT MODEL

A search of the huge literature on development (Myrdal, 1972 ; Meier, 1976; Chaudhuri, 1976; Chenery et al, 1981) leads to the following generalisations about development in Third World countries.

a) Agriculture is the single largest sector contributing to the national income.
b) The majority of the population depends on agriculture for a livelihood.
c) There is widespread rural poverty.

d) Income sharing patterns are highly skew, acting against a vast majority of the rural population.

The model building exercise described in this section of the paper attempts to capture these characteristics of developing economies. The activities which can be considered as representative of a typical developing economy are presented in Fig.1. These activities which form the basis of the system dynamics model used for the investigation were, in fact, selected on the basis of the Indian development situation (Mandal and Wolstenholme, 1984). However, since the pictures in the developing countries are broadly similar, the model may be considered as a fair representation of the major activities common to most of the developing countries.

Since agriculture is defined as being the major concern in national development, the Agriculture Sector in the current work has been modelled in great detail. Non-agriculture (anything except agriculture) has been modelled to take care of mainly those aspects which affect or are affected directly by agriculture. To tie together these two sectors of the model it has been necessary to develop a Finance Sector in some detail to represent the economic activities of development (such as investment generation , allocation by fiscal policies, export - import balances) and, most importantly, to facilitate growth and equity calculations.

The underlying mechanisms by which the activity of these three sectors of the model are interrelated have been discussed by the authors in their earlier work. However, the major influences of the model are reviewed here. A simplified overall influence diagram (Fig. 2) is presented for this purpose.

The influence diagram can be divided into two parts (along the dotted line) which contain feedback loops of two different kinds: loops related with growth (Part I) and loops related with equity (Part II).

- Feedback loops Influencing Growth.

Five prominant influences can be traced out in the Part I portion in Fig.2. Loops 'A' is a strong positive feedback loop which captures the mechanism of increasing agricultural production through investment generation and allocation in various activities of agriculture (such as livestock, cash crop, land development and irrigation). A similar type of strong positive loop 'B' can be traced within the non-agriculture sector which reinforces non-agricultural production through investment. The loops 'A' and 'B' emphasise cash availability generated by savings rates. However, cash availability is also affected by the export-import balance. In an agriculture based economy, higher agricultural production is expected to provide a surplus balance of payments situation and to increase cash availability. This is shown in the loop 'C'. Food import and export is also taken care of by this loop. The feedback loop 'D', a negative loop, outlines the effects of higher imports by the non-agriculture sector, which in turn reduces the amount of cash available for investment. The general tendency in in developing economies is to import capital or intermediate goods to develop industry and this activity depends heavily on agriculture for foreign exchange earnings. One more important area of inlfuencing growth is to alter the composition of the gross national product. Agricultural products form a major part of raw material input to non-agriculture. Again, non-agricultural production is more expensive than that of agricultural production. Both of these two effects are represented by the negative loop 'E'. Here, any increase in non-agricultural production at a rate higher than that of agricultural production is expected to increase the capital - output ratio of this sector and thereby make non-agriculture more cost intensive.

