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Contributions to Indian Economic Analysis: A Survey

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By Jagdish N. Bhagwati and Sukhamoy Chakravarty*

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Contributions to Indian Economic Analysis: A Survey

By Jagdish N. Bhagwati and Sukhamoy Chakravarty*

Any survey of contributions to economic analysis in India, even though confined to the post–war years and to issues arising from domestic economic events and policy, runs into exceptional difficulties. Not only has practically every conceivable problem been raised and discussed by economists, in a country where interest in economic issues dates back at least to the latter half of the 19th century;[1] but there have also been numerous committees and commissions whose report have led to a voluminous literature.

Ruthless selectivity has thus been inevitable. We have generally focussed, in this survey, on contributions which meet the following criteria: (1) they should have analytical interest, either theoretical or empirical; (2) they should be made by Indian or India–based economists; and (3) they should have some bearing on

Indian economic policy issues, even though they cannot necessarily be demonstrated to have arisen in consequence thereof or to have had any impact on policymaking.

The Survey thus rules out of consideration the vast bulk of official literature, whose analytical base is frequently largely minimal, as also the purely descriptive and institutional material from non-official sources (such as the Indian Statistical Institute) whose utility otherwise is not to be minimized. Equally, the Survey does not extend to the growing numbers of contributions to general theoretical economic analysis that Indian economists have begun to make, as is evident from the contents of reputed journals in the last decade.[2]

This Survey, therefore, is neither a comprehensive account of the state of econ-

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[1] For example, the prominent participants in the Independence movement paid considerable attention to economic issues; and India produced her own brand of List-type arguments in favor of departure from free trade in India's national interest [118] [128] [141]. The Indian Economic Association was founded in 1918 and the Indian Society of Agricultural Economics in 1939. Among the important centers of economic research today are the three Centres of Advanced Study in Economics, recognized and financially supported as such by the University Grants Commission: Bombay University, Gokhale Institute of Politics and Economics (Poona), and Delhi School of Economics; and at least two other institutions: the Institute of Economic Growth (Delhi) and the Indian Statistical Institute (New Delhi).

[2] These contributions primarily range over the theory of growth and planning (e.g. S. Chakravarty, G. Mathur, A. K. Sen and T. N. Srinivasan), international trade theory (e.g. P. K. Bardhan, J. Bhagwati, B. S. Minhas, V. K. Ramaswami and T. N. Srinivasan), and econometric theory (e.g. A. L. Nagar). The trend is firmly established and strongly upward.

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omic research in the country[3] nor does it pretend to give an exhaustive picture of the policy issues that have been discussed on the Indian scene since 1947 when India gained independence.

The Survey is broadly divided into three areas: (1) planning theory and techniques; (2) agriculture; and (3) foreign trade. The vast majority of India's policy issues, and analytical literature, fall within one or more of these categories. With her programs for economic development, initiated through the First Five–Year Plan (1951/1956) and continued through two successive Five–Year Plans, the question of overall Plan formulation, and investment criteria in particular, has engaged the attention of many economists. Largely because agriculture is the overwhelmingly important economic activity in the economy, and its capacity to act as a significant brake on growth via its role as the supplier of wage goods to other sectors has been increasingly appreciated, this sector has also attracted considerable economic analysis. And finally, the foreign trade sector has been the focus of interesting debate. The questions raised by foreign aid, foreign investment, the import control regime and export subsidization have led to insights of wider interest.

Since the overall Plan formulation literature inevitably embraces some of the questions raised by agricultural and foreign trade policies, our discussion begins with the survey of the planning literature and only then proceeds to an evaluation of the literature that concerns itself with the *remaining* issues in the areas of agricultural and trade policies.

I. *Planning Theory and Techniques*

The formulation of the successive Five–Year Plans in India has led to a steady evolution of economic thinking on ques-

[3] Among useful attempts in this direction, with respect to agriculture, see Gupta [61] and Dandekar [28].

tions relating to planning theory and techniques. As we shall soon argue, however, the interplay between Plans and economic thinking has often been tenuous. At times there may even have been postfacto rationalization of investment decisions taken on political grounds by ingenious designing of suitable models. At other times, model–building and analysis have inevitably gone ahead of the Plans. However, it is possible to identify with each Plan certain basic model–types which have provided the intellectual backbone to that Plan and were the object of extensive economic debate.

Thus the First Five–Year Plan, which was essentially a collection of several projects, contained at the same time a Harrod-Domar type exercise which sought to examine the growth rates that would be achieved by specification of the (feasible) marginal savings rate and the resulting average savings ratio. The Second Five–Year Plan, on the other hand, marked a distinct departure in favor of the Feldman–Mahalanobis type of structural model which emphasises the *physical* aspect of investment and thus leads, subject to certain restrictive assumptions about transformation possibilities domestically and through foreign trade, to the proposition that raising the rate of investment requires increased domestic manufacture of capital goods. This shift from a Keynesian, "flow" analysis which emphasised the necessity to raise savings (and hence implicitly assumed that the savings could be transformed into required investment) to a "structuralist" view which emphasised the transformation constraint and the supply of capital goods to sustain growing investment (while implicitly assuming that the system would generate the savings to "finance" the growing supply of investment goods) was the most dramatic episode in the evolution of planning literature and debate in India. The formulation of

the Third Five–Year Plan, by contrast, marked a shift away from these *simple decision-models*: the achievement of inter-industrial consistency was attempted in some detail this time. As we shall soon see, the shift to interindustrial exercises not only underlay plan formulation but was also the characteristic of planning exercises undertaken by economists and teams associated with the Indian Planning Commission. These *multi-sectoral models* were also characterised by their explicit extension to questions of intertemporal choice: questions which had been raised as early as 1955 by Ragnar Frisch when he visited the Indian Statistical Institute which was the intellectual center for formulation of the Second Plan (1956/1961).

Having identified synoptically the main outlines of shift in planning techniques in India through the three Plans, we now proceed to survey the major ideas and contributions in this area, considering each of the three planning periods in turn.

The First Five–Year Plan

The first identifiable planning model used in India was developed by the authors of the First Five–Year Plan document which the Government of India placed before the country in 1951.[4] The model was not given an explicit analytical form, but was implicit in the numerical figures which constituted the perspective plan for developing the Indian economy [179, Chapter I]. It was essentially a simple variant of the growth model associated with the names of Harrod and Domar. The sole modification, but a crucial one, was the distinction between the average and the marginal propensities to save. The capital–output ratio was assumed to be the same

on the margin as on the average. No gestation lags were introduced. The model was developed for a closed economy (although it can naturally be easily extended to deal with an open economy, with one part of investment being financed by import surplus). The basic equations underlying the growth process were the following:

$$(1) \qquad I_t = S_t;$$

$$(2) \qquad S_t = aY_t - b;$$

$$(3) \qquad Y_t = \alpha K_t$$

$$(4) \qquad I_t = \dot{K}_t$$

Here I_t stands for investment at 't', S_t for the corresponding amount of savings, Y_t stands for income. All the equations excepting (2) are the same as in the Harrod–Domar model. Equation (2) introduces the distinction between marginal and average propensities to save. The model leads to the basic differential equation $\dot{K}_t = a\alpha K_t - b$ which can be easily solved to give us the time profile of capital stock and output. We get:

$$(5) \qquad K_t = (K_0 - b/a\alpha)e^{a\alpha t} + b/a\alpha.$$

Notice that unlike the usual Harrod–Domar model, the rate of growth here rises from period to period (provided of course $a > S_0/Y_0$). Thus an economy which decides to save more on the margin than on the average can hope to do better and better over time in terms of its rate of growth. The asymptotic relative rate of growth of the system is given by the expression $a\alpha$.[5]

Such Harrod–Domar type models have been explicitly used, with considerable advantage, as the framework for plan formulation in other countries (e.g. by Jan Tinbergen for the first Turkish Plan). They are useful in indicating the basic

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[4] There *had* been earlier attempts at putting together "plans" for India: e.g., the Bombay Plan [169] in 1944. However, no conceptual framework, in terms of an explicit or implicit planning model, underlay any of these exercises.

[5] For any specific t, $r_t < a\alpha$ where r_t is the relative rate of growth of income at time t.

macro-economic features that any more elaborate construct would equally have to satisfy. Further, they have served as "simple" mechanisms for computing the external assistance that may be necessary for supplementing domestic savings to sustain projected growth rates in income.[6]

However, such a Harrod–Domar model obscures problems of importance. For example, concentration on the flow equilibrium, and the implicit assumption that there are no "structural" difficulties in transforming savings into (desired forms of) investment may ignore real constraints in the economy. Further, even within the framework of its assumptions, the model ignores the fundamental choice problem of planning over time, which requires a weighing of present versus future gains, by assuming a constant marginal propensity to save for the economy.

The connection between the actual First Five–Year Plan and the Harrod–Domar type model contained in the document was left vague by the planners. It appears as though the selection of projects for governmental expenditure reflected essentially the "overhead–capital" approach to developmental planning and the model was largely an intellectual appendage with little impact on actual Plan formulation,

although it did serve to give some kind of longrun perspective to the Plan.

The Second Five–Year Plan

By contrast, the Second Plan pattern of industrial investment, with its marked shift in favour of capital goods industries, was deeply influenced by the two-sector growth model developed by P. C. Mahalanobis [95].[7] This model was independently developed by Feldman in the Soviet Union in the 1920s and later revived by Domar [47] in a considerably improved form. The basic model, as stated by Mahalanobis, can be described briefly.

Current investment flow I_t is divided into two parts, $\lambda_k I_t$ and $\lambda_c I_t$, where λ_k indicates the proportion going to the capital goods sector and λ_c the corresponding proportion for the consumption sector.

It is clear that

$$(7) \qquad I_t - I_{t-1} = \lambda_k \beta_k I_{t-1}$$

and

$$(8) \qquad C_t - C_{t-1} = \lambda_c \beta_c I_{t-1}.$$

Now the first equation implies that

$$(9) \qquad I_t = I_0 (1 + \lambda_k \beta_k)^t.$$

Further, $C_t - C_0$ can be written as

$$(10) \qquad \sum_{\tau=1}^{t} (C_\tau - C_{\tau-1}) = \sum_{\tau=1}^{t} \lambda_c \beta_c I_{\tau-1}$$

$$(11) \qquad = \lambda_c \beta_c I_0 + \lambda_c \beta_c I_1 + \cdots + \lambda_c \beta_c I_{t-1}$$

$$(12) \qquad \begin{aligned} &= \lambda_c \beta_c I_0 + \lambda_c \beta_c I_0 (1 + \lambda_k \beta_k). \\ &\quad + \lambda_c \beta_c I_0 (1 + \lambda_k \beta_k)^{t-1} \end{aligned}$$

$$(13) \qquad = \frac{\beta_c \lambda_c}{\beta_k \lambda_k} I_0 [(1 + \lambda_k \beta_k)^t - 1]$$

Since $I_t - I_0 = I_0 \{ (1 + \lambda_k \beta_k)^t - 1 \}$, we get by adding it to $C_t - C_0$ in the preceding equation:

[6] Suppose the planners are ambitious enough to set a target rate of growth in income which implies an investment rate in excess of the current savings rate. In an open economy, this would not raise any problem so long as the required amount of foreign aid (F_t) is available to meet the domestic resource gap. However, if the growth process is of the type described in the text (where the economy saves more on the margin than on the average) then the required amount of foreign aid would diminish from year to year, provided the growth rate is kept constant. The time t^* for which F_t vanishes may be defined as the time of attainment of self-sustained growth. This value for t^* may be compared with the value t^{**} for which the economy would reach the desired growth rate left to itself. The difference between t^{**} and t^* may be used to give one measure of the beneficial influence of foreign aid on economic growth. Thus, the simple growth process described in the text can help one to obtain answers to questions relating to the volume of external assistance that is necessary.

[7] Numerous specific criticisms of the analysis of the Mahalanobis model were made at the time, among them being Chakravarty [20], Tsuru [172] and Mitra [117].

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$$(14) \quad C_t - C_0 = \frac{\beta_c \lambda_c}{\beta_k \lambda_k} I_0 \{ (1 + \lambda_k \beta_k)^t - 1 \},$$

the complete solution for output at time t, where

$$(15) \quad Y_t = Y_0 \left[1 + \alpha_0 \left(\frac{\beta_c \lambda_c + \beta_k \lambda_k}{\beta_k \lambda_k} \right) \cdot \{ (1 + \lambda_k \beta_k)^t - 1 \} \right]$$

where $\alpha_0 = I_0/Y_0$, the initial investment–income ratio.

Several things are quite clear from this equation. First we note that the relative rate of growth of consumption or output is changing over time. It is also clear that the asymptotic rate of growth of the system is given by $\lambda_k \beta_k$ where λ_k is the crucial allocation ratio which indicates the proportion of capital goods output which is devoted to the further production of capital goods. Thus a higher λ_k would always have a favourable effect on the asymptotic growth rate of the system, irrespective of whether it is consumption or output. But what about its immediate effect on consumption? If $\beta_c > \beta_k$, then a higher value of λ_k would imply a lower immediate increment in consumption. Thus, there is implicit in the choice of 'λ_k' a choice of alternative time streams of consumption.[8]

It may be further noted that, while the implicit assumption underlying the aggregative model discussed earlier was that the savings rate was a reflection of the be-

havioral characteristics of the decision–making units such as the household, the corporate sector or the government, Mahalanobis effectively made it a rigid function of certain "structural" features such as the capacity of the domestic capital goods industry and capital–output ratios of the capital goods sector and the consumer goods sector. By making the allocation ratio of current investment going into investment goods sector the policy variable, he showed that a higher allocation would mean a higher saving rate on the margin and hence a greater rate of growth of output or consumption.[9] This can be seen readily by noting that $\lambda_k \beta_k / (\lambda_c \beta_c + \lambda_k \beta_k)$ is none other than the share of incremental investment in incremental output. Macroeconomic balancing for a closed economy would then imply that this is also the share of incremental savings in incremental income. If $\beta_k = \beta_c$, then this ratio of incremental savings to incremental income is exactly equal to λ_k. If $\beta_k \neq \beta_c$, then $\Delta I/\Delta Y$ is a more general function of λ_k, β_k, β_c but the fundamental qualitative point remains unaltered.

