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POVERTY ALLEVIATION POLICIES IN INDIA: FOOD CONSUMPTION SUBSIDY, FOOD PRODUCTION SUBSIDY AND EMPLOYMENT GENERATION

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Abstract

Poverty alleviation has been the overarching objective of the development strategy of India since independence, although achievements have fallen far short of expectations. Over time a number of targeted and non-targeted poverty alleviation policies of varying extent of coverage and efficiency have been tried. The paper compares the effectiveness of some of these policy interventions in alleviating poverty using counter-factual policy simulations with a sequential applied general equilibrium model of the Indian economy for the period 1980-2000. Specifically the simulated policies include

(i) abolishing the existing subsidized public distribution of a specified amount of foodgrains to all urban residents or alternatively extending it to the rural areas and making it completely free,

(ii) the introduction of a rural works programs (RWP) targeted at the poorest groups of varying efficiency in its design and execution as well as its success in targeting,

(iii) abolition of the existing fertiliser subsidy and the use of part of the resources saved for augmenting aggregate investment and the remaining spent either on a rural works programme or on creating additional irrigated area.

The results suggest that a well designed, executed and targeted RWP has the greatest impact in alleviating poverty.

POVERTY ALLEVIATION POLICIES IN INDIA: FOOD CONSUMPTION SUBSIDY, FOOD PRODUCTION SUBSIDY AND EMPLOYMENT GENERATION

1. Introduction

The Directive Principles of State Policy as enshrined in the Indian constitution (Basu (1983)) enjoin the state to strive to secure "a social order in which justice, social, economic and political shall inform all the institutions of national life" and "to minimize inequality in income, status, facilities and opportunities, amongst individuals and groups" (Article 38), and to ensure "that the ownership and control of the material resources of the community are so distributed as best to subscribe the common good; that the operation of the economic system does not result in the concentration of wealth and means of production to the common detriment" (Article 39). Article 41 seeks to make effective provision for securing the right to work, to education and public assistance in cases of unemployment, disability, sickness etc.

The strong egalitarian and redistributive thrust of these principles is evident. The government resolution establishing in Planning Commission in 1950 explicitly invoked these principles and the very first Five Year Plan set out the task of development as to "translate ... the goals of social and economic policy prescribed in the Directive Principles of the Constitution ... into a national programme based upon the assessment of needs and resources" (as quoted in Draft Sixth Five Year Plan 1979-83).

It should also be stressed that from the early days of planning concerns were expressed that benefits of growth may not be equitably shared. We can do

no better than to quote from a speech given by Prime Minister Nehru in the Parliament in 1960 while introducing the Third Five Year Plan:

> "...it is said that the national income over the First and Second Plans has gone up by 42 per cent and the per capita income by 20 per cent. A legitimate query is made where has this gone? It is a very legitimate query; to some extent of course, you can see where it has gone. I sometimes do address large gatherings in the villages and I can see that they are better-fed and better-clothed, they build brick houses..... Nevertheless, this does not apply to everybody in India. Some people probably have hardly benefited. Some people may even be facing various difficulties. The fact remains, however, that this advance in our national income, in our per cpaita income has taken place, and I think it is desirable that we should enquire more deeply as to where this has gone and appoint some expert committee to enquire into how exactly this additional income that has come to the country or per capita has spread."

The concern that the growth process may have been unequalizing led Nehru's government to appoint a committee in 1960 under the Chairmanship of Professor P. C. Mahalanobis to study the distribution of income and levels of living in India. Even before this committee submitted its report in 1964, Mr. Pitambar Pant, then the head of the Perspective Planning Division of the Planning Commission, prepared a paper in 1962 (Srinivasan and Bardhan (1974), ch. 1) outlining a fifteen year perspective plan whose objective was to assure a minimum level of living for the entire Indian population by 1976. He argued that "the central concern of our planning has to be the removal of poverty as early as possible. The stage has now come when we should sharply focus our efforts on providing an assured minimum income to every citizen of the country within a reasonable period of time. Progressively the minimum itself should be raised as development goes a pace." This paper defined a minimum standard of living i.e. a poverty line, which has formed the basis of all discussion about poverty in India since then in the form of a minimum monthly per capita household private consumption expenditure, while explicitly excluding "expenditure on health and education, both of which are expected to be

provided by the State."

Pant rejected massive redistribution as "operationally meaningless unless revolutionary changes in property rights and scale and structure of wages and compensation are contemplated." He argued that rapid growth is vital for poverty alleviation since "a comparison of distribution of incomes in different countries...at very different levels of development and with varying socio-political environments...follows a remarkably similar pattern, especially in respect to the proportion of incomes earned by the lowest three or four deciles of the population." However he recognized that "on account of certain peculiarities of the Indian economy, it is, however, uncertain whether the distribution of income will remain stable with development or how it will change." Indeed, the paper specifically drew attention to the fact that in the Indian economy, the poor living in remote areas and belonging to the vast reserve of under-employed labour in rural areas (comprising landless labour, cultivators with very small holdings, artisans with primitive techniques) with limited mobility (across space and occupations) were loosely integrated with the growing sectors of the economy and that economic development in itself was unlikely to lift them out of their poverty. For them income transfers were seen as needed. Taking all these into consideration the paper arrived at a growth target of 7% per annum by balancing what is desirable with what is feasible by way of rate of growth and income redistribution within a given period of time.