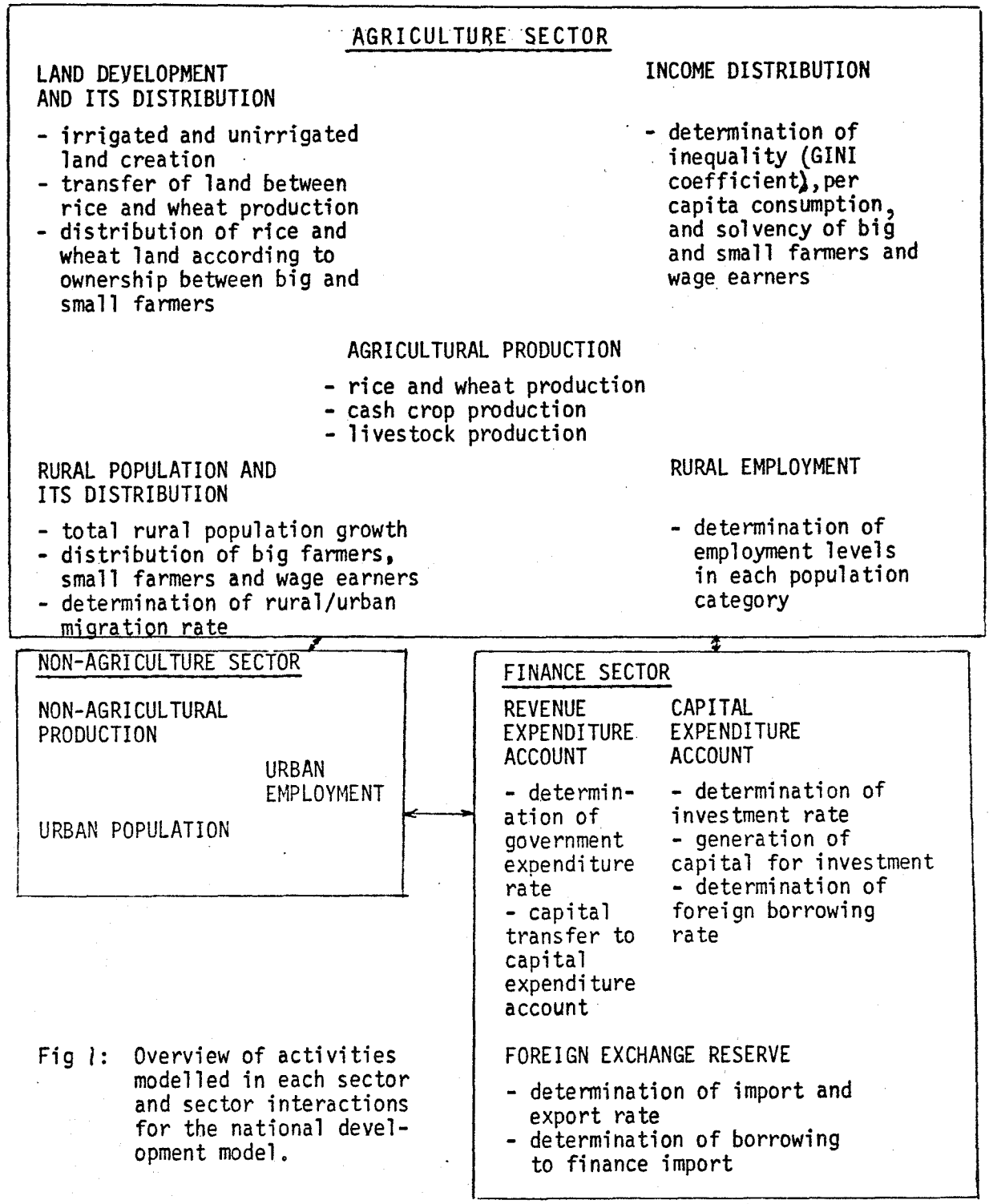


Fig 1: Overview of activities modelled in each sector and sector interactions for the national development model.

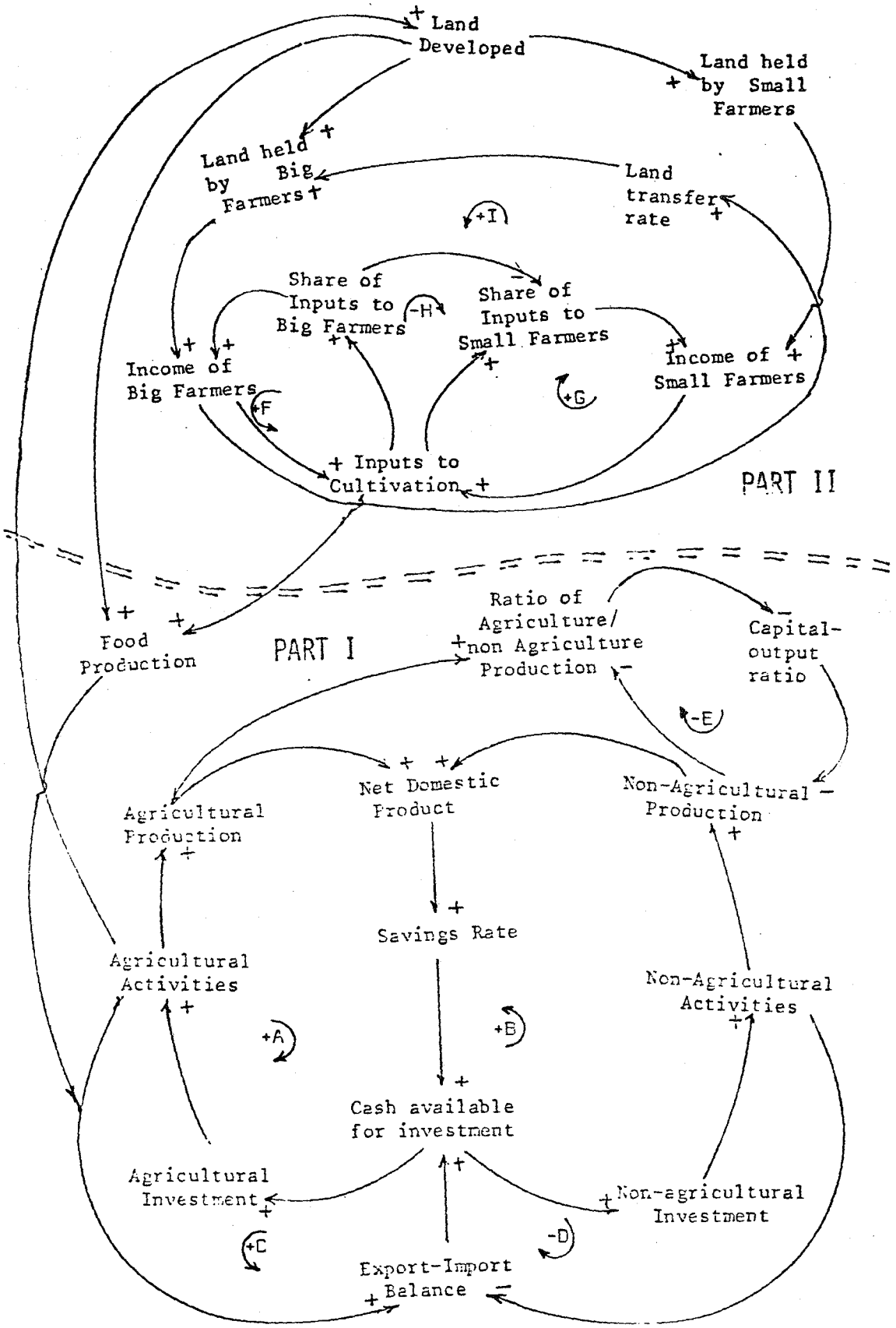


Fig.2: Simplified overall influence diagram of national development model.