Despite the fact that the Mahalanobis model is a severely rigid construct, it has one important virtue. This lies in its recognition of the fact that capital equipment once installed in any specific producing sector of the economy may not be shiftable.[10] An important consequence is that changes in the savings rate, and hence in the rate of investment, are not necessarily feasible and become conditional upon the composition of the existing capital stock; hence, optimal programs of

[8] Mahalanobis did not address himself to the question of how to resolve this choice problem. He, however, pointed out that a specification of the horizon over which the planning was done was essential if any meaningful answer is to be given to the choice of λ_k. This is undoubtedly correct but, as more recent analysis dealing with this question has shown, specification of a planning horizon is only one of the many prerequisites for choosing an optimal path of development over time. We have to make some assumption regarding the nature of the intertemporal utility function as well as the terminal conditions of the problem. We shall deal with these questions to a certain extent when we come to the discussion of the more recent planning models constructed in the Indian context.

[9] In deriving this cental proposition, Mahalanobis implicitly ignored the role of foreign trade altogether and assumed that the government was in a position to control comsumption completely.

[10] Whether, however, the Mahalanobis–assumed non-shiftability from consumer goods to investment goods capital equipment is greater than that within the former group, and how important it is anyway, are matters on which *evidence* is scant and, as we shall soon argue, was in any case not sought by the Indian planners before adopting Mahalanobis' ideas.

capital accumulation worked out under the assumption of nonshiftability differ crucially from those derived from models with complete shiftability in capital stock among alternative uses.[11]

It needs to be stressed, of course, that foreign trade also can get the economy out of the problems raised by limited transformation possibilities domestically owing to nonshiftability of capital equipment: the assumption of a closed economy automatically rules out this important escape route from the problems raised by nonshiftability. Of course to escape these problems completely, we would have to assume the possibility of indefinite transformation at constant rates—the so-called "small country" assumption in trade theory. Therefore, the essential problems raised by nonshiftability will persist if the reciprocal foreign demands facing the planning country are less than perfectly elastic.

Mahalanobis, who assumed a closed economy and total nonshiftability of the capital stock from the consumption goods to the investment goods sector, appears to have used his model merely to provide the rationale for a shift in industrial investments towards building up a capital goods base. However, the *precise* choice of the proportion of investments in the capital goods sector, during the Second Plan and possibly, thereafter, appears to have been arbitrary—at any rate, if there were specific economic considerations underlying it, these were not spelled out. In any case, an optimal choice thereof would have required, at the minimum, a quantification of the transformation constraints (both domestic and foreign)—and we know that neither was attempted.

Indeed, it appears quite plausible to argue that Mahalanobis (who had just then visited the socialist countries and

with whose economists he had close contacts) was impressed with Soviet thinking on industrialization, with its emphasis on the building-up of the capital goods base, without full recognition of the fact that such a strategy presupposes constraints on domestic and foreign transformation which need to be empirically verified. Further, it seems likely that, being a physicist by training and a statistician by practice, he directly identified increased investment with increased availability of capital goods, which in turn he identified with domestic production thereof, ignoring foreign trade in particular.[12] It is interesting that the Second Plan did not explicitly state the rationale of the shift to heavy industries in terms of foreign trade constraints, so that the later justification of this strategy by alluding to "stagnant world demand" for Indian exports comes somewhat close to a *ex post facto* rationalization. Indeed, the Second Plan's examination of export earnings through the Plan is so cursory that it is difficult to believe that the "stagnant world demand for Indian exports" assumption, by virtue of which the shift to heavy industries was later sought to be justified, was seriously made: such a *crucial* assumption, if made, would surely have been examined more intensively! Further it is important to note that the preceding Five–Year Plan's experience with the balance of payments *and* exports was comfortable, so that it hardly seems likely that the export prospects could have been viewed with such pessimism as has later been imagined.[13]

While, therefore, the Mahalanobis two–sector model was used to provide the rationale for a general shift in investments to building up a capital goods base,

[11] Cf. Chakravarty [22] for a detailed treatment of the analytical issues raised by planning for optimality in the context of models with non–shiftable capital.

[12] This probably accounts for his model [96] in the *Draft Frame* of the Second Plan taking no *explicit* account of savings, whereas *economists* looking at growth inevitably started from the savings end.

[13] These arguments have been developed more fully in Bhagwati and Padma Desai [14].

though the actual magnitude of this shift was otherwise determined, Mahalanobis provided yet another model, a four–sector model [96], which broke down total investment among three further sectors, in addition to the capital goods sector: (1) factory production of consumer goods; (2) household production of consumer goods, including agriculture, and (3) the sector providing services such as health, education etc.[14]

Mahalanobis assumed that all four sectors had independent output–capital and labor–output ratios. These were symbolized by β_1, β_2, β_3, β_4, θ_1, θ_2, θ_3 and θ_4 respectively. He assumed a given total of investment. The problem was to allocate the total between the sectors in such a way that specified increases in income (ΔY) and in employment (ΔN) were reached. The policy variables were the shares of investment going to each sector, denoted by λ_1, λ_2, λ_3 and λ_4.

The model was determined, of course, only if one of the three independent λ's (the policy instruments) was exogenously determined, since there were only two objectives: ΔY and ΔN. With the λ for the capital goods sector given a pre-assigned value (the reason for which was never spelled out clearly) the system was solved by Mahalanobis to assign investments among the three remaining sectors. However, as Komiya [78] pointedly noted, the Mahalanobis solution was inefficient, in that it was situated in the interior of the feasibility locus between incremental output and incremental employment. Thus, greater employment and/or output could have been obtained by merely reallocating the given investments among the three sectors, although such a solution would not assign a positive fraction of investment to every sector.

The very fact that a simple linear programming exercise by an outsider could show the inefficiency of the Mahalanobis allocations, in conjunction with the fact that Mahalanobis did not use this technique even though the planners at his Indian Statistical Institute were certainly not lacking in knowledge of these elementary techniques,[15] indicates that the four–sector model was essentially produced to impart (unsuccessfully, as it turned out) intellectual respectability to investment allocations arrived at on other, unspecified considerations. This conclusion seems also warranted by the fact that the statistical source of the parameters (relating to labor–output and capital–output ratios) was not spelled out. Nor was any attempt made to reconcile the model with the real facts of the situation, especially the presence of foreign trade.

The very limitations of the Mahalanobis two–sector and four–sector models pointed to the need for a more extensive, multi–sectoral and multi–period model for more efficient resolution of the choice problems facing the Indian economy. Such models were to be constructed during the Third Plan period and we shall go on to discuss them. However, it is pertinent to mention here an alternative approach to Indian planning, rival to that of Mahalanobis, which was put forward at the time of the Second Plan formulation by P. R. Brahmanand and C. N. Vakil [19].

Their approach constitutes in some ways the polar opposite of the position taken by Mahalanobis. While the latter's whole emphasis was on the role of fixed capital, Vakil and Brahmanand's entire emphasis was on the role of wage goods as

[14] The entire economy was supposed to be divided into these four sectors.

[15] The Indian Statistical Institute is internationally renowned for its contributions to mathematical statistics and its distinguished Faculty which currently includes two Fellows of the Royal Society in this subject. Besides, they had the benefit of visits, at the time, by Richard Goodwin, Jan Tinbergen, Ragnar Frisch and Oskar Lange.

capital. This approach was therefore related to the Marxian concept of variable capital, since in common with Marx they assumed that the wages were paid as advances in the beginning of the production period. However, the operational part of this approach was derived from the assumption that there existed massive overpopulation in agriculture. They did not subject the concept of disguised unemployment in agriculture to any critical investigation, nor did they try to measure the extent of such disguised unemployment in the Indian context. They were following the tradition set by P. N. Rosenstein–Rodan and R. Nurkse in taking it as obvious that a massive reserve army of labor existed in rural areas.[16] Further they assumed, as Nurkse did, that the disguised unemployed must possess considerable savings potential since labor could be transferred from agriculture without lowering production and kept at work producing real capital goods by the payment of wages consisting exclusively of food.

Several assumptions were made by Vakil and Brahmanand to formalize their system. First, the wage good was assumed to be exclusively food. Second, it was assumed that labor could produce capital goods without the assistance of other factors of production. Thirdly, they assumed that a mechanism existed by which average consumption on the farm could be kept constant subsequent to the transfer of labor, and the transferred labor's consumption on the farm be siphoned off to feed it while it was engaged in producing capital goods. To be sure, they recognized the

possibility of leakage in this connection. They assumed that the whole of the hypothetical surplus might not be procurable and further that there might be a need to provide for slightly higher consumption levels than in agriculture to workers engaged in construction. Thus they derived a "multiplier" formula in which the multiplicand was an autonomous increase in the stock of wage goods in the hands of the planning agency.[17]

However, they did not pay any attention to the possibility that the production process may not be of the simple Austrian type that they had assumed: labor→ capital goods→consumer goods. If the facts of life dictated a circular model of the sort analyzed by Marx (in the second volume of Das Kapital) and more recently by Leontief and others, the mere availability of labor alone would not solve the problem of greater capital formation. Extra capital equipment would be needed and would need to be either produced at home or imported, hence raising the complex of issues raised earlier in connection with the Mahalanobis model. As regards the composition of wage goods, if nonfood items were necessary and if there were no corresponding excess capacity in the domestic consumer goods industries, then once again the creation of extra capacity and its synchronization with the deployment of extra labor would be involved, thus necessitating a more elaborate approach.

[16] The early writings of Brahmanand [18] in fact anticipated the notion of disguised unemployment, although the concept was not fully developed. Brahmanand's interest in this question had arisen from a general examination he was undertaking of the applicability of the Keynesian theory to the economic situation in India. In this connection, V. K. R. V. Rao's [143] analysis of the Keynesian multiplier in the Indian situation is also of interest.

[17] The Vakil–Brahmanand approach could be readily used to provide a rationale for the policy of importing food as a means to step up capital formation and generate extra employment. It is interesting that these authors did not make any effort to link up their analysis directly with the question of food aid. Although such an approach was implicit in the early work of Dandekar [27] and others, it was only much later that Chakravarty and Rosenstein–Rodan [26] tried to develop the logic of food aid somewhat more fully in an analysis which was considerably influenced by a model similar to that provided by an economy with massive rural overpopulation.

The social welfare function implicit in Vakil and Brahmanand's approach to planning was novel at the time: they were emphasizing the need to minimize the time needed to reach full employment. Whether such an objective constitutes an adequate social welfare function is very doubtful;[18] but that it is an objective which needs very careful consideration is beyond doubt. Mahalanobis' model, at least in its formal aspects, had paid no attention to this.

Despite its limitations, Vakil and Brahmanand's attempts to build an analytical scheme which tried to tackle the problem posed by disguised unemployment in agriculture deserve emphasis.[19] In discussions subsequent to the formulation of the Second Plan, the wage goods approach has not figured prominently. Amongst eminent economists, Gadgil [55] has been the only one to draw pointed attention to the importance of mobilizing rural labor to build social overhead capital, which he did as late as 1961. In more attenuated forms, however, this aspect of the planning problem is still alive.

The Third Five-Year Plan

The Third Plan was not entirely pioneering in its attempted utilization of multi-sector balances to achieve consistency. Quite aside from Ragnar Frisch's suggestions in this respect [54], Jan Sandee [150] had actually constructed a simple linear programming model during his visit to the Indian Statistical Institute during 1957/1958, which was used to maximize aggregate consumption in a terminal year (1970) as an excess of consumption over a base year (1960), subject to maintaining intersectoral consistency conditions and feasibility conditions on the side of the balance of payments.

While the Sandee model was essentially

a straightforward, *static* linear programming exercise, it had one analytically important feature which deserves special mention. This relates to his treatment of investment in the terminal year. If this year were taken really to be the terminal year of the Plan, then clearly there is no justification for having any investment at all in that year (assuming, of course, that all investments fructify beyond the one year horizon). Since no planner ever takes such a myopic point of view, it is necessary to elaborate a rationale for introducing investment activity in single-period optimization models. One can theoretically conceive of several procedures which can be used for this purpose. Sandee's procedure was to assume that, over the decade of 1960–70, investment flows should increase linearly every year. We may spell this out.