In the event, the perspective plan presented in Pant's paper was not adopted. Until Mrs. Gandhi raised elimination of poverty as the main plank of her electoral platform in 1971, the planning commission did not formally propose a poverty oriented component of five year plans. They did so with the Fifth Five Year Plan for the period 1974-79.

The approach to the Fifth Plan postulated a specific objective of poverty eradication along with the elimination of net external aid on concessional

terms, neither of which has been attained to this day! It included a "minimum needs" component which was an updated version of the notion of minimum levels of living of the Pant paper which itself anticipated the few worthwhile elements of the late, but not so lamented, Basic Needs approach proclaimed by some international agencies. The Sixth Plan (1979-84) included a number of poverty eradication measures such as programmes for rural works and self-employment and schemes for increasing the productivity of small and marginal farmers and rural artisans. The urban poor had always been beneficiaries of the public food distribution system under which a specified quantum of food grains and a few other basic items of consumption were supplied to all urban residents at a subsidized price. This was a legacy of the food rationing system introduced by the colonial government during the war. The supplies for the distribution system were obtained in part from imports and in part from domestic procurement at prices which were, until a few years ago, considerably below open market prices. Besides the policy of procurement and public distribution, various policies to encourage production through the adoption of the cultivation of high yielding fertiliser responsive varieties were introduced. These were mainly in the form of subsidies on the purchase of agricultural inputs such as fertiliser, fuel and power as well as water from public irrigation systems. It was believed that such policies alleviated poverty, on the one hand by improving the productivity and incomes of small farmers, and inducing an outward shift in the demand for agricultural labour, and on the other, by moderating any increase in the price of food because of outward shifts in the demand for food due to increases in real incomes. Subsidized credit was made available for working capital as well as for investment in irrigation (tubewells and energised dug wells) and farm equipment. We propose to compare the effectiveness of some of these policy interventions in alleviating poverty. Before describing the analytical framework of an applied general equilibrium model used for this comparison, some general considerations that led to that choice are worth describing.

2. The Rationale for and the Basic Features of an Applied General Equilibrium Model

In a mixed economy such as India's in which market transactions are dominant, the welfare of an individual depends on the quantities and prices of the goods and factor services she sells (or buys) in the market as well as on any income transfers she receives from others including the government. In particular, government fiscal policies (other than income transfer policies) affect the welfare of all individuals including the poor through their direct effects on the prices they face and the incomes they earn. Of course, income tarnsfer policies also affect prices indirectly through their effects on demand.

It is self evident that in an economy with a fairly complex structure such as India's, any economic policy is likely to affect market prices and hence will have an impct on the welfare of the poor, although for many policies this impact is likely to be negligible. Of course policies that are explicitly targeted at the poor, in principle, can be expected to have significant effects. It is unlikely that governments have a single well defined objective such as poverty alleviation and choose a mutually consistent set of policies towards achieving that objective. It is much more likely that they have several objectives and choose policies that promote some objectives further than others, if not at their expense. The combined effect of the mix of policies, on the economy in general and the poor in particular is sometimes difficult, if not impossible, to assess without an empirical model that incorporates the important feed-back effects.

No real economy is likely to remain in a static or steady state equilibrium. As such dynamic or inter-temporal effects of policies are important. An oft discussed trade-off, mistakenly described by some as between growth and equity, is in fact between more equity (or less poverty) in the present and less equity (or more poverty) than otherwise in the future through policies that finance present poverty alleviation through reductions in growth promoting investments. For example, the resources used in

subsidizing the food consumption of the poor, if invested in increasing the quantum as well as productivity of assets owned by the poor, will obviously hurt the welfare of the poor in the present while improving their incomes in the future. These considerations suggest that the analytical framework must be capable of evaluating the combined effects of several policy interventions on different socio-economic groups over time. A natural framework satisfying these desiderata is the dynamic applied general equilibrum model.

An applied general equilibrium model that is Walrasian in spirit assumes that all agents recognized in the model behave rationally, i.e. each has a consistent set of preferences over the outcomes of his or her actions and chooses that action which has the most preferred outcome among all feasible actions. Typically, a consumer's preferences are assumed to be represented by a utility function whose argument is the vector of his consumption of various goods and services. An action as well as its outcome is a particular choice of the consumption vector. And the feasible set of actions is simply those within his budget, i.e. it is the set of all consumption vectors that cost no more at the prices he faces (over which he is assumed to have no influence) than the value of his endowment of commodities and factors and his share of the net profits of firms. In principle, the utility function and the budget constraint can extend over several periods of time, thereby incorporating the consumer's saving and portfolio choices. Consumer choices, aggregated over all consumers, yield the consumer demand for commodities, supplies of factor services and demand for equities and debentures in firms. A firm's action is a vector of outputs it produces and inputs it purchases. Feasible action vectors are those that the technology available to the firm for transforming inputs into outputs permits. This set is the firm's production set. Firms are assumed to maximize net revenue, i.e. the difference between the value of output and the cost of inputs at the prices they face over their production sets. Firm choices, aggregated over all firms, result in the supply of goods and demand for factors. Once again, by defining actions as extending over several periods, investment activities can be accommodated, with the finance

for investment arising from sale of equities and issue of debentures. The price vectors that ensure that markets for goods, factors and equities clear is an equilibrium price vector. Government is most naturally modeled in this set up as an agent who sets commodity and factor taxes, tariffs, etc. makes transfers and supplies some goods and services and demands others. Its expenditures are restricted to what it can finance through tax revenues and borrowing from the public at home and abroad. Although real world governments also have the option of using the inflation tax mechanism of fiat money creation for financing their expenditures, there is no theoretically satisfactory way of introducing it in a 'real' model of the Walrasian genre. Of course, the market clearance requirement will take into account government demands and supplies as well.