- Feedback loops influencing Equity

The mechanisms of income distribution, shown in Part II of the Fig.2, are identified by four feedback loops, F, G, H and I. Both the loops "F" and "G" reinforce the demand of inputs to cultivation (i.e. fertilizer, pesticides) which are dependent on the levels of income by small and big farmers. However, the sharing of inputs acts against the small farmers. With higher solvency power the big farmers' share of inputs is expected to increase, hence curtailing small farmers' share. With less input the income of small farmers is likely to decrease. The process, once started, will reinforce the deteriorating condition in earnings of small farmers from cultivation. This is shown by the negative "H" loop.

Higher income of big farmers also instigates the transfer of land ownership from small farmers to big farmers (positive "I" loop). Because of land transfer, the income of big farmers increases and this undermines further the rural income distribution situation.

The major influences described above need to be studied in more detail to understand the behaviour of the national economy. It is possible to control these influences by various policy options and their implications may be studied in terms of the major outputs of the model. Growth and equity are two major outputs of the present model. Growth is measured by the annual growth rates of agriculture, non-agriculture and overall economy. Equity measurement is somewhat tricky and it is quantified by calculating the deviation of the actual income sharing of the various groups of population from the equal proportional share. Rural and national equity positions are represented by the variables GINI and NEQTY, respectively. An ideal equity situation assigns 0 for both GINI and NEQTY, whereas an extreme inequality will be represented by 1 in the values of both GINI and NEQTY. However, prior to analysing growth and equity values from specific policy options, it is necessary to understand the nature of feasible policies for development control and their classification.

TAXONOMY OF NATIONAL DEVELOPMENT POLICIES

The controls on a national economy may be applied at different levels and the degree of importance of the policies may vary from level to level. There are essentially three levels, national, inter-sectoral and sectoral, in the economy where controls can be exerted and they can be depicted in Fig.3. This classification of policies at the national, inter-sectoral and sectoral levels helps to create a visual overview for policy analysis which stresses the hierarchical nature of the policy process. Performances in the sectoral level determine the success of policies in the inter-sectoral level and, ultimately, success at the national level. The control in terms of both the number of decision points and effectiveness of policy measures increases as one moves down from the national level to the sectoral level. In terms of the overall sensitivity of the policies, the decisions made at the national level will have greater impact than those of policies at lower level.

The basic aim of the policies, whether to influence growth or equity or both, are also important in the characterisation of control policies. The policies associated with growth are mainly concerned with increasing output or in influencing the pattern of growth by way of investment, or allocating investment in desired ways among the various activities of the national economy. The growth policies also influence the availability or adoption of inputs for economic activities, for example, introduction of

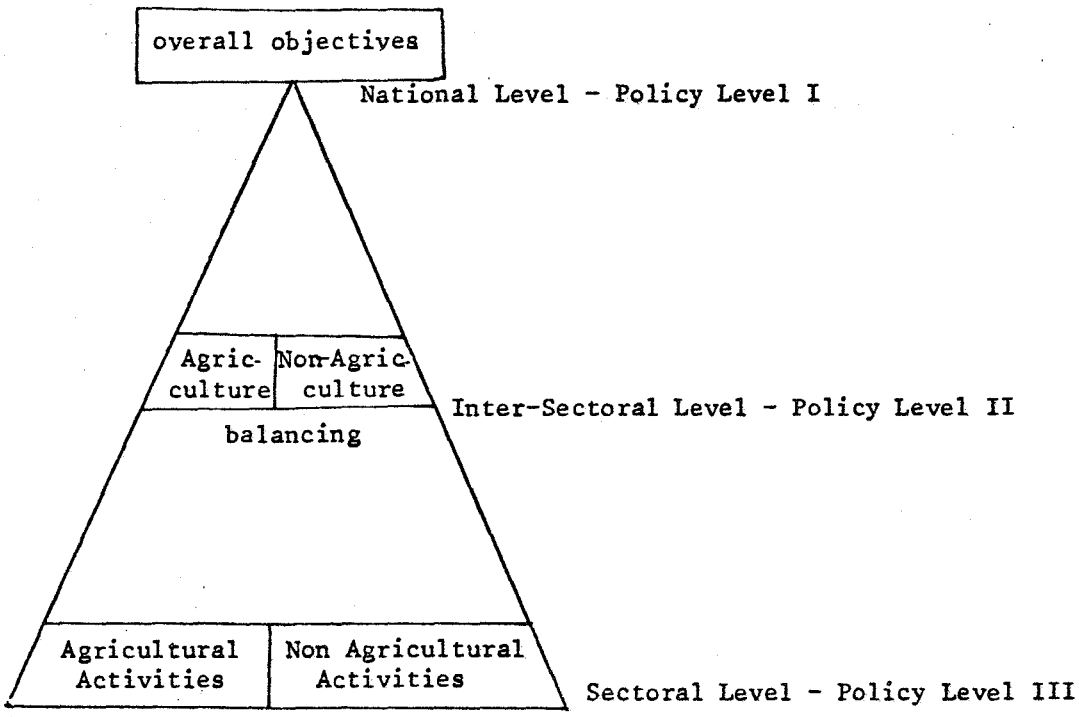


Fig. 3: Level of Policy Application

new technology in agriculture. On the other hand, equity policies are mainly concerned with distribution of inputs as well as outputs from economic activities among the various sections of the population in the society. On the input side, the equity policies may be designed to distribute inputs of agriculture, namely, land, fertilizer and labour among the sections of rural population. The policy controls may also be applied to distribute the outputs by way of taxation or any other fiscal policy.