Let us denote the year 1960 by '0' and the year 1970 by T. Then the cumulated investment over the period is given by

$$\int_0^T I(t)dt.$$

Sandee assumed $I(t) = a + bt$. Then we have

$$\int_0^T (a + bt)dt = aT + \tfrac{1}{2}bT^2.$$

The proportion of total investment that must take place in the T–th year out of the total over the entire T year period is given by $a + bT/aT + \tfrac{1}{2}bT^2$. Now applying this factor to the investment demand for the product of the i–th sector induced by output increase in 1970 over 1960, which equals

$$\sum_j b_{ij}\Delta X_j,$$

we get the estimate for investment of the i–th type for the year for every i. Hence the vector of goods to be delivered on the investment account in the terminal year is determined. Intersectoral deliveries on the

current account, together with the balance of payments considerations, must be included. Sandee, then, proceeded to maximize consumption in 1970 subject to obeying a lower limit on total investment summed over all the sectors and a few other inequality constraints.[20]

The work underlying the Third Plan was nowhere as explicitly set out as in Sandee's exercise, although balances of supply and demand at a detailed sectoral level were set out. Reddaway [145], who was associated with the Perspective Planning Division of the Indian Planning Commission,[21] undertook a systematic supply–demand balance exercise, for many industries, essentially putting together different target outputs, imports and demands to test for simple consistency for the year 1965–66, the terminal year of the Third Plan. If this exercise were construed as constituting simple, *ad hoc* checks on targets supplied to Reddaway by the Perspective Planning Division (PPD) it was valuable. But construed as an attempt at devising a full–fledged Third Plan, with only partial targets of production supplied by the PPD, the exercise was less satisfactory even within the framework of testing for consistency (as distinct from optimality). This was pointed out by Padma Desai [42] who, on attempting to formalize the Reddaway exercise, found it underdetermined despite efforts at discovering (from Reddaway's work) ways in which the model might have been intended to be

closed.[22] The problem clearly arose from Reddaway's omission to state his model, if any, in formal terms. It therefore throws into focus the need for stating carefully the model underlying the investment allocations and related decisions, quite aside from the theoretical elegance and scrutiny of otherwise vague assumptions that such a procedure would entail.

In fact, during the Third Plan period itself, many economists such as Alan Manne, Ashok Rudra, Sukhamoy Chakravarty, Richard Eckaus, Louis Lefeber and Kirit Parikh, turned to precisely this kind of work in connection primarily with the Fourth Plan: whereas Manne and Rudra were to build static, multi–sector consistency models, the Chakravarty–Eckaus–Lefeber–Parikh exercises were to be concerned with explicitly dynamic, multi–sector models.[23]

Before we discuss either of these two developments, both of which marked improvements over the earlier computational models of planning, we should note that the Third Plan not only marked a shift to examination of consistency at the inter–sectoral level but also incorporated some fresh, though embryonic, analytical thinking. The notion that foreign trade might be the bottleneck to increasing the rate of investment had come more sharply into focus, instead of being the implicit premise of a Mahalanobis type of investment strategy.[24] Thus, significantly more than

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[20] It may be noted that, as Sandee assumed that the balance of payments in 1970 would be such as to require no import surplus, he could pay no attention to any parametric variation in foreign aid availability, a question which has been repeatedly posed by many model builders in India since then.

[21] Reddaway was on the M.I.T. Center for International Studies Program, under which several distinguished economists were associated with the Planning Commission's work. P. N. Rosenstein–Rodan and Max Millikan headed this program, which brought to India numerous economists including I. M. D. Little, Trevor Swan, Arnold Harberger, Louis Lefeber, J. Mirrlees, Richard Eckaus, and Sir Donald MacDougall.

[22] See the interchange between Padma Desai and Reddaway [146] on this issue.

[23] As it eventually turned out, the Fourth Plan was deferred by three years, largely thanks to the dislocation of aid flows following the Indo–Pakistani war of late 1965 and two unprecedented agricultural droughts in 1965–66 and 1966–67 which, in turn, led to a recession in industrial investments. The planning exercises, which had not anticipated these major disturbances, turned out to be irrelevant to the immediate situation. Whether, however, the Fourth Plan should have been postponed in consequence is a matter on which there has been much debate.

[24] This view was, at least partly, a reflection of the stagnation in India's export earnings during the decade

with the Second Plan, the investment decisions in the Third Plan were taken with an explicit attention to the role of foreign aid in breaking this bottleneck and the possible desirability of "using aid to end aid," and reach self-sustained growth at some foreseeable future date. To put it differently, the Third Plan investments, which continued the shift to the heavy industrial sector, were taken against the notion that foreign aid would enable the economy, by permitting these investments, to cross over the hump (posed by the foreign trade constraints) from a low growth rate equilibrium to a high growth rate equilibrium. This precise view was to be the basis of more formal exercises by Manne and Bergsman [100] in connection with the Fourth Plan work.

Models for the Fourth Plan

Among the detailed, *static* exercises attempted during the work on the Fourth Plan was that by Manne and Rudra [101], who were both working in collaboration with the PPD (which had put out its own "bluebook" of projections based on similar thinking).

Although their exercise was of the standard type, and related to the consistency of the terminal year of the Fourth Plan, there were certain interesting features. For example, they followed Sandee in attempting to give a rationale for investment activity in the terminal year. However, unlike Sandee, they assumed that investment would rise exponentially over the intervening years and hence the proportion of investment to be completed in the terminal year was given by

$$(16) \quad \gamma = \frac{e^{rT}}{\frac{1}{r}[e^{rT} - 1]} = \frac{r}{1 - e^{-rT}}$$

This proportion "γ" was called by them the stock–flow conversion factor. Having done this, they took the consumption vector to be given and tried to find out the gross production vector that would be needed if all the end use activities were to be satisfied at given levels, subject to the assumption of a stipulated stock flow conversion factor. Their procedure may be summarized as follows.

Let $\hat{x}$ stand for the vector of production levels in 1970 and x^0 for the vector of production levels in 1960. Then we get

$$(17) \quad \begin{aligned} \hat{x}_i + M_i &= \sum a_{ij}\hat{x}_j + F_i \\ &\quad + \gamma \sum b_{ij}(\hat{x}_j - x_j^0) \end{aligned}$$

where M stands for imports, F for final demand and a_{ij} and b_{ij} are the standard current input–output and capital coefficients respectively. If M were written as $[m]\hat{x}$ where $[m]$ is a diagonal matrix of import coefficients, then we may write the solution of the above as:[25]

$$(18) \quad \hat{x} = (I + m - A - {}'\gamma'B)^{-1}[F - \gamma Bx^0]$$

where I is the unit matrix.

Since Manne and Rudra were concerned with constructing a terminal year model for the Indian economy, they did not specify in a complete way the path the economy was to follow from a given initial

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1951–1960, which made the hypothesis of a foreign exchange bottleneck to Indian development seem much more plausible. Manmohan Singh [163] was later to show that this stagnation was largely a result of domestic policies, although demand factors would have constrained significant expansion of export earnings.

[25] It is clear that the choice of 'γ' cannot be completely unrestricted. It must satisfy an upper bound restriction if $(I+m-A-\gamma B)^{-1}$ is to be non negative. From the theorems on non negative square matrices we know that this would be the case provided m were sufficiently small so that $(A+\gamma B-m)$ is non negative, and $1 > r_0$ where r_0 is the Frobenius root of the matrix $(A+\gamma B-M)$. A sufficient condition for this to hold is that $\max_j \Sigma_i(m_{ij}+a_{ij}+rb_{ij}) < 1$ for any suitable choice of units. Hence, given the coefficients of production, the capital coefficients and a given pattern of competitive import demand, γ must have at least an upper bound.

point to the terminal configuration. Thus this model may be said to give a perspective rather than a plan. However, the construction of a terminal configuration is an essential ingredient in any finite horizon planning model so that the Manne–Rudra model did provide some guidelines for the planner, even though it did not specify a complete time phased course of action.

Models which give some guidelines regarding the phasing of investment can be usefully divided into two categories.[26] One of these categories may be described as giving us intertemporally consistent planning models. The other category, somewhat more ambitious in scope, deals with optimization over time, and has been experimented with by Chakravarty, Eckaus, Lefeber and Parikh.

Chakravarty and Eckaus [24] first outlined the logic of an intertemporally consistent multisectoral planning model and pointed out the basic difficulties. They did

not, however, compute numerical growth paths. It is of some analytical interest to give a brief summary of their arguments.

For the sake of simplicity, let us ignore temporarily all the non-homogeneous elements of a Leontief dynamic system other than consumption. Then, we have a dynamic system characterized by the following equation:

(19) $\qquad X(t) = AX(t) + BX(t) + C(t)$

where $X(t)$ stands for the vector of output levels, $\dot{X}(t)$ for its rate of change, $C(t)$ for the vector of final consumption, and A and B are the standard Leontief matrices. The complete solution of the dynamic system assuming $C(t)$ to be growing exponentially over time is given,[27] using the notation of a matrix exponential, by the following expression:

(20) $\qquad X(t) = {}_e[B^{-1}(I - A)^+]$
$\qquad\qquad + (I - A - rB)^{-1}Ce^{rt}$

where P is a vector of arbitrary constants and C represents exogenous levels of consumption to be determined through policy considerations. The advantage of using this matrix exponential notation is that it shows the analogy with the ordinary scalar case involving one variable quite explicitly.

The above equation holds provided B has an inverse, a condition which is often not satisfied. The solution for more general time paths of $C(t)$ may also be worked out, either in an analytical form or through numerical approximations.

Now if $X(0)$ and $X(T)$ are both given, in the first case from history and in the second case from the planner's specifications, then we have $2n$ equations to determine the unknown P and C's. This is the logic of the consistency models. However, difficulty arises in so far as the matrix

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[26] The Mahalanobis model, through possibilities of variation in the choice of λ_k, was also in principle capable of generating alternative time phased programs. The Mahalanobis model was further elaborated, by disaggregation with respect to intermediate goods (where the Mahalanobis model had been vertically integrated) and via the explicit assumption that capital goods producing the consumer (and intermediate) goods could not be shifted to producing capital goods (which *in any case* was implicit in the Mahalanobis model and indeed provided its basic economic rationale). This was done by Raj and Sen [140]. They produced a number of illustrative time paths whose value consisted in reemphasizing that an intertemporal choice had to be made, although no attempt was made by them to indicate how this might be done. Besides their model, while set in the context of an open economy, ignored the possibilities of trade offs between domestic production and imports for supplying any given bundle of goods at a point of time, as pointed out by Bhagwati [6]. For other comments, see Prasad [129].

Mention should also be made of a more novel, exploratory paper by P. N. Mathur [109] which gave a computational, time-phased solution to investment allocation decisions. Mathur, writing in 1962, explored the consequences of transforming an initial technological matrix for the Indian economy into technology of the U. S. type within a specified planning horizon. He used a linear programming formulation to discriminate between alternative transformation paths.

[27] See the article by S. Chakravarty and R. S. Eckaus [24].

$B^{-1}(I-A)$ may not be well behaved: thus there is no guarantee that the dynamic system which is governed by the matrix will ensure nonnegativity of the relevant variables over time. Hence, one cannot be sure that consistency necessarily implies viability. On the other hand, one could also work recursively backwards from an assumed terminal condition by using the finite difference version of Leontief's structural equations. The advantage of this procedure is that it would not require the B–matrix to be invertible. However, in all probability, we would fail to tally exactly with the initial conditions. If the magnitude of the difference between the historically given initial situation and the desired initial situation (thus worked out) was not large, then one could argue that the model provided some sort of a time-phased plan. But there is no a priori guarantee that the difference would not be significant; nor can we assume that the deviations would be found only in the sectors producing 'tradeables,' and hence be remediable by international trade.

Unlike the procedure discussed by Chakravarty and Eckaus, Manne and Bergsman [100] used a different method which gave what they called an "almost consistent model." In working out this almost consistent model, they did not rely on the complete solution of the non-homogeneous dynamic Leontief system. They computed a set of terminal output levels of $X(T)$ based on the need to reach specified levels of final consumption in the year T and to sustain growth in gross output at specified levels beyond the horizon T. This part of the exercise was therefore based on different assumptions from those underlying the determination of terminal investment levels used by the other models. Once $X(T)$ was determined, Bergsman and Manne obtained the timepath of $X(t)$ starting from $X(0)$, by log linear interpolation. Hence they had a unique planned output trajectory $X(t)$. As for the demand side, the timepath of final demand for year 0 to T was assumed to be given exogenously. But induced investment in both fixed capital and inventories was determined by planned output increases. Now, if we denote the planned requirements trajectories over time by $D(t)$, clearly $X(t) \neq D(t)$ for every t (and for every industry). Such differences were to be met by so–called "shock absorbers." These shock absorbers were either imports of producer's goods, or changes in projected consumption of food and fabrics and the domestic output of service sectors. Since construction, which was treated as a domestic service, turned out to be too severe a bottleneck for the initial year, they called their model an almost–consistent model.

The planning model first developed by Chakravarty, Eckaus, Lefeber and Parikh and later extended by Eckaus and Parikh [51], and hereafter described as the "CELP model," was formally the most detailed of all the models so far developed in the context of Indian planning.[28] This is not to suggest that it was completely adequate for the purpose of generating development plans for the Indian economy. But within the limitation of a linear model, the structure had sufficient flexibility to handle a number of important planning questions.

The model constructed by the above authors is best described as a finite horizon, linear optimization model involving explicit intersectoral and intertemporal relationships, which satisfies boundary conditions relating to the initial year as well as to the terminal year of the plan. This description indicates that the CELP model formally subsumed the structural features of the preceding models. In addition it provided an intertemporally optimal path of development which brought the economy from the initial situation to the

[28] This model has been described and discussed by Eckaus [49] and by Chakravarty and Lefeber [25].

desired terminal situation. It also distinguished between investment starts, investment in execution and completed investment.