It is clear that the task of empirically specifying such a model is demanding in terms of data, the need for specifying functional forms for utility functions, production functions etc as well as requiring estimates of the relevant parameters. And it will inevitably involve making compromises that are unsatisfactory from a theoretical perspective but dictated by the available data and econometric knowledge. Nevertheless, this framework or something akin to it is absolutely essential if the various feed back effects of several policies are to be analyzed consistently. Above all it ensures that there are no hidden sources for meeting excess demand or blackholes into which excess supplies disappear, subsidies have to be financed, tax revenues have to be spent etc. For example, it will require that the introduction of, say, a subsidy on the food consumption of the poor, is accompanied by a specification of the mode of its financing so that both the direct impact of the subsidy on the welfare of the poor and the indirect impact arising out of the particular way in which it is financed are fully reflected in the equilibrium.

Section 2 briefly describes the features of our applied general equilibrium model of the Indian economy, its strengths and weaknesses.

Section 3 is devoted to the specification of reference and policy scenarios for simulation. Section 4 presents the simulation results. Section 5 concludes the paper drawing out the policy implications of the results.

3. Features of the Applied General Equilibrium Model for India

The analytical model is of the sequential applied general equilibrium (AGE) genre in which an equilibrium price vector is computed for each year in succession. Unlike other such models, a number of behavioural functions relating to demand and supply have been econometrically estimated with data mostly from the period 1950-51 to 1973-75. In the running of the model, for the period up to 1980, outputs, imports and exports were set equal to their actual values, and the actually observed prices were generated as equilibrium prices by ensuring market clearance at these prices through stock accumulation or decumulation. Indeed, the fact that such a procedure did not lead to implausible values of changes in stocks was viewed as a validation of the model. The period after 1980 was the simulation period. Great simplication was achieved by imposing a one-year lag between production and market sale. Thus, in effect the economy became an exchange economy for the purposes of computing equilibrium prices.

The economy is divided into ten sectors, of which the first nine produce agricultural commodities and the tenth produces the only non-agricultural good.[1] There are three sets of agents: producers, consumers, and government. Consumers are classified by their residence as rural or urban. Rural as well as urban consumers are divided into five expenditure classes each according to their monthly per capita household consumption expenditure. Means of production (capital), natural resources (land), human resources (labor), and livestock (draft and milch animals, poultry, etc.) generate income through production activities that is distributed to consumers. Thus,

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[1]The nine agricultural commodities are rice, wheat, coarse grains, bovine and ovine meats, dairy products, other animal products, protein feeds, other food, and non-food agriculture.

behaviour of producers (i.e., their production activities) determines commodity supplies and incomes. Consumer behaviour generates commodity demands (and implicitly resource supplies). The government sets policies (e.g., investment targets, taxes, tariffs, quotas, rations, price supports and ceilings, etc.). Finally, equilibrium is achieved through exchange in which domestic demands, together with export demand by the rest of the world for each sector's output, is equated to the sum of domestic supply (emerging from previous year's production net of changes in stocks) and (foreign) import supply.

Per capita consumer demand of each of ten classes of consumers for the output of each sector is modeled as a Stone-Geary linear expenditure system. The growth of total population and number of households (rural and urban) is exogenously specified. The joint distribution of households according to their per capita income and consumption expenditure was assumed to be log-normal in each period. However the mean of the marginal distribution of logarithm of per capita income was allowed to over time with the growth of income. Other parameters such as the variances, the correlation coefficient and the intercept of the linear regression of logarithm of per capita consumption on per capita income of the household were assumed to remain constant at their estimated values from 1976 data. This meant that the mean of the conditional distribution of (the logarithm of) per capita household consumption varied linearly with the mean of logarithm of per capita household income. Thus, the relevant population of households falling within each of the ten expenditure classes as well as their mean per capita consumption expenditure could be determined for each year given aggregate consumer income for that year. The difference between income and consumption expenditure represents household savings.

Admittedly, the above distributional assumptions, including in particular the assumption that only the means of the logarithm per capita household income (and consumption) vary over time, are strong. They imply that the

concentration of the marginal distributions of logarithms of income and consumption do not change. A more satisfactory procedure would have been to specify an initial distribution of factor endowments and derive the changes in factor endowments from one period to the next as well as the savings in each period from an intertemporal optimization procedure, given appropraite assumptions about expectations regarding the path of factor prices including returns on assets. It goes without saying that implementing such a procedure is beyond the reach of modelers of even developed countries with more extensive data bases and econometric studies on savings, investment and fertility behaviour of households. Indeed modelers most often ignore distributional issues altogether by assuming that the society consists of a single household or alternatively avoiding dynamics by concentrating on static distributional effects. Given our interest is in dynamics, our strong assumption has an operational justification that it enables us to derive the dynamic distributional effects in a relatively easy way. It is also consistent with econometric studies showing that a log normal distribution fits the data from the various rounds of the national sample survey on the distribution of households according to per capita private consumption expenditure.