The other major factor which helps the categorisation of the policies is the system's configuration. Depending on whether a system is 'closed' or 'open' the characteristics of the policies will change. For the discussions in this paper a simple definition of the 'open' system may be considered as being where the major outputs of the model do not feed back information to the controllable variables of the system. The opposite is the condition for a 'closed' system where major outputs feed back information to the controllable variables. In an open system configuration of the model the decision concerning the application of a policy is made at the beginning of a simulation run and the policy remains operational throughout the simulation period irrespective of changes in the states of controlling variables. It can be strongly argued that this mode of representation is exactly in keeping with how policy implementation takes place in practice in developing countries. Many policy plans are created and implemented with little monitoring of their effect. This view is confirmed by the literature where most policy analysis in developing economies are based on non-adaptive assumptions (Holland & Gillespie, 1963; Saeed, 1982; Wolstenholme & Mandal, 1984). In the case of a closed system configuration the policies can be made adaptive and the states of the controlling variables are used to decide whether a policy should remain operational or not. This mode of representation is, in fact, often the mode assumed as normal and existing in system dynamics models. In an

open system configuration of the present model growth rates and income distribution do not influence any policy parameters. But in the closed system configuration there is a lot of scope for the growth rate and income distribution to influence policy application. Some of these possibilities can be seen in Fig. 4 where information on the growth rate and equity at any time are fed back to suitable variables at different levels of the model.

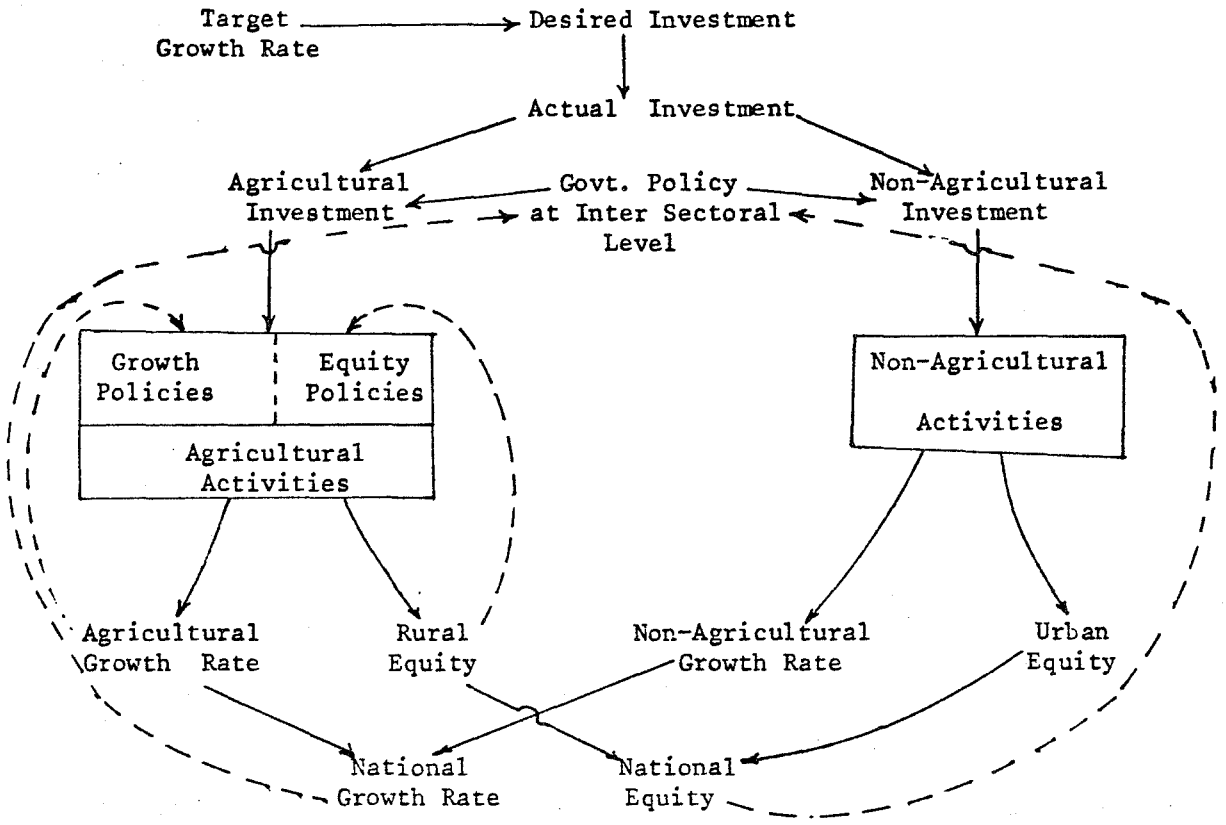


Fig.4: Growth rates and equity information fed back to policy variables

Finally, the functioning of adaptive governments may be viewed in two ways. Firstly, the government may decide to change the policies continuously depending on the situation which evolves as a consequence of its policies. Secondly, the changes might be incorporated only when the consequent situations within any sector become critical. However, in the case of criticality the policy measures are drastic and remain in force so long as the criticality exists. There is little evidence of any work having been carried out on the analysis of adaptive government policies - either continuously adaptive or adaptive to criticality. The work cited in the following section of this paper highlights the major issues associated with adaptive policies.