The linear maximand used in the CELP model was the discounted sum of consumption over a five year period. The relative rate of discount over time was assumed to be constant to avoid 'regret' phenomena of the type discussed in the theoretical literature by Robert Strotz [167]. Consumption in each period was assumed to be of constant composition. In other words, there was no substitution allowed between the different items of consumption in one single period. This is an assumption of the Leontief variety on the side of consumption. These assumptions could be formally stated as follows:

$$(21) \qquad \text{Maximize} \sum_{t=1}^{T} W(t) C(t)$$

where $W(t) = (1+r)^{-t}$ and $[c]$ $C(t) \leq F(t)$ where $[c]$ is a diagonal matrix of proportional consumption coefficients with $\sum c_i = 1$. Clearly, r is the social rate of time discount whereas $F(t)$ is the vector of sectoral outputs designated for consumption. The authors expressed their unhappiness over their extremely rigid assumption with respect to consumption but justified their procedure on the ground that, for an economy such as India, the low level of per capita income did lend some credibility to the assumption of a fixed composition consumption basket.[29]

To make sure that consumption did not fluctuate from period to period, a linear model such as this required an explicit monotonicity constraint: $C(t+1) \geq C(t)$ $(1+n)$ where 'n' is a predetermined growth rate. Further, consumption in

[29] Clearly the assumption of a fixed-consumption pattern, in turn, implies the CELP model assumed identical, constant returns to scale tastes for each individual, thus ruling out explicit consideration of the question of the effects of changes in income distribution on consumption patterns.

year 1, denoted by $C(1)$, was assumed to be greater than $\overline{C}(1)$, a predetermined amount. On the side of the structural relations, the CELP model specified inter-industry relationships both on the current and on the capital account. The model differed from the traditional treatment on the side of capital formation by introducing a gestation lag of 3 years coupled with the assumption of an exogenous pattern of investment buildup. The model permitted the authors to assume that the pattern of buildup in investment was either uniform or different between sectors. These restrictions on the structure of the economy were described by the following set of relationships:

$$(22) \quad \begin{aligned} AX(t) + F(t) + N(t) + H(t) + G(t) \\ + E(t) - M(t) - X(t) \leq 0. \end{aligned}$$

$F(t)$, $N(t)$, $H(t)$, $G(t)$ were vectors of consumption, capital accumulation, inventory accumulation and governmental expenditure respectively. $E(t)$ was the vector of export levels and $M(t)$ was the vector of import levels.

With regard to capital formation the CELP model used the following set of relationships:

$$ bX(t) - K(t) \leq 0, $$

$$(23) \qquad \text{where } [b] = \begin{bmatrix} b_1 & & \\ & b_2 & \\ & & b_n \end{bmatrix}$$

a diagonal matrix of sectoral capital-output ratios.

$$(24) \quad \begin{aligned} K(t) - K(t-1) - Z(t) \\ + R(t-1) \leq 0 \end{aligned}$$

$$ q^k Z(t) = I^t(t-k); $$

$$(25) \qquad \sum_k q^k = 1, \qquad k = 1, 2, 3. $$

$$ \sum_k \dot{p}_{ij}^k I_j^{t+k}(t) - N_{ij}(t) = 0; $$

$$(26) \qquad \sum_j N_{ij}(t) = N_i(t). $$

Equation (23) states that total demand for fixed capital must be less than the capital stock currently available. Equation (24) states the balance relationship for net capital formation. $Z(t)$ is gross new capacity available in 't' and $R(t-1)$ shows the replacement requirements computed on any reasonable basis. Equations (25) and (26) describe certain structural aspects of the process of capacity creation. These consist of the assumption that additions to capacity consist of the blending of different sectoral outputs according to given proportions and at given moments of time. In other words, capacity additions are produced by outputs devoted to capital formation with a distributed lag structure. A well defined part of the intended capacity increase must be completed at $t-3$, $t-2$, $t-1$ periods in order to have the desired capacity increase available at period t.

If q^k denotes the proportion of total capacity increase that must be completed k periods in advance ($k=1, 2, 3$), then in order to have a unit of capacity increase in t, $I^t(t-k)$ must represent that part of $Z(t)$ that has to be completed in period $(t-k)$. This is shown by the equation (25)

$$q^k Z(t) = I^t(t-k); \quad \sum_k q^k = 1, \quad k = 1, 2, 3.$$

The lagged investment components $I^t(t-k)$ have their fixed coefficient production functions, one for each lagged period. In any one time period t, a given sector is going to contribute inputs for producing $I_j{}^{t+1}(t)$, $I_j{}^{t+2}(t)$ and $I_j{}^{t+3}(t)$. These inputs at time 't' are additive whether or not they are provided for capacity intended for $t+1$, $t+2$ or $t+3$. When summed, they make up the sector's contribution to gross investment in t. This is described in equation (26) where $p_{ij}{}^k$ is the fixed production coefficient. Thus,

$$(27) \qquad \sum p_{ij}{}^k I_j{}^{t+k}(t) - N_{ij}(t) = 0$$

$$(28) \qquad \sum_j N_{ij}(t) = N_i(t).$$

In addition to capacity formation, there is also the equation for inventory accumulation, which is indicated by the following equation:

$$(29) \qquad H(t) = S[X(t+1) - X(t)]$$

where $S = [S_{ij}]$ is the diagonal matrix of inventory requirements.

Foreign trade problems were introduced in the model in a "complete" way, but not necessarily in a very satisfactory way. Export demand levels were assumed to be given exogenously. Hence no optimization was introduced there. Imports were divided into two categories: competitive imports and noncompetitive imports. Noncompetitive imports were related to sectoral production levels by fixed proportions. Competitive imports were related to the sectoral production levels through the device of import ceilings. Formally the competitive imports of the i-th type of commodity were given by the following inequality:

$$(30) \quad \begin{aligned} &M_i{}^2(t) \\ &\leq m_i{}^2[FA(t) + \sum E_i(t) - \sum M_i{}^1(t)] \end{aligned}$$

where $M_i{}^2(t)$ was competitive import of the i-th type at time 't', $FA(t)$ was the foreign aid availability at 't', $E_i(t)$ was exports of the i-th commodity at time 't', $M_i{}^1(t)$ was noncompetitive import into the i-th sector, $m_i{}^2$ was an import ceiling. This meant that, after deducting from the total amount of foreign exchange earned at time (t) the total bill of noncompetitive imports, no more than $m_i{}^2$ times the residual could be allocated for competitive imports of the i-th type. This device of handling competitive imports through introducing boundary relationships was important in avoiding a pattern of complete specialization to which a linear model

would otherwise gravitate. Hence, despite the awkwardness of the procedure, it served an important purpose in view of the procedure of linear maximization adopted in the CELP model on the assumption that $\sum_i m_i^2 > 1$.

The manner in which the investment figures for the terminal year were derived in the CELP model was different from that employed by Sandee, or Manne and Rudra.[30] The CELP model brought the post plan future into focus in terms of investment in the terminal year. This had some conceptual advantage over the converse procedure used by the earlier authors in as much as the growth rates were applied to the terminal year consumption component directly rather than to investment figures. This is readily seen as follows. From the purely mathematical point of view, the terminal configuration is merely the sum of the particular solutions corresponding to the nonhomogeneous elements of an open dynamic Leontief model. If we write the sectoral balance equations in the compact vector matrix form, as

$$(31) \quad X = AX + B\dot{X} + C + E + G - M$$

where X is the vector of gross output level, C the vector of consumption, E the vector of exports, M the vector of imports and G the vector of government expenditure, then the sum of the particular solutions corresponding to C, E, M and G gives the terminal configuration. Investment is treated here completely endogenously, since we assume $I = B\dot{X}$. The complete solution to the nonhomogeneous part of the above differential equation is given by

$$(32) \quad \begin{aligned} X &= (I - A - rB)^{-1}Ce^{rt} \\ &\quad + (I - A - \lambda B)^{-1}Ee^{\lambda t} \\ &\quad + (I - A - \mu B)^{-1}Ge^{\mu t} \\ &\quad - (I - A - vB)^{-1}Me^{vt}. \end{aligned}$$

[30] This procedure has been used independently by Manne. Also see Frisch [53].

Here r, λ, μ, v are the growth rates of C, E, G and M respectively.

We should note that since the CELP model assumed a fixed consumption basket, only the scale of consumption of the composite good was left to be determined by the logic of the optimizing mechanism. The items for the terminal year such as exports, government expenditure and imports were exogenously determined. Given these exogenous items, $K(T)$, which stands for the terminal vector of capital stocks, was expressed in this model as a function $f(r; T)$ where f is a vector function of the vector of the post Plan growth rates 'r' and the length of the horizon T; 'f' was determined implicitly by the solution of the optimizing mechanism.

Given the information on post terminal growth rates, the length of the planning horizon, the initial conditions, the structural equations, and the inequalities on the side of competitive imports, the model could work out a complete time path for all the variables such as production, consumption, and investment levels. (The model can, of course, be analyzed from the dual angle, e.g., in terms of the shadow prices of the relevant scarce factors. These shadow prices are the optimal rentals of different types of equipment as well as the price of foreign exchange. It is interesting to note that the shadow price of foreign exchange was always positive in this model since imports could always be used to increase the value of the maximand.)

The model as developed by the above authors was the subject of a critical appraisal by Srinivasan [165]. Many of Srinivasan's criticisms[31] were directed at the degree of weight to be placed on the numerical solutions thrown up by the model in some preliminary runs as well as

[31] For these comments, which are of considerable relevance to an evaluation of the Third Plan targets, Srinivasan [165] should be consulted. We turn to these questions shortly.

on the comparability of the solution to the model with the actual Third Five–Year Plan figures. Srinivasan, however, raised a *conceptual* question of general importance. This question related to the way in which the terminal conditions were specified in the CELP model. This model had envisaged terminal conditions as a way of sustaining post terminal rates of growth of consumption, where the composition of consumption was given exogenously but the scale was left to be determined by the optimizing mechanism. There are two limitations to this procedure. In a model involving an infinity of time, no indefinitely sustainable growth rate can exceed the growth rate of the labor force. Further, the composition of consumption, which in this model was pegged till eternity, could be expected to change if, as planned, income levels were going up year by year. Srinivasan, therefore, expressed a preference for setting terminal conditions in a way which would maximize indefinitely sustainable consumption per capita. This, of course, is none other than the disaggregated version of the so–called golden rule of accumulation. The terminal capacity vector in this case would be a function of the rate of growth of the labor force, and the production relationships of the system. Coupled with the assumption of full employment and a given time horizon, this would give the planner a vector of absolute levels of capacity needed at the end of the planning period. The method of setting terminal conditions along the lines suggested by Srinivasan has both conceptual and policy determination merits, especially in the context of a country like India with a massive and rapidly growing population.

Since the original form of the above model was published, moreover, Eckaus and Parikh [51] have done further work within the framework of the CELP model. While the conceptual structure of the model used by Eckaus and Parikh is essentially the same as that of the CELP model, the introduction of longer time horizons and also of new techniques in the agricultural sector by Eckaus and Parikh constitute important improvements.

Having stated the formal properties of the CELP model, and argued for its superiority over earlier efforts at operational planning models in the country, we now proceed to comment further on the analysis of the CELP model, indicating the areas in which further research is necessary and thereby highlighting some additional limitations of the CELP approach. We then conclude our survey of Indian planning models and techniques by discussing the precise manner in which the experiments with the CELP model were actually designed to throw light upon the important policy questions which Indian planners were concerned with at the time.

Possibilities of Further Improvement in Model–Making. The first important improvement in designing computable planning models would be to relax the assumption of linearity by introducing a nonlinear maximand. This is because linear maximization problems over time are known to display the so–called "flip–flop" behavior in consumption and investment levels, which is certainly very awkward for realistic planning models. If this "flip–flop" behavior is then sought to be corrected through the imposition of additional constraints, the constraints become more important than the optimization procedure, and hence the problem is not really solved. In the context of a multisector, intertemporal maximand, it is necessary to distinguish between two types of nonlinearity. First, there is the possible nonlinearity of a one–period utility function involving different types of consumer goods. Such a utility function would be an improvement upon the fixed coefficients approach. Secondly, the aggregate utility function over

time could be nonlinear bringing in considerations relating to the diminishing marginal utility of consumption as the consumption vector rises over time. Maximization of a nonlinear maximand however would raise many problems of a computational nature which may yet take time to solve but, with a Leontief type technology, the problem does not seem to be by any means hopeless.

Secondly, the foreign trade problem requires a more satisfactory treatment. Changing comparative advantage positions with respect to different commodities should be reflected more adequately in the structure of the model. On this point also, progress would require solving intricate questions of nonlinearity in somewhat the same way as in connection with the preceding objective.[32] However, in one respect, the nonlinearities relevant to an open economy would be somewhat more intractable to handle. These nonlinearities would arise when some learning phenomenon is operative or some other form of economies of scale is relevant, rendering the classical convexity property of the feasibility surface inapplicable. The programming problem in this context would then have a mixed integer form, for which no very suitable algorithm yet exists.

In addition to all these questions, we should also note that the structure of consumption and the techniques of production in the model are quite rigid and that this certainly restricts its empirical relevance. Further it may be valuable to introduce an explicit savings constraint, as political factors may impose a ceiling on the capacity to raise savings.

An additional feature which planning

models devised specifically in the Indian context ought to take into account is the phenomenon of massive unemployment, disguised and open. No formal planning model developed in the Indian context *fully* takes into account the problem posed by such unemployment. The only way unemployment is reflected in these models is through the assumption that labor is free, thus enabling one to focus attention on scarce resources such as capital and foreign exchange. Since the clear implication of these models is that full employment can be reached only over a relatively long period of time, important questions arise regarding the way unemployment is to be handled in the intervening period. This not only raises problems of distributive justice, which are very considerable, but may also raise serious problems relating to economic efficiency if one remembers that, given suitable organizational efforts, unemployed labor may be put to creating extra social overhead capital, which would largely involve redistribution of aggregate consumption. We have noticed that this aspect of planning received considerable emphasis in the work of Vakil and Brahmanand which we discussed earlier. But we have also seen that the linkage between the deployment of labor in such labor intensive rural construction activities is not entirely independent of the decisions taken elsewhere in the economy with respect to the use of scarce resources including wage goods. This is because we do not have many cases in real life where labor can produce capital goods unassisted by capital goods, and further, there is no automatic mechanism through which potential savings of the agriculturists could be transferred into consumption of labor working on construction projects. Thus, there is always some linkage between labor used on social overhead projects and the pattern of industrial development that is envisaged. Thus, what is necessary is an

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[32] On the problem of planning India's trade pattern within the context of linear one–period maximization models, one can refer to the thorough work done recently by T. E. Weisskopf. Weisskopf [175] does not consider the choice of export levels; instead he assumes these to be given.

explicit analysis of a planning model which would incorporate this important structural feature of the Indian economy and explore fully its implications. The models which have been developed so far, while they range considerably in their sophistication from simple to very elaborate constructs, have, however, been essentially concerned with the implications of the shortage of capital and foreign exchange, rather than with a full analysis of the abundance of one important factor of production, e.g. unskilled human labor.