Public consumption is assumed to be a constant proportion of GDP and it is spent entirely on non-agricultural goods. The proportion of aggregate investment in GDP is exogenously specified. Income tax rates adjust so as to generate enough public savings (revenues minus consumption) which, together with household savings and exogenously specified foreign capital inflow, will equal aggregate investment. The share of agricultural investment in aggregate investment is a function of the relative price of agricultural goods. Agricultural investment influences the total gross cropped area as well as the irrigated portion of it. A detailed model of allocation of area among crops, choice of varieties to be cultivated (high yielding and traditional), fertiliser intensity based on a version of Nerlovian adaptive expectations

framework determine the vector of crop outputs. Capital is the only factor used in the production of the non-agricultural good. Capital stock in this sector is updated by net investment. Thus, the value of outputs of agriculture and non-agriculture together net of taxes and transfers determine the income available to consumers.

The complete algebraic description of the model and its numerical version are available in Narayana et al (1987a). A more concise description is available in Narayana et al (1987b). It should be pointed out that the two major weaknesses of the model are the absence of a labour market and the extreme aggregation of all non-agricultural goods into one. By the absence of a labour market we mean first, that labour is not formally treated as a factor of production in any of the ten sectors that a demand function for labour (let alone for labour distinguished by age, sex, residence and skill) cannot be derived from producer behaviour, given the structure of wage rates, product prices etc. Second, in the household utility function leisure does not enter nor does the value of labour endowment explicitly enter the household budget constraint. Thus a labour supply function cannot be derived from household behaviour. With both demand and supply functions absent, deriving an equilibirum wage rate for each period is ruled out. There is no capital or land market in the model in the model so that the only real choices of agricultural producers are the allocation of available land (irrigated and unirrigated) to crops (and varieties of crops), and the amount of fertilisers to use. Non-agricultural producers can choose the rate of capacity utilization. In short, only value added is endogenously derived in the model and not its allocation between factors. However this does not preclude an analysis of distributional effects since the joint distribution of household income (which is obtained from value added) and consumption is specified directly. The major reason for not introducing an explicit labour market is the lack of satisfactory studies of labor supply and demand. After all, even in developed countries robust estimates of labour supply elasticities are scarce!

One could interpret the absence of an explicit labour market as implying that an infinitely elastic labour supply at some real wage is being assumed. But such an interpretation has no operational significance for most of the analysis except the simulations which involve rural works. In these scenarios it is assumed that enough labour will find it attractive to be employed in rural works programmes offering an exogenously set fixed real wage that is constant over a twenty year period. It is impossible to say whether this is too strong an assumption without a well specified labour market that realistically describes rural India. On the other hand, given the actual rural labour market environment, if indeed not enough labour will be forthcoming (i.e. there will be an excess demand for labour at the offered wage), to that extent the scale of rural works programmes could be reduced without affecting the extent of poverty alleviation. It is argued that because of the self-targeting nature of rural works employment, only those with relatively low reservation wages and capacity for physical work (eg. women, children and elderly) will be attracted to the programme and to the extent, physical effort determines the capacity and durability of roads or irrigation canals constructed with their labour, the quality of such assets may suffer. But the complexity of the relationship between food energy intake and expenditure of energy in work-effort precludes any firm conclusion. There are no carefully designed empirical studies available to base one's judgment on this issue.

The assumption that all goods are internationally traded precludes the analysis of the role of nontraded goods, particularly infrastructural goods in the development of the Indian economy. The model is better viewed as computing a sequence of temporary equilibria rather than a full blown intertemporal equilibrium. In particular strong assumptions on preferences are needed to ensure the intertemporal optimality of the household savings behaviour incorporated in the model. The specification that the proportion of aggregate investment in GDP is a function only of time also violates the

spirit of models of intertemporal equilibrium. Almost all applied general equilibrium including ours ignore considerations of political economy. The assumption that government policy is set exogenously and agents respond to the policy as if they have no influence in its formulation is extreme. In fact, lobbies form and spend resources in getting policies favoured by them enacted or to appropriate the benefits of policies in place. These considerations which form the core of the literature on neo-classical political economy are absent from our model. On the other hand, if the model is broadened to generate a politico-economic general equilibrium there will be no room for policy change by definition. Only a comparative static analysis is possible with respect to changes in those exogenous variables that determine both equilibrium policies and economic variables!

4. The Reference and Policy Scenarios

The role of the reference scenario is to serve as a benchmark for comparison with scenarios in which one or more policies are changed from their reference specification. It should be kept in mind that the model is not a forecasting model--all the scenarios including the reference scenario are counterfactual simulations. Although, unlike many models of this genre, in our model values of most of the parameters are econometrically estimated, still several were indeed exogenously specified. It is our contention that any alternative specification of values of these parameters will change both the reference and policy scenarios in a similar way so that the impact of policies expressed as changes relative to the reference scenario would be the same whichever set of parameter values were used. In a way, this is more an article of faith than an analytically or empirically established fact. It is convenient to have as the reference scenario one in which essentially the relevant policy regimes remain unchanged in the simulation period as compared to the pre-simulation period.