DEVELOPMENT SCENARIOS UNDER ADAPTIVE GOVERNMENT POLICIES

The typical developing economy modelled in this work has been subjected to seven different adaptive policies and the performances of the scenarios generated from these seven policies are analysed in comparison with a reference mode of behaviour for the model. The reference mode is designated by Policy A in Fig.5. This represents a continuation of past policies and normal functioning of the economy where 23% of the total investment goes into agriculture sector and the rest to the non-agriculture sector. Similarly, the other seven experiments corresponding to seven adaptive policies are marked alphabetically by Policies B to H in Fig.5. A statement on each of these policy experiments and a section of the major outputs of the experiments also appears in Fig.5. It must be noted that in all the policy experiments policy changes are introduced at the year 1985 and the model is run for the period 1980 to 2010 AD. Amongst the adaptive policies, Policies B, C and D represent a group of continuous adaptive policies and Policies E, F, G and H belong to adaptive policy group associated with the concept of sector criticality. Policies E and F attach high priority to growth objective of development, whereas Policies G and H are concerned with equity improvements.

In Policy B, agricultural investment is influenced continuously by observing the national equity situation achieved. If the value of national equity increases above a target value (0.30 in all the experiemnts) agricultural investment is raised proportionately. The underlying assumption with this control policy is that the national equity situation can be improved by rapid development of agriculture. Policy C attacks directly the equity situation in agriculture. Equity correction policies, such as fertilizer subsidy to small farmers, imposition of land ceiling, implementation of minimum wage rate or combined measures, are imposed on the agriculture sector depending on the rural income distribution situation achieved. If rural income distribution value increases above a target level (it is also chosen to be 0.30 for all the experiments) then a suitable policy or set of policies are employed. The choice of equity policy(ies) depends on the degree of departure from the target value. Policy D combines the Policies B and C. Policies E and F are designed to study the effects of growth and equity policies which are applied only when the system reaches criticality. In Policy E, national growth and national equity are compared against some acceptable values (specified as 75% of the target growth rate and 25% above the target equity, respectively). Agricultural investment is decided on the basis of whether growth or equity, or both, become critical. In the case where equity alone becomes critical, 90% of the investment is diverted to agriculture. If growth becomes critical and not equity, 90% of the investment goes to non-agriculture. However, it is 50/50 when both growth and equity are critical. In Policy F, in addition to criticality of national growth and equity, rural equity is also influenced by equity correction policies in the agriculture sector. Policies G and H are replications of Policies E and F respectively, but with emphasis on equity. In these two policies it is assumed that, if equity value rises above 5% of the target equity value, then the equity situation will be defined as critical.

The results from the above eight policies are presented here to highlight the growth scenarios and equity scenarios generated by the simulation of the economy.

| Policy | | Growth Outputs | | | | Equity Outputs Average of 1985-2010 | | Remarks |
|---|---|---|---|---|---|---|---|---|
| No. | Description | Domestic Product (Cr.Rs) (at 2010) | Agric. Growth Rte % per yr. (1985-2010) | Non-Agric. Growth Rte % per yr. (1985-2010) | Ratio of Agric/Non-Agric(Product(2010) | National Equity (NEQTY) | Rural Equity (GINI) | |
| A. | Normal policy - continuation of past scenario | 277,280 | 2.82 | 2.94 | .74213 | .3461 | .5100 | |
| B. | National equity influences agriculture/non-agric. investment continuously | 301,955 | 3.23 | 3.25 | .75861 | .3397 | .5073 | |
| C. | Rural equity influences equity policies in rural sector continuously | 272,535 | 2.75 | 2.86 | .74360 | .3071 | .3903 | Only min.wage rate policy remains active after 2003 |
| D. | Combination of Policy B and Policy C | 277,243 | 2.83 | 2.93 | .74570 | .3060 | .3903 | |
| E. | Critical value of nat'l growth rates & equity influence agric./non-agric.investment. Priority is in growth | 228,463 | 1.89 | 2.24 | .69851 | .3582 | .5134 | Growth rates drop drastically after 1994 and pick up again by 2005 |
| F. | Policy E along with rural equity equalisation policies | 195,913 | 1.14 | 1.70 | .66352 | .3262 | .3943 | Growth rates drop after 1987. Lowest growth ach'd. |
| G. | Critical value of nat'l growth rate and equity influence agric./non-agric.investment. Priority is on equity improvement | 378,618 | 4.25 | 4.12 | .78590 | .3139 | .4880 | Best growth situation.Average agric.growth rate is higher than average non-agric. growth rate |
| H. | Policy G along with rural equity equalisation policies | 305,048 | 3.20 | 3.34 | .73847 | .2973 | .3886 | Best equity situation |

NOTE: NEQTY,GINI = 0 means perfect income distribution

NEQTY,GINI = 1 means extremely inequal income distribution

Fig. 5: Policy experiments with major outputs.