Empirical Applications of the CELP Model. Despite these limitations, and essentially on an experimental basis, the CELP model was utilized to analyze certain important, policy questions.

Two essentially important problems were explored with the aid of the CELP model, which appeared contemporaneously with the execution of the Third Plan. (1) Suppose that the Third Plan terminal year (1965/66) capacity targets were accepted, and the initial conditions and structural coefficients also accepted as implicit in the Third Plan, was there a feasible timepath from the latter to the former? Further, aside from feasibility, was the implicit timephasing in the Third Plan "optimal" if the preference function involved a discounted sum of consumption over the five year period (1961/1966)? (2) Moreover, the CELP model was also used to generate an optimal timepath of investments and outputs, while replacing the exogenous terminal year capacity targets of the Third Plan and instead allowing endogenous determination of these targets via specification of the rates of post-terminal growth in different items of final demand. This latter trial run, therefore, raised the question of the optimality of the actual Third Plan in a more comprehensive manner.

The first set of questions was analyzed on the assumption that an annual aid flow of Rs.5000 million would be available through the Third Plan—an assumption shared by the actual Third Plan. Further, the targeted rate of growth of consumption was specified alternatively at $2\frac{1}{2}\%$ and 5% per annum; the rate of time discount was set at 10%. With these specifications and the structural coefficients assumed to be those implicit in the Third Plan, the actual Third Plan turned out to be feasible. However, it turned out that the *optimal* timepath solution for going from the initial to the terminal year capacity levels, under either assumption with respect to the growth of consumption,[33] required a lowering of consumption in the first year of the Third Plan as compared with the actual consumption that obtained in the year 1960/61 which preceded the Third Plan. Thus the crucial question on the feasibility side, if one were considering an optimal transition path from initial to terminal capacity levels (as defined in the Third Plan), was whether the planners were willing to be very austere in the beginning of the Third Plan. The optimal timephasing of the Third Plan, therefore, was not merely at variance with that implicit in the Plan itself[34] but, furthermore, it seemed unlikely to be feasible in practice.[35] Furthermore, quite aside from optimality, if the capital coefficients matrix used by CELP was indicative of the structural relationships in the Indian economy, then the investment figures in the Third Plan represented a serious underestimate.

The optimality exercise which allowed the terminal year targets to be endogenously determined, however (and which

[33] The difference between the two alternative growth rates with respect to consumption showed itself more in the derived figures for the first year consumption levels than in the maximum value achieved by the objective function over the planning period.

[34] Since the possibility of such a reduction in consumption in the first year was certainly not envisaged in the Plan document.

[35] It should be noted that varying the discount rate from 10% to 20% hardly changed the solution, especially with respect to the reduction in first year consumption

therefore envisaged the possibility of an investment allocation different from that in the Third Plan itself), threw up a solution which was considerably different from the official Third Plan. First, the total discounted sum of consumption was considerably higher. The average annual rate of growth of consumption was considerably higher than the figure officially assumed for the Third Plan. Furthermore, the major constraining factors in this modified growth process turned out to be the consumption goods sectors rather than the sectors producing capital goods. Such a striking dissimilarity between the optimizing planning model and the official Third Plan was the subject of extensive comments by CELP [25] and by Srinivasan [165]. Clearly several important factors were responsible for this difference. One was the assumption of a fixed–composition consumption basket which was heavily weighted in favor of food, the chief consumer good. Secondly, agriculture was treated in the model as some sort of a "bargain" sector with highly favorable capital–output ratios and relatively small requirements for flow inputs of industrial raw materials. Furthermore, the length of the gestation lag of three years, which involved a substantial amount of investment in the pipe line so far as the capital goods sectors were concerned, together with a horizon length of five years, also affected the numerical results substantially. In the subsequent exercises done by Eckaus and Parikh [51], most of these assumptions were modified; the revised results showed a narrowing of the difference between the CELP results and the official Third Plan allocations, although the difference continued.[36] We might note here that

the CELP results, pointing to a shift in investment allocations away from the capital goods sectors to the consumer goods sectors (primarily agriculture) became available at the same time as the new Indian Prime Minister, Lal Bahadur Shastri, was expressing views to the same effect and recommending publicly a shift in investments and policy attention to the agricultural sector. In view of the practical importance, therefore, of the issues raised by the CELP work, there ensued a lively debate. As it happened, the shift towards the agricultural sector was to come largely as a result of two successive droughts during 1965/66 and 1966/67,[37] which underlined the inadequate growth of agricultural output in relation to the growth of population and income, the consequent reliance of the economy on P. L. 480 imports and the necessity to push more systematically on the agricultural front. Further, the relative investments in the capital goods sector were to slacken off during this period (and until the moment of writing this Survey) owing to the significant decline in the availability of project aid for fresh projects and the slow completion of those in execution, and also the fact that the governmental investments were constrained by the shortage of wage goods owing to the two successive droughts.

Having discussed the general area of planning theory and techniques,[38] and analyzed the interplay between planning models and actual planning within the country, we now proceed to two related

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[36] For further points on this difference, including the possibility that the official Third Plan might have had a different objective function implicit in its targeted allocations (even though no evidence of explicit and coherent argument on this question could be found in the Plan document) and that the Third Plan might after all make sense in terms thereof, see the original

papers by Chakravarty and Lefeber [25] and Srinivasan [165].

[37] The resulting economic difficulties were to be accentuated by the Indo–Pakistani war of late 1965 and the concurrent stoppage of aid.

[38] By way of completion, we may also refer to the very recent work of Alan Manne and T. Weisskopf [102] which represents a dynamic, intersectoral model for India, 1967–1975, and is an extension of the CELP type research. Also, we should refer to two papers of interest, by A. Ghosh [58] and K. N. Raj [134], which survey the literature on Indian input–output research and planning models from different points of view.

questions that have led to extended discussion in India and have produced ideas of interest. These relate to (1) the choice of techniques and evaluation of investment projects, and (2) the issues of "financial" versus "physical" planning, "Keynesian" versus "quantity theory" approaches to planning without inflation, short term planning and spatial planning.

Choice of Techniques and Investment Criteria

The question of the choice of appropriate technology has been extensively discussed in India. The debate grew out of the preoccupation of Gandhians with the protection of traditional modes of production such as handweaving and home spinning in the cotton textiles industry (from elimination by competition in the market from modern techniques).[39] Much of the debate on this issue occurred concurrently with the formulation of the Second Plan. With its emphasis on the buildup of the capital goods sector, and also its concession to the demands for protecting the traditional forms of production, the Second Plan represented a curious blend of Soviet and Gandhian economic philosophies—consistent with the reputed Indian genius for reconciling the irreconcilables!

The economic discussion of the issue was largely centered around comparisons among three alternative techniques of weaving, representing different degrees of mechanization.[40] Raj [130, 131] whose

pioneering discussion of this question was to prove fruitful, attempted to show that the rate of return on capital invested in any technique, if the capitalist rules of the game were followed, might not give a 'true' indication of the social rate of return on capital. He obviously had in mind the argument, earlier raised by Tinbergen [170] and others outside India, regarding the possible differences between 'accounting prices' and market prices in many underdeveloped economies. Raj also wanted to take into account the dole to be paid to the unemployed as a part of the cost of using the more mechanized technique, and to include the cost of social overhead involved in setting up highly mechanized new units, which could be largely avoided by sticking to more traditional techniques.

Raj's paper, which was published in the *Economic Weekly*,[41] generated an extensive debate in that journal, with both Indian and foreign economists participating therein.[42] The main thrust of the controversy that followed related to the question of how labor cost should be evaluated from a social point of view. The answer to this question turned, quite naturally, on how the social objective before the planner was defined. If, as Sen [153] noted, the objective was to maximize current output, "surplus" labor was "free" in terms of opportunity cost. If, however, the objective was to maximize the rate of growth of output, then the wage bill represented a

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[39] Indeed, economic policy was to be deeply influenced by such political thinking, supported at times by economic argument. See Manmohan Singh [163] on this question, in the context of its impact on India's export performance in cotton textiles. As we will note later in the text, the Indian economic discussions ignored the effects on foreign trade, via quality effects, although these appear to have been empirically quite significant.

[40] We may also note here the interesting work of Dhar and Lydall [45] and Lakdawala and Sandesara [88] on the economics of small scale industries, which explored the problem of choice of technique, in this context, in a systematic manner.

[41] *The Economic Weekly*, now continuing as *The Economic and Political Weekly*, has occupied a unique place in Indian economic journalism. Founded and edited by Sachin Chaudhari, it has served as an outlet for tentative, economic ideas for many economists in the country, and with its semi-academic nature, it has helped to focus attention on many of the interesting problems facing the country. Among its contributors can be counted practically all the major economists, sociologists and political scientists in the country.

[42] Among the Indian economists in the debate were Ashok Rudra [149], Ajit Biswas [16, 17] and A. K. Sen [155]; the foreign economists were Joan Robinson [147], Charles Bettelheim [3] and Jan Tinbergen [171]. There were also several other contributors: [59].

social cost—provided we could assume that wages would be spent and would thus represent incremental consumption.[43]

However, the following comments on this position are warranted. (1) The conflict between current output and the rate of growth of output arises from the implicit assumption that the rate of savings is a function of the choice of technique and cannot be varied by fiscal policy to desired levels.[44] (2) Furthermore, from a policy point of view, we would have to assume that the government has adequate control machinery for fully regulating the choice of technique but not for varying the savings rate to any desired extent. (3) The argument that the wage bill represents the social cost of consumption must also be modified, as Raj had already noted, by the saving in consumption, if any, in the sector from which the labor "emerged." (4) Also, the formulation of the two objectives, maximization of current income and maximization of the rate of growth, involves juxtaposing two extreme forms of social preferences. The problem could instead be posed, following Ramsey, as one involving the evaluation of the entire streams of consumption associated with the choice of alternative techniques. This is, in fact, how Sen [156] proceeded later to look at the problem although his formal analysis emphasized the possibility of alternative timepaths and the necessity to choose therefrom, rather than formal optimization procedures.[45]

Furthermore, in the attempted application of these ideas to empirical problems

such as the choice of technique in weaving, two major defects were evident. (1) The fact that alternative techniques may have different impacts on quality, and hence also on export performance, was not seriously considered. (2) Moreover, while computations of "reinvestable" surplus were made for each technique, it was forgotten that similar computations would have to be made all the way "backwards" to get a complete answer: the reinvestable surplus may be higher in technique A than in technique B if we take only the final stage of production into consideration, but the ranking may reverse if both direct and indirect reinvestable surpluses were taken into account.[46]

Finally, if we are to evaluate the entire debate as conducted at the time, it is indeed surprising that while the "true cost" of labor came in for a good deal of discussion, the associated concept of the "true cost" of capital did not figure much in the Indian discussion. It was, of course, mentioned from time to time that the market rate of interest did not reflect the true scarcity of 'capital' but it was not quite clear what was meant by such an expression. Some people argued that the current rate of return on capital invested by the companies for which balance sheet data were available constituted the index of scarcity of capital. But there were two difficulties in this case, one due to the unreliability of the estimate of capital as measured by the information given on bookvalues, and the other due to the difference that would normally exist between the average return and the marginal return. However, the question remains as to the relevance of the return on the capital even when one is referring to the marginal return.[47] Such a marginal rate of re-

[43] Little [93], writing independently later, formalized the arguments relating to the "real cost" of labor in the context of well defined models.

[44] This point was strikingly made in the early paper by F. Bator [2] on the subject of choice of techniques.

[45] Sen indicated however the resolution of this choice by maximizing the sum of consumption over a finite planning horizon: this would, however, amount to assuming implcitily a constant marginal utility of consumption. Subsequent attempts at dealing with this class of questions have recently been made by Dixit [46] and Marglin [104]

[46] The fallacy consisted in carrying over an argument, worked out at the macro level, to the evaluation of a micro industry.

[47] For an empirical attempt at estimating such a marginal return, see Eckaus and Lefeber [50].

turn would be an appropriate interest rate for discounting future benefits only insofar as we could assume that the capital market was perfect and hence society was equating the marginal rate of return on cost (in the Fisherian sense) with the marginal rate of substitution between consumption at two consecutive time points. In the absence of such assumptions being satisfied, the appropriate social rate of discount would diverge from the marginal rate of return, the degree of divergence depending upon what time profile of consumption is regarded as optimal by society.[48]

From the foregoing survey, it is clear that the Indian discussion of the choice of techniques was concerned primarily with the selection of an appropriate social rate of return on a unit of invested capital.[49] This problem came to be directly confronted eventually in connection with the cost/benefit analysis of the multi-purpose river valley projects, to which many economists turned their attention.