The more important assumptions and policies in the reference scenario are:

(i) The public distribution system for urban areas: the quantity of foodgrains distributed in any year as a share of net output of foodgrains is a nonlinear function of the level and the change over the previous year of net output per capita and real non-agricultural income per capita subject to a ceiling of 135 kgs. per urban resident. Historically a maximum of little over 150 kgs. per urban resident was distributed in the severe drought year of 1966. The price subsidy on publicly distributed grain is 20%. (However the subsidy is 3.0% according to 1989-90 budget.) The quantity of foodgrains purchased below market prices was in general related to output and the ratio of procurement price relative to expected open market prices.

(ii) Quantitative restrictions on the net foreign trade of different agricultural commodities range from 5% to 15% of domestic supply (i.e. production plus initial stocks).

(iii) Foreign trade deficit is set at 1.5% of GDP.

(iv) Domestic price policy interventions steer the domestic market prices gradually towards exogenously specified world prices, i.e. gradual liberalization of markets is postulated.

(v) Total population grows by 2.26% per year from its value of 674 million in year 1980 to 1048 million in year 2000. The proportion of urban population in the total rises from 23% in 1950 to 31.5% in 2000.

(vi) Aggregate (public plus private) investment as a proportion of GDP was assumed to be a monotone function of time with an asymptote of 0.45.

The counterfactual policy scenarios that we consider are:

(i) Variations in the public distribution system ranging from its abolition to its extension to rural areas and making food rations free (i.e. 100% subsidy).

(ii) A rural works programme targeted at the bottom two classes with alternative assumptions regarding the efficiency of its design and execution as well as success in targeting.

(iii) Abolition of the fertiliser subsidy and the use of part of the resources saved for augmenting aggregate investment and the remaining spent either on a rural works programme or on creating additional irrigated area.

Table 1 provides some recent data on the extent of subsidies relating to fertilizer and food distribution from the Central government budget. In 1988-89 these two amounted to Rs. 56 billion. We should add to this figure the budgetary support implicit in water charges and electricity tariffs. Just charging operating costs (let alone capital charges) would have put at least 40 billion more in the hands of central and state governments. The total loss to government budgets was around Rs. 96 billion in 1988-89. The total expenditure of the central government in 1988-89 was Rs. 758 billion (revised estimate) and that of the states was Rs. 542 billion (budget estiamte). The above four subsidies account roughly for 12.5% of central budget and 7.5% of the budget of the centre and states together.

5. Simulation Results

The welfare impact of alternative policies can be seen by comparing the distribution of population according to their equivalent expenditures (i.e. consumption expenditure needed to achieve the welfare achieved under the policy if consumers were to face 1970 prices). Since the average equivalent expenditure within each class as well as the proportion of population in the class can vary among policy scenarios, for an overall comparison we adapt the approach of Willig and Bailey (1981). They show that, given a population of individuals ranked from 1 to n according to their equivalent expenditures, $m^1_{\beta i}$ and $m^2_{\beta i}$, in two distributions (i.e., $m^j_{\beta i}$ = the expenditure that a person i needs at some base price p^0 to achieve the same welfare that he enjoys at prices p^j and nominal income y^j in distribution j, j = 1.2), the first distribution is preferred to the second according to any social welfare function that satisfies the Pareto principle, anonymity, and aversion to regressive transfer if and only if

$$\sum_{i=1}^{k} m_i^1 > \sum_{i=1}^{k} m_i^2 \quad \text{for} \quad k = 1,2,\ldots,n.$$

It should be noted that person i (i.e., the one having the ith lowest equivalent expenditure) in distribution 1 need not be the same as person i in distribution 2. As the authors point out, the above inequality for k = 1 corresponds to a Rawlsian social welfare fnction, and for k = n corresponds to the Hicksian compensation criterion. But for a general social welfare function, the inequality has to hold for all k to ensure dominance. Of course, the ranking is not independent of the base price vector p^0, and this serious limitation has to be kept in mind in interpreting the results.

Another welfare indicator that we use is the average energy intakes (kcals per capita per day).

5.A. Alternative Public Distribution Policies

Three public distribution scenarios are compared with the reference scenario. In scenario DPO, at one extreme, the distribution system including domestic procurement is abolished. FRFD-100W, at the other extreme, provides 100 kg of wheat per year to all consumers, urban as well as rural, with the cost being financed by increasing income taxes (largely borne by the two richest classes of urban consumers). Policy FRFD-100W-X is the same as FRFD-100-W except that the subsidy is financed by reducing investment. The results are shown in Tables 2 and 3. All policy changes relative to the reference scenario are introduced in 1980.