- Growth Scenarios

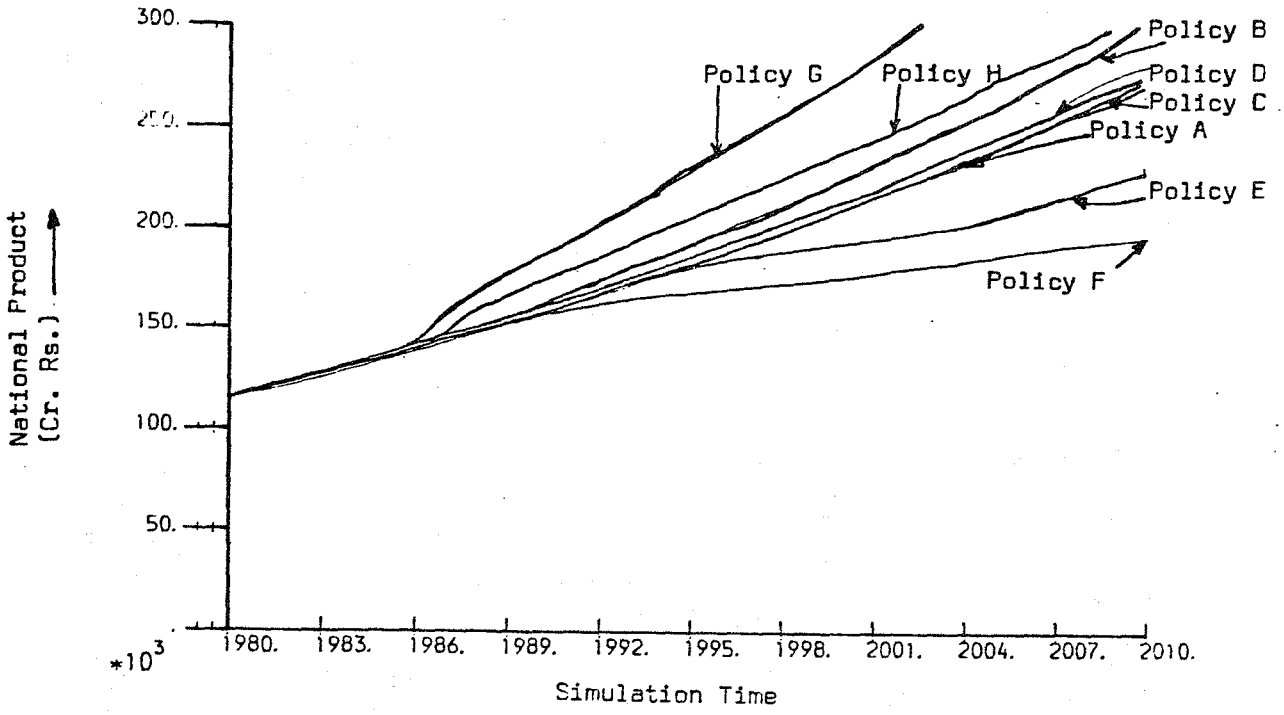


Fig. 6: National Product with the Policies A to H.

Fig. 6 compares the time series behaviour of the gross national product from all the eight policies. In general, the continuous adaptive policies (Policies B, C and D) perform well in terms of growth, even though there has been slightly poor performance by Policy C compared to the reference policy (Policy A). The growth improves in Policies B and D by the result of the increased investment in agriculture. This is quite possible and can be reaffirmed by the simple reasoning that as the agriculture sector grows rapidly (through investment in agriculture) the raw material available for the non-agriculture sector improves and the production in this sector becomes less expensive. This is consistent with the influences emphasised by the negative feed back loop 'E' in Fig.2 and is substantiated by the increasing value of the ratio of agriculture to non-agriculture production in Fig. 5 for Policies B and D compared with the reference policy. The development of the non-agriculture sector is greatly dependent on the development of the agriculture sector (Wolf, 1978) and higher growth in agriculture is conducive to higher growth to its counterpart. The growth in Policy D is not as high as in Policy B though the policy of diversion of investment from non-agriculture to agriculture remains operational throughout the simulation run. The reason is that most of the equity correction policies which were active during the simulation period of Policy D (and also for Policy C) acted counteractively to growth. Equity correction policies, particularly minimum wage rate, improve consumption expenditure patterns among the rural population and force down the savings rate. Although fertilizer subsidisation policies generally act favourably to

growth (Mandal and Wolstenholme, 1984), this policy was effective only for one year in Policies C and D over the simulation period.

The growth scenarios with critically adjusted adaptive policies are widely divergent and very sensitive to the government priority. The performances of the Policies E and F, where priority was given to growth, are far from expectations. Growth is here, in fact, far below the normal policy and even the equity position is no better than that of Policy D. It is suggested that this result occurs because of the higher priority that is given to growth which directs greater emphasis towards the non-agriculture sector and investments are diverted to this sector. Since it is deprived of investment the agriculture grows at a slower rate, which in turn makes non-agriculture more cost intensive. The net result is lower growth rate both in agriculture and non-agriculture. Whereas, higher priority to equity considerations, as modelled in the Policies G and H, forces higher investments into agriculture. Agricultural development induces non-agricultural growth and, ultimately, higher national growth.

- Equity Scenario

Fig.5 contains the values for national equity (NEQTY) and rural equity (GINI) averaged over 1985 to 2010 AD for all the policies, and Fig.7 shows the time behaviour of rural and national equity situation for some of these policies. It will be seen that the equity situation improved in all of the policies, except in Policy E. Amongst the continuous adaptive policies, Policy D performed best in terms of rural and national equity. The improvements in equity by diverting investment into agriculture in Policy B and by imposing equity correction measures in Policy C are successfully combined in Policy D to produce a better national and rural income distribution situation without sacrificing growth. The diversion of investment into agriculture (as in Policy B) leads to higher growth in agriculture and, thereby, the share of rural income in the total national income increases. Consequently, this leads to the improvevements in rural and national equity. The improved growth in agriculture by investment benefits all sections of the rural population. But, a favourable treatment to the weaker section of the rural population can be provided (as in Policy C) by the adoption of the equity correction policies. These measures either directly transfer income from economically advantaged group(s) to economically disadvantaged group(s) across the population stream and/or help economically disadvantaged group(s) to have higher access to means of production. Equity policies directly redistribute rural income and, thus, are more effective than the indirect way of influencing income distribution by directing investment to agriculture. Though the national equity improves in the Policies B, C and D, the improvements in the latter two policies are greater because of higher effectiveness of the equity policies incorporated in them.