It would be tedious to attempt a detailed survey of all the studies; besides, their conceptual framework is largely identical. Hence we concentrate on three major analyses of investment projects, to illustrate the full range of methodological issues that were raised in the Indian context. These were the work of K. N. Raj [133] who dealt with some aspects of the Bhakra–Nangal project in the Panjab, of N. V. Sovani and N. Rath [164] who ex-

amined the economics of the Hirakud dam, and of Paul Rosenstein–Rodan [148] who analyzed the economic worthwhileness of nuclear prower production in India.[50] Rosenstein–Rodan's analysis differed from that of Raj and Sovani–Rath, in having *preceded*, rather than followed, the execution of a project.[51]

Raj's analysis was particularly acute in its discussion of the employment aspects of the project, and of its spillover effects in the form of indirect demands for consumption. Among the interesting conclusions he reached was that labor could *not* be drawn away in unlimited amounts at a given real wage rate: more labor could be had only by incurring higher costs to secure the migration of labor from more distant areas. Raj also found that the marginal propensities to consume of labor which migrated to the project site and of labor which came daily from rural households were different, the former having shifted to superior grains. He further noted several areas where the project design had ignored possibilities of substituting labor for capital, thus resulting in unduly high capital and import intensity. The design of the power project also suffered from not taking into account the time and the location pattern of the demand for power which was likely to arise: as a result, substantial investment in transmission lines, among other things, was made which could have been saved by building cheaper sources of power supply.

While, however, the analysis made by Raj clearly indicated that the time factor

[48] In fact, the social rate of discount, the "true cost" of labor and the optimal rate of consumption are all interdependent elements in a single, intertemporal optimizing problem. Hence, it would be inappropriate also to go about setting up numerical values for these magnitudes in an unconnected fashion, as is sometimes done. In this connection see the recent work of Dixit [46] and Marglin [104].

[49] The notion that the shadow foreign exchange rate may be higher than the parity also became more prevalent in the later stages of the discussion, although it had been obscured or omitted from many early analyses, both theoretical and empirical.

[50] Rosenstein–Rodan's analysis was essentially a critique of an earlier memorandum, advocating nuclear power production in India, by Homi J Bhabha, the late Director of the Indian Atomic Energy Commission.

[51] Indeed, one of the major deficiencies in Indian planning has been an inadequate appreciation of the need to analyze critically the economics of major investment projects prior to their approval and execution; there are indications, however, of forthcoming change in this respect. There is also considerable interest now among economists in conducting such studies of industrial plants and projects.

was crucial in evaluating an investment project like the Bhakra Nangal, which locked up an enormous amount of resources over a very long future, he did not make any attempt to compute the present-value estimates of benefits or costs associated with the project. Raj's reluctance on this point was understandable in view of our inability to say anything numerically very firm as to the social rate of discount which could be used to convert benefits and costs accruing at different points of time to commensurable units. But even the use of alternative sets of notional estimates would have been worthwhile to indicate the different margins of choice which existed in designing and implementing the project.

The analysis of Sovani and Rath corresponded to the usual type of cost/benefit analysis. Instead of computing an overall present value, however, they computed an annual cost/benefit ratio on the assumption of a given constant interest rate and a given depreciation flow every year. The interest rate was assumed to be 10%, on grounds which were not spelled out. The relative abundance of labor as a factor in the project design was not discussed; nor were the indirect effects of the project examined. Instead the authors concentrated on computing intensively what they considered to be the direct benefits associated with greater irrigated facilities and greater availability of hydroelectric power. While the use of the apparatus of cost/benefit analysis was a welcome feature of their exercise, the assumptions made with regard to the estimation of benefits and costs were somewhat drastic and could be questioned.

The substantive issues raised by Rosenstein–Rodan, by contrast with the exercise of Raj and Sovani–Rath, included the question of the suitable rate of discount. His calculations, based on data partly supplied to him by Ian Little, showed that the estimated unit cost of electricity generation was highly sensitive to the choice of the discount rate, because the capital costs of setting up nuclear power plants are extremely high. Further, Rosenstein–Rodan raised an interesting question with respect to the social, as distinct from the market, cost of inputs such as coal, which is an exhaustible asset with a highly uneven geographical distribution in India (implying significant transportation costs). Moreover, if a nuclear power plant were to be built, it would have necessitated heavy imports in the early stages. Thus the scarcity value of foreign exchange had to be guessed if the official exchange rate could not be regarded as an index of "true" scarcity.

Aside from all these considerations, there were uncertainties regarding technological progress, which might reduce the costs significantly in the future: the question of the optimal timing of the project was therefore equally important in this case and the possible postponability of the project was an additional factor to be considered. Even leaving out uncertainty, however, any answer relating to timing would require both an explicit assumption relating to the future demand and specification of the discount rate, even when the cost profile is known accurately: however, such an analysis was not undertaken by any of the participants in the debate.[52]

[52] In a nonstochastic context, this question of the optimal timing of a project has been analyzed by Marglin [103] [105]. He shows that the optimal time for construction occurs when the marginal loss in benefits from further postponement just equals the marginal savings in interest costs. Since this rule is too general, Marglin shows that under certain additional assumptions, the above rule could reduce to a simpler rule which says if we assume that the immediate benefit rate from a project will continue over its finite lifetime (whatever that may be), then the optimum time for construction is when the present value of benefits is not less than the cost of the project for the first time. Unfortunately, this simple rule, as Marglin is well aware, cannot be applied to situations involving increasing returns to scale. Since the argument for the nuclear power station was partly

Thus, while the discussion on investment projects which took place in India raised a number of important questions, no specific study of any investment projects undertaken so far can be said to have provided anything like a complete analysis in terms of the social cost–benefit calculus.

Other Issues Pertaining to Planning

Among the interesting debates in India, relating to planning, has been that associated with the notion of "physical" planning as contrasted with "financial" planning.

The phrase "physical" planning, attributed to Mahalanobis, was put forth as a counter to those who wished to opt for a smaller level of financial outlay on the ground that larger outlays would lead to inflation. The argument of the physical planners at the time was that if a set of investment targets was internally consistent and feasible in the sense that enough capacity and labor were available to produce it and the draft on foreign exchange did not exceed export earnings plus committed foreign aid, then there should not be any problem in generating enough "financial" resources to undertake the acts of investment.

But this contention, if taken at its face value, was spurious (despite the fact that it played a major role in getting policy-makers converted to larger outlays on investment). At its essence, the argument presupposes that if, "structurally" or "physically," we can raise the proportion of investment in national income, the necessary *ex ante* savings can be found to make the program "feasible" without inflationary effects. While this is a tautology

at one level, its implication that policy-makers can therefore raise as much savings as are necessary to support the planned investments is clearly untenable.[53] There is no escape from having to investigate separately the problem of generating enough savings to support the projected investment, if inflation is to be avoided. Direct measures controlling the level and composition of consumption may be sometimes called for if the physical planning targets are to be implemented, a fact which was not fully emphasized by the 'physical planners'.

A related fallacy was the tendency, at the time, to argue that if India went in for capital goods production, it would not merely be *possible* to raise the savings–investment rate (by getting over the postulated transformation constraints) but that this would also *ensure* that the savings–investment rate would automatically be stepped up. The basis for this assertion was that "no one can consume capital goods so the only choice would be to have the higher savings–investment rate." It was forgotten that the effect could well be, for example, excess capacity in the capital goods sector or cutting into exports of (traditional) consumer goods (which could reduce imports of capital goods) *unless* fiscal policy was used to raise the savings rate to match the projected increment in the rate of investment.

While the notion of "physical" planning was used by the "big planners" (who favored larger investment outlays) against the more cautious "small planners," the actual fixation of the overall investment targets appears to have been more in the nature of a compromise between these

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based on increasing returns through time, one could not therefore discuss its timing on the basis of the Marglin theorem. The resolution of the question requires an explicit intertemporal analysis of the particular investment projects in question, which was not undertaken by those engaged in this controversy.

[53] In a corn economy, for example, it may be possible to put all corn back into the ground and raise the ratio of investment to national income to 100%; but it would be patently absurd to argue then that, because this is technically or "physically" feasible, the necessary "financial" resources (i.e. savings) can therefore be found!

rival groups.[54] It has further been alleged by some critics that the savings–investment balance worked out in the Plans suffered from an inherent inflationary bias even when the numerical projections looked quite safe on paper. These biases arose from (1) exaggeration of productivity estimates (especially in agriculture), (2) liberal guesses at the 'safe' limits to deficit financing, (3) underestimation of investments in private agriculture and small industry (which generally were 'cut' by the big planners to reduce the total investments, in full knowledge that no reduction would *actually* follow as these were mere estimates and fairly beyond policy control), and (4) failure to make allowance for additions to inventories, not to mention (5) the 'uncovered gap' in the resource balance exercise which was actually published in the Second Plan document.[55]

In this context of fiscal policy programing, which examines whether *ex ante* savings would match the projected investments, we may note that the "Keynesian" approach has now come to stay in India. It has become customary for the Plan documents to present fiscal policy in the context of an overall savings and investment exercise, rather than purely in budgetary terms. This has been the case despite a tendency toward thinking in quantity–theoretic terms on the part of some economists in India.[56]

The question of fiscal policy also raises the entire question of *short–term* (or annual) *planning* in India. There is little doubt that short–term planning, which takes a narrower horizon than the Five Year Plans, is essential in a country such as India where (i) agriculture plays an important role (in exports, industrial production and consumption) but is subject to wide fluctuations in performance—as was brought home to Indians during the two successive and serious droughts during 1965/66 and 1966/67; and (ii) foreign aid also is crucial (in project investments and utilization of industrial capacity). The need to adapt planned expenditures, and economic policies in general, in the light of fundamental revisions relating to critical assumptions, is certainly obvious.[57]

Unfortunately, there has been no serious attempt so far at building a relevant short–term model for the Indian economy, which would permit the policymakers to take informed decisions—a lacuna which became only too obvious when the recent

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[54] The cautious groups have belonged to the Finance Ministry whereas the big planners have been associated with the Perspective Planning Division of the Planning Commission.

[55] Pointing to these factors which build into the Plans a systematic tendency towards price inflation, despite the apparent balancing of *ex ante* savings and investment, Bhagwati [10] has observed that such "overextended" planning is likely to have led to too many starts and too few completions of projects, thereby leading to a serious decline in the overall level of productivity. He has also argued that the protagonists of such a strategy may have thought that, "getting exaggerated Plan targets accepted by the Government would push it into the extra effort (via domestic taxation) which otherwise would not be forthcoming. This strategy presumably relied on the built–in creation of a mildly inflationary situation to put pressure on the Finance Ministry to tax even more than its Plan commitments, quite ignoring the fact that the resulting unrest in the urban areas could possibly prevent the Finance Ministry from taxing even as much as they would have (if the inflation had *not* been deliberately built in) and thus reducing the resultant level of real investments as also their efficiency."

[56] On this issue, see Little [92], Chakravarty [21] and Padma Desai [43]. Further, Little's [94] systematic work on taxation for the Third Plan, for the PPD, was one of the first attempts at conducting the overall savings–investment exercise in some detail, although the Second Plan did contain the rudiments of essentially the same type of exercise. Coming from the side of the big planners, Little's work appears to have had an influential role in the favorable outcome for the big planners.

[57] In this connection, it is interesting that there has been no extended discussion of suggestions such as the "rolling plans" discussed in the Swedish literature. However, the question *has* led to demands such as, for example, having a "core" of "basic" projects and expenditures which would be carried through in any case, with more being done if aid comes through. However, there has been no systematic exploring of these issues.

industrial recession, in 1967, left the policymakers in a position where action had to be taken without any systematic knowledge of key relationships (such as the effect of corporate taxes on savings, pricing policies of corporations etc.).[58] We should note here, however, an interesting, early attempt towards building an econometric model for India, by Narasimhan [122]. Narasimhan constructed an econometric model roughly on the same lines as Tinbergen's pioneering model for the United States and the United Kingdom. Narasimhan's model had 18 equations, of which 7 were definitional, one was institutional and the remaining were behavior equations. While Narasimhan's was a pioneering attempt, he appears to have paid insufficient attention to adapting the Tinbergenesque models to the very different structural features of the Indian economy. These would relate, for example, to the distinction between urban and rural propensities to save, the elasticity of the marketable surplus in agriculture, the distinction between factory employed labor and self employment, and so on. In view of these limitations, therefore, Narasimhan's exercise is best regarded as an exploration of the question of building a suitable, short-term econometric model for India, rather than as a realistic and usable model.[59]

Finally, it is interesting to note that, while Indian planning models have become fairly sophisticated in relation to intertemporal phasing and perspective planning, there has been no comparable extension of analysis to questions of *spatial* planning. This is somewhat surprising in a country with a federal setup and where the constituent States have come to follow increasingly inward looking policies.[60] An important consequence of the lack of spatial planning of industrial targets has been the tendency for the targeted industrial capacities in each industry to be competed for by numerous claimant States, thus resulting in the allocation of plants with uneconomic scale to as many States as politically necessary.[61] While it would certainly be naive to expect that efficient allocation of industrial targets among different States, consistent with the satisfaction of constraints with respect to *aggregate* levels of industrial investments in each State on political grounds, would necessarily be accepted as a politically satisfactory method of spatial planning, it is nonetheless true that few economists gave serious attention in India to this question. An important, recent departure in this respect is the work of Srinivasan and Manne [99] which has brought original analysis to bear upon the policy question of optimal location, size

[58] We may record, however, that in this area as well, more systematic work is beginning to emerge. An example is the detailed study of inventory holdings in the large scale, manufacutring sector by Krishnamurty and Shastri [85] which illuminates an otherwise obscure area of the Indian economy.

[59] In this connection, we may also refer to a short-term policy model built by Padma Desai [41] for India, which was of an illustrative nature. Her model was based on a (3×3) input–output table which was closed with respect to consumption. The exercise was interesting because of the way in which she determined consumption endogenously via the assumption that the propensities to consume of workers in different industries were different. The model could thus predict the effect of changes in exogenous items of final use on sectoral output levels more completely than the input–output models discussed earlier in the text. However, the model did not specify how the instrument variables

at the command of the government were related to the exogenous variables in the input–output sense, so that it was not sufficient for generating a shortterm plan in a complete way.