The implications of the simulations presented in Tables 2 and 3 are clear. The aggregate impact of alternative public distribution in terms of GDP growth, average energy intake per capita per day etc are modest. For example, between the extremes DPO and FRFD-100W, real GDP in year 2000 differs only by about 10%. On the other hand, the distributional consequences differ

substantially between policies. The massive redistribution scenario FRFD-100W of supplying 100 kgs. of wheat free of cost to all, financed by additional taxation results in a substantial reduction by 60% in the poorest population in rural areas from the reference value of 164 million (31.6% of rural population) in 1980. The reduction is by 39% from 148 million (20.5% of rural population) in 2000. The reduction in the number of urban poorest is numerically considerably smaller since there are fewer urban poorest but proportionately more impressive than the rural reduction. The other extreme, DPO which abolishes the public distribution system that operates in urban areas only in the reference run, has negligible impact on the rural poorest but, as expected, increases the population in the poorest class in urban areas significantly. The growth consequences of financing a free food policy by reductions in investment are marginal (i.e. less than 10% fall in real GDP over a 20-year period). However poverty reduction is virtually the same as compared to financing by additional taxation. In any case, a social welfare measure based on equivalent incomes that incorporates aversion to regressive income transfers shows that a free food policy improves social welfare in a modest way (see Figure 1). In an apparent paradox the abolition of the public distribution system reduces real GDP growth slightly. The paradox is only apparent--it is a consequence of the fact that in the reference scenario the public distribution system generates more revenue through procurement tax than it spends on consumption subsidies in later years. This is because the model does not restrict procurement to equal what is distributed.

It should be pointed out that in all the food subsidy scenarios the recipient of the food ration is assumed to be able to sell a part or the whole of the ration as he sees fit at open market prices. Thus the subsidy on the food ration is equivalent to an income subsidy of equivalent value at open market prices. We also examined the consequences of the polar opposite assumption of the impossibility of open market sale. This meant that as long

as the ration is not free the very poor cannot afford to buy and consume their entire ration. They buy only what they can afford and the impact on their welfare of the ration is less than in the case where rations can be freely sold.

The above analysis assumes that the extension of the public distribution system to rural areas does not involve any additional costs, i.e. the unit cost of the distribution system does not depend either on its scale in terms of the volume of grains procured and distributed nor on its geographical coverage. If there are economies (diseconomies) of scale or scope the unit cost will fall (rise) as the system is extended. Without any robust empirical evidence it is hard to decide on this issue. In any case our results are based on assuming that unit costs do not change. While it is true that our model postulates a fairly high incremental capital output ratio (ICOR), it is kept the same in policy and reference scenarios. As such the growth consequence of alternative policies expressed as a percentage change from the reference scenarios are not affected by the high ICOR.

5.B. Rural Work Programmes

A more complete discussion of the rationale for Rural Works Programmes (RWP) and detailed simulation results are presented in Narayana et al (1988). We assume that only the two poorest expenditure classes are the target groups to be covered under RWP. An average quantity of 100 kgs of foodgrains per year are distributed to the participants as wages. However, the per capita quantity distributed to the poorer of the two classes is fixed at 125 kg so that the quantity r_2 received by the next poorest class is given by

$r_2 = (100p - 125p_1)/p_2$ where p, p_1, p_2 are respectively the population of the two classes together, of class 1 and of class 2. The value of r_2 varies between scenarios because of variation in p, p_1 and p_2.

Various inefficiencies and leakages do occur in RWP. Analytically these

can be viewed as of two types. The first one relates to the productivity of the assets created under RWP relative to that of non RWP investment in the economy. The second one relates to a failure of targeting--the benefits intended for the target groups leaking to non-target groups.

In our model the inefficiencies of the first kind are introduced through an efficiency parameter e (which takes three values 1.0, 0.5 and 0.0) representing the ratio of the productivity of RWP created assets relative to economy-wide average return to investment. Clearly e = 1 represents a well-designed and executed RWP, while e = 0 represents an RWP with which is completely infructuous as investment but is simply a transfer. Targeting efficiency is represented by a parameter t (taking two values 1.0 and 0.5) representing the proportion of RWP wage bill that accrues to the target groups in rural areas. We present the simulation results in Table 4. A scenario is characterized by its (t,e) combination and the mode of financing of its cost, namely, whether it is through additional taxation or by reduction in investment. Thus a free food scenario in which 40 kg of wheat is distributed free to all is also considered and financed by reduction in investment. This costs roughly the same as the RWP. This scenario is denoted as FF40X.

It is seen from Table 4 that in a well designed, executed and targeted RWP, not only the rural poor improve their welfare substantially but the economy grows slightly faster (because of the additional investment through rural works) as well, provided the resources needed for the RWP are raised through additional taxation. However the additional tax effort needed initially is substantial--in 1980 an additional 6% of GDP has to be raised as income taxes over the reference run value of 2% but with the economy growing, additional tax effort required declines substantially and by the year 2000 reduces to around 1% of GDP with the reference run value being 7%. As such, if foreign aid in the form of grants are available for a limited period, poverty alleviation through RWP can be initiated without straining the fiscal

capacity of the government. If foreign aid is not available and taxes cannot be raised, an RWP financed through a reduction in investment reduced real GDP in year 2000 by a marginal 4.6% relative to the reference run while it was higher by 3.5% in the scenario with tax financed RWP. Thus the sacrifice in growth is modest, while the favourable impact on the welfare of the poor is unchanged. Further social welfare comparison using the Bailey-Willig criterion shows (Figure 2) that such an RWP dominates a free food policy that costs just as much. Finally, if the investment component of RWP is completely infructuous, and 50% leakage occurs, the welfare of the poor is roughly halved compared to a well designed, executed and targeted RWP also financed by taxation.