The equity scenarios produced by policies associated with sector criticality are very interesting. The equity situation in Policy E is as bad as in Policy A, and the national equity situation is even worse. An apparent reason for this is that, because of a higher emphasis placed on non-agriculture sector, the investment into this sector becomes more than its normal share. This paves the way for urban income to increase at a rate higher than rural income, despite the fact that the final position of national income is far lower compared with Policy A. Even after the imposition of the equity improvement policy (Policy F) the improvement in equity is not very remarkable. This is because of the simple fact that substantial income, in excess of minimum requirements, should be generated before it can be distributed by government policy measures. Mechanisms have been built into the model to

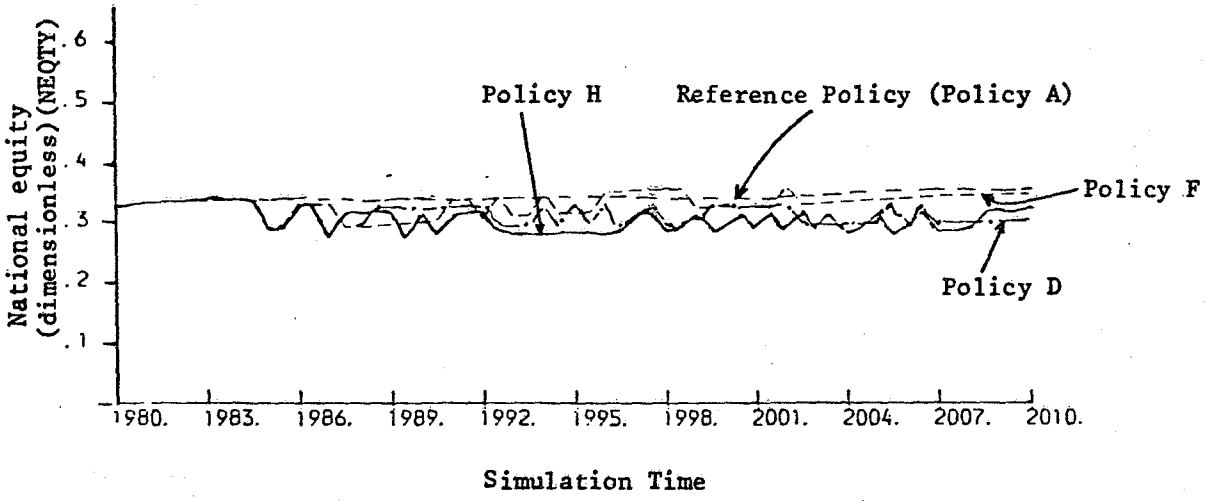


Fig. 7(a): Behaviour of national equity

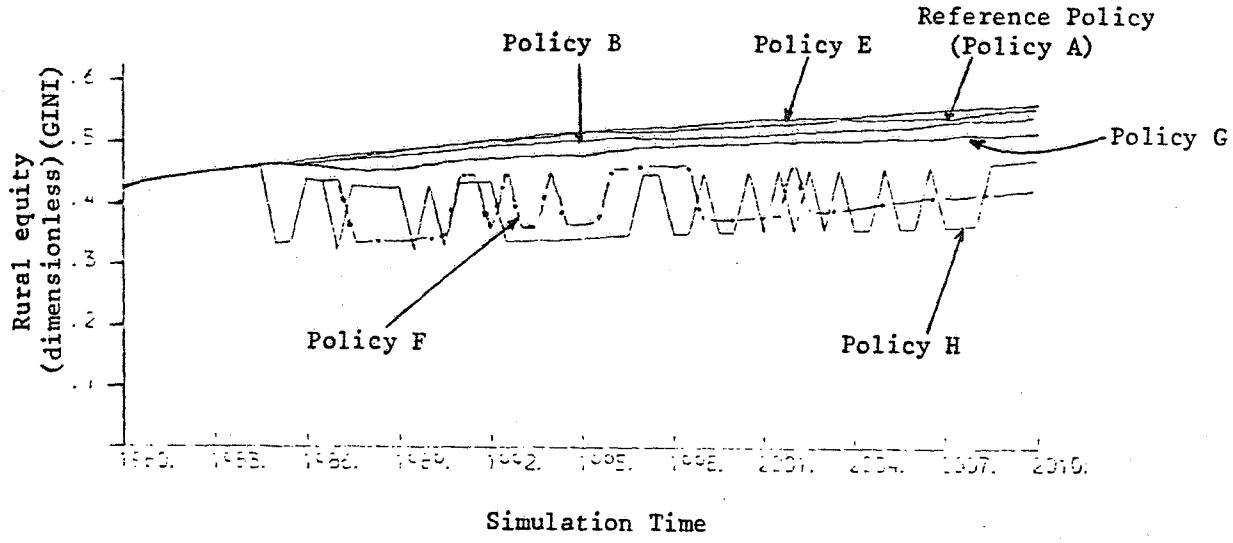


Fig 7(b): Behaviour of rural equity

Fig. 7: National and rural equity under various policies

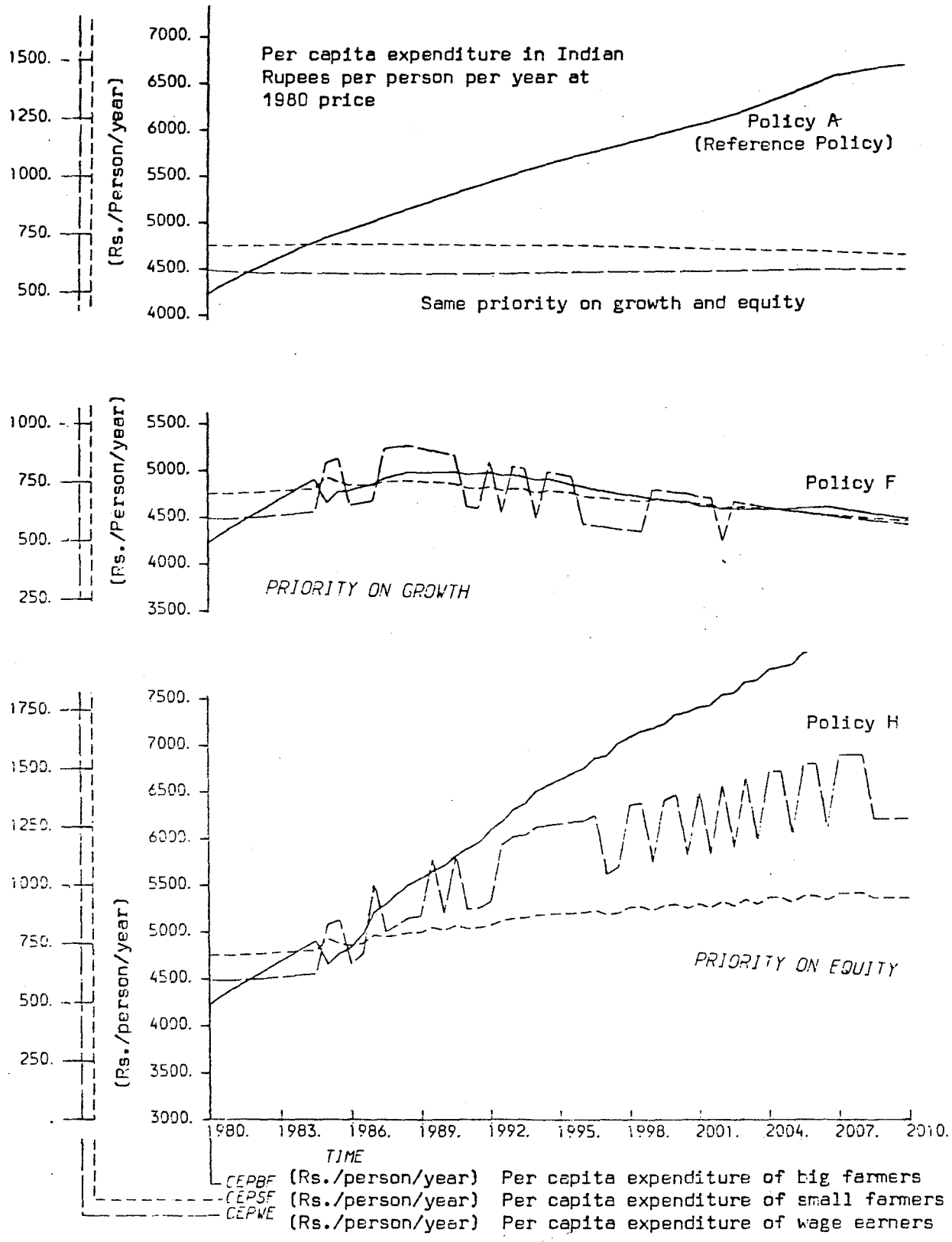


Fig. 8. Per capita expenditure of the rural population in policies A, F and H.

adjust income sharing depending on the minimum requirements of the various groups of people. Since there had not been much improvement in income generation in agriculture, the per capita expenditure did not improve (except for wage earners for some intermittent periods), see fig. 8. Even it was falling slightly near the end of the simulation period.

The higher priority to equity in the Policies G and H performed well in terms of equity. Higher income generation in agriculture helped effective income sharing by government measures. The per capita expenditure of all sections of the rural population in Policy H as seen in Fig. 8, exceeded than that in the reference policy. The overall equity situation improved also due to the lower differential between rural and urban income.

## CONCLUSIONS

The analysis on policy experiments conducted above leads to the following major conclusions.

Firstly, it is possible to achieve an improvement in income distribution without sacrificing growth rates. The continuous adaptive policy of adjusting agricultural investment by observing national equity situation and critical adjustment policies with priority to equity show better performance both in growth and equity compared to normal policy.

Secondly, a higher growth in agriculture would appear to be a precondition for higher national growth and improvement in equity.

Thirdly, depending on the government strategy, the development scenario may be completely different. With higher priority on equity significant improvement in growth and income distribution may be achieved. But high priority on growth may worsen and equity situation.

Finally, the impacts from continuous and critical adjustments are not noticebly different for equity output, though the difference may be significant in growth outputs.

The conclusions arrived at in this study answer, to some extent, the issues on growth with redistribution, currently the most important issue on development studies. The study has demonstrated an effective alternative means in selecting development strategies for the developing countries.

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