[60] We take up this question again in the next section, when we discuss the food zones that have operated in India.

[61] This process has been noted, and the lacuna in Indian planning techniques criticized by several economists: see Bhagwati [9] and Hanson [62], in particular. Bhagwati [9] has also emphasized that the uneconomic scale plants may well be economically justified if the spatial distribution of demand and transport costs, for example, make centralized production uneconomic, and that it is the lack of economic analysis of this issue, rather than the actual solutions implemented, which is unsatisfactory.

and expansion of industrial capacities.[62]

Having then discussed the principal issues and models which have emerged in relation to Indian planning, we now proceed to the Indian analyses that bear on questions of agricultural policy.

II. *Agriculture*

Indian agricultural policy discussion has taken place against the background of a trend rise in agricultural production, especially of foodgrains, which has fallen sufficiently short of the growth in demand arising from income and population growth to require continual and significant import of foodgrains under the P.L. 480 program. In consequence, economic analysis has largely been concerned with questions relating to agricultural price and distribution policy, and also the economic efficiency of alternative forms of land tenure and agrarian organization.[63]

In turn, these questions have led to analytical work on a whole range of problems with a direct bearing upon policy decisions.[64] Prominent among these studies have been the analysis of (1) the economic "rationality" of farmers, (2) the response of marketed surplus and production to price changes, (3) the relationship of land tenure systems and agrarian organization to the efficiency of factor use and to the elasticity of marketed surplus, production and investment to price change, and (4) the question of the existence and measurement of disguised unemployment.

Furthermore, Indian economists have also turned increasingly to efficiency questions relating to public agricultural investments. Economic analysis has been increasingly deployed, principally by Minhas [114] and Minhas–Srinivasan [115] to examine problems such as the efficient allocation of irrigation water and fertilizers,[65] although the choice between alternative ways in which farm output may be raised (e.g. land reclamation *versus* intensive cultivation) has not yet been fruitfully explored at an empirical level.

Agricultural Performance

At the outset, we may note that the production performance of Indian agriculture has been the subject of lively debate.[66] Pointing to India's continued reliance on P.L. 480 imports, economists such as Dandekar [33] have tended to dismiss India's agricultural performance as dismal. On the other hand, Raj [135] and Dantwala [34], while conceding the inadequacy of this performance, have attempted to put it into perspective by noting that the annual, compound rate of growth of production of foodgrains at 2.98 per cent and all commodities at 3.19 per

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[62] For general work on "regional" models in India, the survey by Ghosh [58], which we have referred to earlier, is a valuable reference. Aside from the many references there, work on transportation and regional planning models has been done in India by several other economists, including M. Datta–Chaudhuri [39] and K. Sundaram [168].

[63] With respect to agrarian organization, the *social* aspects of alternative policies have also claimed equal attention in the Indian discussions. Cf. Dantwala [35]: "It may be pertinent to enquire as to what has provided the main inspiration for the proposal to impose a ceiling on individual ownership of land: the urge for distributive justice or the necessity of a more rational use of the land surface? The impromptu answer would perhaps be: both. But it would be honest to admit that the prime motivation is distributive justice. In the context of the acute land hunger and millions of dwarf farms, ownership of large areas of cultivated land by a few is considered highly inequitable, justifying the imposition of an upper limit to individual ownership."

[64] *The Indian Journal of Agricultural Economics*, currently in its 22nd volume, is an excellent guide to the full range of problems that Indian agricultural economists have considered from time to time. As already noted earlier, our survey is necessarily selective.

[65] We may also recall here the cost–benefit analysis of Sovani and Rath [164] and Raj [133] which we have surveyed in Part I. See also the excellent review of the literature on application of economic theory to Indian agricultural policy discussion by Khusro [76].

[66] We may note here the important work of Minhas and Vaidyanathan [116] in measuring the rate of growth of Indian agriculture, by 268 districts, for the aggregate output of 28 major crops for 1951–54 to 1958–61. For their method of measurement, including their decomposition of this growth into crop pattern change, productivity and acreage "effects," as also a valuable survey of other work in this area, see Minhas [113]. Parikh's work [127] in this area is also noteworthy.

cent for 1949–50 to 1964–65 does not compare unfavorably with performances in most other countries including those in South East Asia.[67] Moreover, Dantwala [34] has also noted that, contrary to general belief, productivity has also increased through this period, with acreage under all commodities increasing by 8 per cent but production by 34.8 per cent.[68]

Whether one regards the agricultural performance, however, as dismal or just inadequate for India's developmental needs, the pertinent questions are whether (1) governmental policies (especially concerning prices) could have improved it, and (2) governmental policies (especially with respect to internal procurement, imports, private trade and public distribution), were efficient, *given* the agricultural performance. Before we discuss these two principal policy questions at some length, we survey the Indian analysis of the empirical relationships, pertaining chiefly to the marketed surplus and production of foodgrains and overall agricultural production, that have a direct relevance to these questions and have indeed entered into the controversies surrounding these questions.

Economic Rationality in Agriculture

We begin with the literature on the "economic rationality" of the agricultural sector. Whether agricultural and rural people and institutions respond to econom-

ic motivation or are impervious to it is a general question, of which the possible response of marketed surplus and production to price changes (which we discuss in the ensuing sections) are only the most obvious examples. The Indian literature on the broader question of economic rationality in this sector divides itself into empirical analysis aimed at (1) examining the efficiency of factor use within the existing institutional framework, and (2) demonstrating that the institutional framework itself adapts to the profit motive.

(1) Among the principal contributions to the former class of questions is Hopper's [70] analysis of the efficiency of Indian farmers in the allocation of resources. Hopper's method is to estimate production functions for his selected crops[69] and demonstrate that the factors used indeed earn the value of their estimated marginal products. However, as Nowshirwani [123] has correctly pointed out, Hopper's single equation estimation of his production functions leads to estimates that are neither unbiased nor consistent (in a statistical sense) so that Hopper's results must be treated with some scepticism.

Furthermore, we must note a different approach by D. K. Desai [40] to the problem of efficiency of factor use, which aims at discovering the optimal utilization of *existing* resources on individual farms and contrasting the resulting utilization pattern and returns with the actuals. Desai uses linear programing methods for this purpose, utilizing data collected for the Farm Management Studies in two districts of Maharashtra during 1954–55 to 1956–57 and examining forty *individual* farms. This pioneering work has reached the conclusion, at variance with Hopper's, that there is often a significant gap between possible and actual returns to farming, indicating economic inefficiency. However, as Hanu-

[67] Dandekar [33] has noted that if the two (drought) years 1965–66 and 1966–67 are included, the performance looks even less satisfactory; however, Dantwala [37] has pointedly replied that the 1967–68 crop, which is at a bumper level, would bear out *his* notion of the trend. In this context, we may also note that Raj's [138] comparison of the agricultural growth rates in India and Pakistan is a useful corrective to Mason's [106] adverse, comparative view of India's agricultural performance.

[68] However, the performance through the entire period conceals a serious deceleration which sets into the overall growth performance as also in the growth of average productivity, with the Third Plan. Hence, the agricultural performance may have been not merely inadequate but also steadily becoming worse. The 1967–68 crop, however, has been a bumper crop.

[69] The data relate to one Indian village and to the expected output from invested resources of its farmers in a single agricultural season.

mantha Rao has pointed out to us, the gross inefficiencies which Desai's analysis indicates are probably to be attributed to the fact that the results are derived by references to single period, *ex post* price vectors. If *expected*, rather than *ex post*, prices were considered, the results might be significantly different. A similar doubt attaches to Desai's use of given production relationships, which again may lead to inefficiency in the design of the test for optimality: expectations with respect to weather, for example, may significantly alter the crop pattern that may be adopted on efficiency grounds. Apropos of this discussion, it is also pertinent to remember the important distinction that Lipton [91] has drawn between farmers' production response to price change (which we discuss later) and profit maximization. For example, producers responding to prices in a cobweb model may not be maximizing profits in the long run.[70]

(2) The analyses which seek to establish that the rural institutions change in response to economic motivation are of equal interest. While a sociologist such as Scarlett Epstein [52] has attempted cross-section analysis to show this, by contrasting two villages which differ only in terms of the recent availability of irrigated water, Raj [139] has noted that the "sacred cow" is not so sacred after all and manages to get slaughtered even in Hindu-intensive areas if ecological and price factors make it economically advantageous to do so.[71]

Hanumantha Rao's [67] analysis of share cropping is also of considerable importance in this context. Rao shows in an ingenious fashion that share cropping obtains generally in those areas, and for those crops (such as rice and wheat), where the element of innovative management and entrepreneurship is minimized because of lack of significant substitution possibilities among rival crops and factors, and the element of *uncertainty* is thus reduced to negligible levels: "crop-sharing arrangements are extensive under relative economic certainty and fixed contractual payments where the degree of uncertainty is high."

A few comments on this novel idea are in order. (1) Rao's hypothesis, which seems consistent with the cross-sectional facts of the Indian situation as of any one period, would lead to the further refutable hypothesis that, as technological possibilities for application of new inputs such as better seeds and fertilizers are introduced, share cropping would give way to other forms of tenurial relationships. With the introduction of these new techniques in India during the last few years, such an empirical test should be feasible.[72] (2) Further, even if Rao's explanation of the "rationality" (in the sense of its consistency with profit maximization) of share cropping is valid, how are we to interpret its effect on efficiency of the utilization of available resources? An alternative formulation of the rationality of share cropping, in the spirit of Rao's argument, provides a clue to the optimality of share cropping as an institution. If we focus on the *stability* (or stationariness) of the agricultural techniques and acreage allocation possibilities, it is possible to argue that share cropping is consistent with optimality because the shares would come to approximate the level where factors tend to earn the value of their (stable, long-run) marginal product. Share cropping would then yield, on the average, the same results as capitalist

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[70] Lipton [91] provocatively entitles his review of Dharm Narain's work: "Should Reasonable Farmers Respond to Price Changes?".

[71] Raj's cross-section investigation of this question is of further interest because he considers the important, related question of how the cattle stock should be evaluated from an economic point of view.

[72] Rao explicitly notes that: "Crop-sharing may cease to be a beneficial arrangement as modern profitable inputs assume significance. The incentives for increased investments as well as for capturing the returns on such investment may lead to the preference for fixed contractual payments."

methods in a situation of long–run stability characterized by stagnant technological possibilities. A possible test of this hypothesis would be to examine share cropped farms, over a period characterized by such stability, for efficiency of factor-use in the sense in which Hopper [70] has done for his village.[73] Clearly, in any case, Rao's analysis opens up a fruitful area for further empirical investigation.

Behavior of Marketed Surplus

Indian economic analysis has concerned itself with two principal questions relating to the marketed surplus of agricultural foodgrains: (1) does this surplus vary directly with the relative price of these goods or does it behave "perversely"; and (2) what is the share of holdings of different sizes in the supply of marketed foodgrains? The former question has direct and obvious relevance to the issue of agricultural price and tax policy whereas the latter bears on the important question of the economic effects of land reform which involves regrouping of landholdings into different sizes, whether towards smaller holdings via measures such as landholdings ceilings or towards larger holdings via measures such as legislation preventing further fragmentation. Further, the two questions have, in turn, been linked in the analytical discussion by economists who argue that the price response of the small and large holdings with respect to marketed surplus is not similar.

Response to Price Change: Essentially, the question at issue, in analyzing the response of marketed surplus to price change, relates to the elasticity of the Marshallian offer curve of the sector supplying the surplus. And this is indeed how Raj Krishna [80] and T. N. Krishnan [86] have explicitly formulated their analysis

[73] In this connection, it is suggestive that Hanumantha Rao's comparison of the share cropping rental with the output per acre on "capitalist" farms [67, Table 6] shows a similar intensity of cultivation, per acre, on both sets of farms.

of this question. Furthermore such a formulation of the problem directly indicates that positive and negative price responses are both "normal": the offer curve may readily have a backward bending stretch where the elasticity of supply of the (foodgrain) surplus with respect to price change is negative.

Nonetheless, the Indian debate on this issue has elicited arguments, mainly by Khatkhate [71] and Khusro [75], which aim at establishing a priori the "normalcy" or the inevitability of a positive or a negative elasticity. More interesting, however, have been the analyses, principally by Mathur and Ezekiel [110], which have attempted to explore the issue a prori within a framework which differentiates between different size–classes of holdings. At the same time, Raj Krishna [80] and Krishnan [86] have made perhaps the only systematic attempts at indicating what the likely elasticity of the offer curve for foodgrains might be in the Indian context.