5.C The Abolition of the Fertiliser Subsidy

It was pointed out earlier that farmers receive a subsidy of roughly 30% on the price of the fertilisers they use. We examine below the consequences of abolishing the subsidy from 1989 onwards and use the resources used for financing the subsidy in three alternative ways; (i) augment aggregate investment (scenario NS), (ii) use part of the released resources for financing a RWP that distributes 20 kg of wheat per capita per year as wages to the two poorest rural classes, with t and e parameters both set at 0.5. The remaining part of the released resources is used for augmenting aggregate investment. This scenario is denoted as NS-RW20, (iii) use part of the released resources to create an additional 2 million hectares of irrigated area per year over the reference run. The remaining part is used to augment aggregate investment. This scenario is denoted by NS-IR + 2M. The simulation results of this section are based on a slightly updated version of the model of the earlier sections in which some parameters have been reestimated with data up to 1984. As such the reference scenario results for these simulations differ from those for the simulations of sections 4A and 4B although the policies remain the same. Further policy changes are introduced in 1989.The results are presented in Table 5.

Increasing aggregate investment instead of subsidising the use of fertilisers (as in the reference scenario) increases real GDP by a negligible 1% and reduces the output of foodgrains by about 4% in year 2000. The proportion of the rural population in the poorest class increases by 4% in 1990 as well as 2000. The urban pooor are unaffected. Using part of the resources saved from the abolition of the fertiliser subsidy on rural works and the rest on additional investment improves the real income of the poorest in rural areas while leaving GDP, foodgrains output and urban poor unchanged as compared to investing all of it. On the other hand, creating additional irrigated area of 2 million hectares per year with part of the resources and using the rest for increasing investment increases real GDP by 9%, fertiliser use by 5% and foodgrains output by 12% all in year 2000 compared to the reference scenario in the continuing fertiliser subsidy. The proportion of the rural population in the poorest rural class falls by about 1.5%. What this suggests is that augmenting irrigated area, rather than subsidizing the use of fertiliser, achieves not only increased use of fertiliser but has beneficial impact on the rural poor. Compared to the scenario in which there is no fertiliser subsidy, the changes in poverty or in macro aggregates associated with the other three scenarios in Table 5 are very small. In other words untargeted and indirect poverty alleviation policies cannot be expected to make much of a dent on poverty.

6. Conclusions

We considered three broad sets of policies for alleviating rural poverty and hunger, namely, an untargeted policy of subsidizing part of the food consumption of the entire population including the poor, a targeted policy of providing additional employment opportunities for the rural poor through a rural works programme (RWP) and an indirect policy of subsidizing fertilizer or alternatively increasing the area irrigated both of which augment the

production of food. It would appear that a well designed, executed and targeted RWP has the greatest impact on the poor. Thus, compared to a free food programme that provides 40 kgs of grain to all that raises the energy intake of the poorest (two poorest) class in rural areas by 11% (10%), an RWP of comparable cost raises it by 70% (40%) over its reference run value. The increase in equivalent income is 11% (10%) in the case of free food and 67% (39%) in the case of RWP. This is seen by comparing scenario RW100-1-1 and FF40X in Table 3. The indirect poverty allevition policies of subsidizing fertilisers or augmenting irrigation as expected have only modest impacts. It would appear that the potential of employment generation in poverty alleviation has been understood by policy makers. The introduction recently of the Jawahar Rozgar Yojana, an employment programme that consolidates and expands preexisting programmes, is an indicator of this fact.

Table 1

Food and Fertilizer Subsidies in

Central Government Budget

(Rupees billion)

Year	Fertilizer	Food
1979-80	6.03	6.00
1980-81	5.05	6.50
1981-82	3.75	7.00
1982-82	6.05	7.10
1983-84	10.42	8.35
1984-85	19.27	11.00
1985-86	19.24	16.50
1986-87	19.33	22.00
1987-88	19.16	22.00
1988-89[a]	32.50	23.60
1989-90[b]	36.51	22.00

[a]Revised budget estimate.

[b]Budget estimate.

Table 2

Impact of Alternative Procurement and Distribution Systems

on Selected Macro Economic Indicators

Variable	Year	Absolute Values	Percent Change over Reference scenario		
		Reference scenario	DPO no procurement no distribution	FRFD-100W Free food to all; Tax rate adjusted	FRFD-100W-X Free food to all; Tax rate fixed
GDP total[a]	1980	530.0	0	0	0
	2000	1429.0	-0.07	0.72	-9.36
GDP agriculture[a]	1980	220.0	0	0	0
	2000	354.0	0	0.47	-2.50
GDP non-agriculture[a]	1980	310.0	0	0	0
	2000	1075.0	-0.09	0.81	-11.62
Total investment[a]	1980	110.0	0	0	-16.71
	2000	492.0	0	1.19	-18.46
Tax rate (%)	1980	2.3	39.0	486.9	160.87[c]
	2000	9.8	11.2	19.39	0
Price index of agriculture over price index of non-agriculture	1980	0.93	-0.15	12.5	18.44
	2000	0.89	0.46	2.89	4.30
GDP per capita[b]	1980	786.0	0	0	0
	2000	1363.0	-0.07	0.72	-9.36
Food energy intake (Kcal/person/day)	1980	2162	0.42	3.63	5.42
	2000	2569.0	0.45	1.59	-1.18
Average equivalent Expenditure[c]	1980	544.0	0	-0.44	3.43
	2000	661.0	-0.18	0.46	-2.82

[a] 10^9 Rupees at 1970 prices.

[b] Rupees at 1970 prices.

[c] Expenditure needed at 1970 prices to provide same utility as provided by current consumption at current prices.

Table 3

Impact on the Poorest Class of Alternative Public Distribution Policies

Items[a]	Poorest Class with Annual Per Capita Equivalent Expenditure of less than Rs.216			
	Absolute Values	Percentage Change Over Reference Scenario		
	REF	DPO	FRFD-100W	FRFX-100W
Rural 1980				
Population	0.316	0.00	-60.32	-60.44
Equivalent Expenditure	129.0	1.32	15.49	14.18
Energy Intake	981.0	1.33	14.78	13.15
Urban				
Population	0.019	52.63	-89.47	-89.47
Equivalent Expenditure	165.0	-1.03	-7.95	-9.65
Energy Intake	1085.0	-1.11	-9.77	-11.80
Rural 2000				
Population	0.205	1.46	-38.54	-34.15
Equivalent Expenditure	133.0	2.64	15.51	15.59
Energy Intake	1059.0	2.08	15.20	13.22
Urban 2000				
Population	0.004	75.00	-50.00	-25.00
Equivalent Expenditure	172.0	-1.51	-0.29	-0.87
Energy Intake	1252.0	-2.64	-1.92	-4.95

[a]Units: Population - proportion of total rural or urban population.

Equivalent Expenditure - Rupees per cpaita with 1970-71 prices as reference prices.

Energy Intake - Kcal per person per day (as reflected in the data of household's expenditure--excludes consumption provided by employer at place of work).

Table 4

Impact on Growth and Rural Poor of Rural Works Programs

Percent Change from Reference run - Year 2000

Scenarios	GDP70 per capita	Difference in GDP 70 growth rate 1980-2000	Avr EQY/ Cap	Cal/ Cap	Rural Poor: Poorest Class EQY/ Cap	Rural Poor: Poorest Class ENY/ Cap	Rural Poor: Two Poorest Classes EQY/ Cap
With additional Taxation:							
RW100-1-1	3.5	0.22	2.2	5.7	67	70	39
With fixed tax rates:							
RW100-1-1X	-4.6	-0.25	-0.2	4.7	67	70	39
RW100-1-.5X	-8.5	-0.47	-2.6	3.8	67	70	39
RW100-1-0X	-13.2	-0.73	-5.4	2.6	67	70	39
RW100-.5-1X	-3.7	-0.20	0	3.0	33	40	19
RW100-.5-.5X	-7.3	-0.40	-2.0	2.1	33	40	19
RW100-.5-0X	-11.8	-0.66	-4.7	1.0	33	40	19
FF40X	-4.2	-0.23	-0.8	1.3	11	11	10

GDP70 = Gross domestic product at 1970-71 prices.

EQY = Equivalent Expenditure; ENY: Energy Intake (kcals per day)

Table 5

Impact of Alternative Input Subsidy Schemes

		Reference Scenario (fert. subsidy (30%) continued)	NS (No fert. subsidy from 1989	NS-RW20 (rural works)	NS-IR+2M (additional irrigation)
GDP 70 (10**9 1970 Rs)	1990	746.01	746.23	746.23	748.32
	2000	1262.93	1280.43	1276.09	1371.80
GDP Agr* 70 (10**9 1970 Rs)	1990	247.47	247.69	247.69	249.78
	2000	315.55	317.13	317.09	346.65
Fertilizer use (10**3N)	1990	10007	8625	8625	8846
	2000	12874	11160	11154	13552
Total irrigated area (10**6 hectares)	1990	56.19	56.19	56.19	58.17
	2000	77.85	79.24	79.19	103.48
Wheat (10**6 tonnes)	1990	57.82	52.78	52.78	53.97
	2000	82.18	76.67	76.64	92.12
Rice (10**6 tonnes)	1990	64.37	63.67	63.67	65.26
	2000	85.84	85.74	85.69	103.93
Foodgrains (10**6 tonnes)	1990	161.03	154.45	154.45	157.64
	2000	209.47	201.76	201.70	234.48
TOTAL POPULATION					
Energy intake (Kcal/person/day)	1990	2129	2101	2122	2104
	2000	2307	2292	2305	2347
Average equivalent Expenditure (Rs/person/day)	1990	515.7	509.4	512.9	510.2
	2000	580.3	578.0	579.5	601.0
RURAL POOREST CLASS					
Proportion of rural population	1990	0.389	0.404	0.404	0.403
	2000	0.307	0.320	0.320	0.303
Equivalent Expenditure	1990	120.2	118.8	124.4	118.9
	2000	124.7	123.5	128.8	124.7
URBAN POOREST CLASS					
Proportion of urban population	1990	0.020	0.020	0.020	0.020
	2000	0.010	0.009	0.009	0.009
Equivalent Expenditure (Rs./person/day)	1990	172.7	172.7	172.7	172.7
	2000	172.5	172.6	172.5	173.3

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