Khusro's [75] analysis reaches the "strong" result that farmers will retain more and hence market less, out of given foodgrain production, if the market price is lowered. This is the consequence of his method of analysis which implicitly puts restrictions on the shape of the offer curve. Taking a box diagram as in Figure 1, where AZ is the given output of foodgrains, Khusro draws in PR' as the curve showing diminishing marginal utility of produce retained for consumption and SS' as the schedule representing diminishing marginal utility of sales. Then, equilibrium is at D where the amount of marketed surplus is EZ. With a lower price for foodgrains, Khusro shifts the curve SS' down to ss', when G becomes the new equilibrium point and the marketed surplus has decreased to FZ. This conclusion, however, is the result of two highly restrictive assumptions: (i) separable (and hence cardinal) utility, explicitly noted by Khusro; and (ii) sufficient restrictions on the rate at
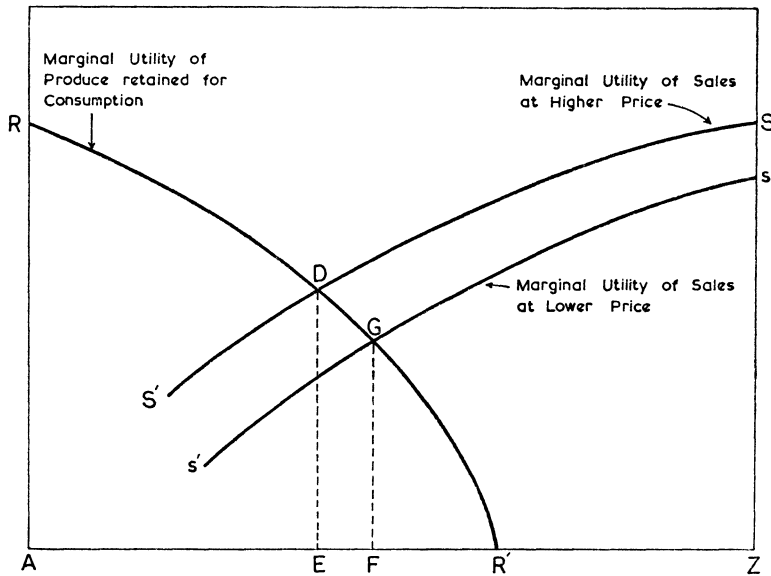
FIGURE 1

which the marginal utility of nonfood-grains falls vis-a-vis the price difference in the two situations, to ensure that the SS' and ss' curves do not intersect.[74] If either of these assumptions is relaxed, the possibility of a negative elasticity of marketed surplus will reemerge.[75]

As with Khusro's attempt, other economists have attempted to argue exactly the opposite proposition on a priori grounds. Thus, for example, Khatkhate [71] has argued that the (small scale) Indian farmer will increase his marketed surplus when price falls "in order to maintain the same level of money income." Mathur and Ezekiel [110] have similarly argued that the subsistence farmers have an inelastic demand for cash and hence "if prices rise, the sale of a smaller amount of foodgrains provides the necessary cash and vice versa. Thus prices and marketable surplus tend to move in opposite directions." The fixed cash needs which these authors have in mind are debt obligations, rent, land revenune and a Ricardian-type bundle of nonagricultural subsistence goods. However, this argument seems tenuous. It implies that, at subsistence level, there is zero income elasticity of demand for commodities other than the foodgrains (produced on the farm) and also a zero substitution effect: neither assumption would appear to be logically or empirically inevitable at a "subsistence" level of farming and income, no matter how subsistence is defined.[76]

Dandekar [31], in examining the Mathur–Ezekiel thesis, has argued that a

[74] Khusro [75, page 278] outlines the second condition as well, though not quite fully. While he mentions that the rate of diminishing marginal utility of sales receipts should be "small," he omits reference to the fact that the price change may be "large" and may outweigh the "smallness" of the diminishing marginal utility, resulting in the interesection of the two schedules and the reversal of his proposition.

[75] Of course, the entire argument relates only to the sign of the consumption effect as price changes. If production were also allowed to vary in Khusro's exercise, and if it was positively price elastic, then the price elasticity of marketed surplus could well be positive despite the consumption effect being positive.

[76] Also note that the Mathur–Ezekiel assumption of "fixed cash needs" is overly sufficient for deriving a negative elasticity of marketed surplus. Further, as Nowshirvani [125] has noted, the negative unitary price elasticity for marketed surplus is implausible on dynammic stability grounds, since it would require the urban elasticity of food demand to exceed unity, which is an implausible assumption.

negative price elasticity of marketed sur-
plus would characterize the farms which
are not too close to subsistence and hence
are large enough to supply marketed sur-
plus and therewith earn cash income and
which are at the same time not large and
prosperous enough to show a "normal,"
positive price elasticity of marketed sur-
plus. Dandekar argues that, for this size–
class of holdings, the negative price–
elasticity is readily explained, not by
reference to a "fixed cash needs" hypoth-
esis, but "as normal consumer behavior
in the face of changing income. When the
price of the crop which they produce
changes relative to other prices, the real
income of the farmers in effect changes.
With lower relative prices for what they
produce, their real incomes are in effect
lower and as consumers they are worse off.
Under the circumstances, they behave like
other consumers at their income level
would do. They must consume a little less
of everything, food and non–food alike
even if they happen to be producers of
food. This is what they do. They consume
a little less of their own produce and con-
sequently sell more of it on the market."
Dandekar reaches this apparently obvious
conclusion by either ignoring the substitu-
tion effect or by implicitly assuming that
the income effect will dominate the out-
come.

Dandekar's analysis of the elasticity of
price response by other size–classes of
farmers is also not persuasive. With re-
spect to the farmers at the bottom end of
the scale, he argues that the absence of
marketed surplus of foodgrains and the de-
pendence "mainly on other means such as
sale of other crops or wages earned from
farm and off–farm employment or even
remittances received from family members
working in cities" implies that the ques-
tion of the elasticity of marketed surplus
does not apply to them. However, this
argument rules out the possibility of a
marketed surplus arising in response to

price rise, for example, via shift in resource
allocation toward foodgrains and/or cur-
tailment in own consumption if the sub-
stitution effect is large. Dandekar's further
contention that, in many cases, the far-
mers in this size–class of landholdings
actually buy foodgrains on a *net* basis, is
also inconclusive in this respect: these far-
mers can still turn into net suppliers if the
price change is favorable enough and the
consumption effect has a negative sign.
Moreover, even on an empirical level,
Dandekar's citation of the data for sale
and purchase of Jawar by the small land-
holdings in the Akola and Amraoti dis-
tricts of Madhya Pradesh for 1955–56 is
not conclusive. The fact that these farmers
purchase *jawar* on a net basis does not
necessarily rule out their selling *other* food-
grains (such as wheat, which is also pro-
duced and sold in these districts), so that
the *net* position on *overall* foodgrains sup-
ply may be different from that on the sup-
ply of only *jawar*. More systematic em-
pirical analysis of this question is clearly
necessary.

Similarly, it is hasty to conclude that the
"large" holdings will necessarily have a
positive elasticity of marketed surplus,
thanks to a "well behaved," negative con-
sumption effect. It is easy enough to im-
agine, for example, a lower price of wheat
leading to greater supply of marketed sur-
plus thereof as the farmer shifts to in-
creased consumption of the inferior cereal,
jawar.

Despite these qualifications, it is clear
that empirical analysis of the price re-
sponse of marketed surplus, which differ-
entiates between different size–classes of
landholdings, is likely to be more insight-
ful than an aggregative analysis.[77] Un-
fortunately, however, the only serious
attempts at empirical analysis of the

[77] Since foodgrains also represent a complex of differ-
ent cereals, the analysis would have to contend also
with (1) their price substitution in production and con-
sumption; and (2) the possibility that some of them may

problem in India have been at an aggrega-
tive level.

Using Rural Credit Survey data on
the market surplus of foodgrains, Krish-
nan [86] has estimated the constant
elasticity demand function: $r\overline{Q} = AP^{-\alpha}$
$(\overline{Q}P)^{\beta}$ where $\overline{Q}$ is the total output of food-
grains in the short–run, P is the price of
foodgrains, $\overline{Q}P$ is the income of the farmers
and r is the proportion of output consumed
by the farmers themselves. He estimates
the elasticity of marketed surplus to be
-0.3030 for the period 1959–60 to 1962–
63. Note, however, that if the price elastic-
ity of production response, which has been
estimated to be positive in other studies
surveyed elsewhere by us, were to be ad-
mitted into this exercise, and the assump-
tion of a constant output thus relaxed, the
price elasticity of marketed surplus could
well become positive.

Raj Krishna [80], in fact, has experi-
mented with different ranges of price
elasticities of output and consumption to
establish that, in the Indian context, the
price elasticity of marketed surplus of a
single subsistence crop (as distinct from
Krishnan's estimate for all foodgrains) is
indeed likely to be positive. Starting with
the simple identity:

$$(33) \qquad \frac{dM}{dP} \equiv \frac{dQ}{dP} - \frac{dC}{dP}$$

where M is the marketed surplus, Q is pro-
duction, C is self–consumption and P is the
price, Raj Krishna further decomposes the
consumption term into income and sub-
stitution effects and then proceeds to put
hypothetical ranges of values on each of
the parameters in the derived expression
for the elasticity of marketed surplus.[78]

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be inferior goods in consumption. In consequence, a
sharp distinction would also have to be drawn between
the price elasticity of the marketed surplus of a single
foodgrain and more.

[78] These values are not entirely hypothetical but are
derived by him from several studies, including his own
study of the production response to price change in the
Panjab [81].

Unfortunately, however, his decomposi-
tion of the consumption term omits the
income effect which follows from the
change in the value of the initial consump-
tion as price changes. Nowshirvani [124],
who spotted this error, has reworked Raj
Krishna's analysis and, on using the same
empirical ranges of values for the para-
meters relating to production and con-
sumption response, finds that it is not
possible to rule out negativity in the price
elasticity of the marketed supply of food-
grains in the Indian context.[79]

*Distribution of Marketed Surplus by
Size-Classes of Landholdings:* Indian anal-
ysis has also extended to the question of
the shares of different size–classes of hold-
ings in the marketed surplus of foodgrains
and agricultural produce in general. Un-
like with the question of the price elasti-
city of marketed surplus, however, this
problem has attracted mainly *empirical*
analysis. Among the contributions to this
area of research, Mathur's [107] findings
on the marketed output of *jawar* in Akola
and Amraoti for 1955–56 and Dharm
Narain's [120] patient compilation and
processing of the relevant information for
the marketed surplus of *agricultural pro-
duce* for India in 1950–51 are of interest.
Raj Krishna's [82] attempt at cross–
section analysis of the marketed surplus,
by size of farm *output*, for rice and wheat
for selected markets has also attracted
considerable controversy in this context.

While these studies agree on the pro-
position that the supply of marketed sur-
plus is not a characteristic of only the
"large" landholdings, they differ on several
other points of substance. While Dharm
Narain finds, for example, that even
landholdings in the size–class 0–5 acres
contribute as much as 20.7% of the value
of their output as marketed surplus (Table
1), Mathur's study shows that the sale of

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[79] We may emphasize however that the negativity of
price elasticity does not imply the unitary elasticity
assumption of Mathur and Ezekiel.

TABLE 1—DISTRIBUTION OF MARKETED SURPLUS BY
SIZE-GROUPS OF HOLDING

Size of holding (acres)	I			II		
	Marketed Surplus (Rs. crores)	(1) as % of value of output	(1) as % of Total Marketed Surplus	Marketed Surplus (Rs. crores)	(4) as % of value of output	(4) as % of Total Marketed Surplus
	(1)	(2)	(3)	(4)	(5)	(6)
0–5	266.7	20.7	24.9	564.0	33.6	26.0
5–10	175.8	14.1	16.4	444.8	27.4	20.5
10–15	54.7	9.7	5.1	170.1	23.1	7.9
15–20	80.1	18.2	7.5	172.8	30.1	8.0
20–25	54.0	20.4	5.0	111.0	32.2	5.1
25–30	65.4	28.8	6.1	116.8	39.7	5.4
30–40	80.5	29.9	7.5	139.6	39.8	6.4
40–50	67.8	38.0	6.3	107.8	46.4	5.0
50 and above	228.0	44.8	21.2	339.9	51.4	15.7
Total	1073.0	21.5		2166.8	33.4	

Source: Dharm Narain [120, 35].

jawar by landholdings in the size–class 0–5 acres is practically nil. While this discrepancy in the results may arise from differences in the concept of the marketed surplus and also in the period and area covered, it arises undoubtedly also from the fact that Mathur's findings refer to a single crop, *jawar*, whereas Dharm Narain refers to agricultural produce in general. As Dandekar [31] has noted, the All–India Rural Credit Survey has shown that this size–class of farmers are typically net purchasers of *foodgrains*, while earning cash income by "*sale of other crops* or wages earned from farm and off–farm employment or even remittances received from family members working in cities."[80]

Another difference of considerably greater policy relevance relates to Dharm Narain's finding that the proportion of output marketed falls until the size–class 10–15 acres is reached and rises rapidly thereafter. An important consequence of

[80] Italics have been inserted by us.

this finding, if statistically valid despite the numerous "adjustments" that have gone into its derivation, would be that land ceilings resulting in breakup of the larger holdings could increase, rather than diminish, the marketed surplus of agricultural produce—ignoring, of course, the derivative effect of any resulting shifts in production itself.[81] Since in Dharm Narain's findings, the distribution of marketed surplus by size of holdings is bi-modal, this would imply that the effect of redistribution and changes in the number of landholdings on the proportion of marketed surplus would be ambiguous in general. On the other hand, Raj Krishna's

[81] We deal with this question separately, when we analyze the response of production to shifts in parameters such as prices and size–class of the landholdings. We may also note here that a satisfactory investigation of the question of the effect of land ceilings and a consequent break up of larger into smaller farms requires a *general equilibrium* analysis, even within a comparative static framework, which would also take into account resulting shifts in the labor force, consumption patterns and relative prices between agricultural and nonagricultural commodities.

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[82] analysis of market arrivals of rice and wheat for certain markets, by size–classes of farm output, reaches the conflicting conclusion that, except for the "very poor, and the very rich" areas, the marketable surplus (M) is linearly related to the level of garm output (Q) by the relation: $M = a + bQ$ (where the estimated 'a' involves a negative intercept). This conclusion naturally implies that shifting output between farms of different size–classes will *not* affect the volume of the marketed surplus if the number of landholdings is not changed; however, if the number is increased via land ceilings, for example, the marketed surplus would necessarily diminish (since 'a' $<$ O).

Raj Krishna's startling finding, however, may be largely due to the fact that, as he had himself noted and Hanumantha Rao [65] has emphasized, he is dealing with a *single crop* and not with the overall marketing of agricultural produce by different farms. Indeed, it would appear that his data must come from farms which produce more than a single crop, or alternatively have income from different sources. As Majumdar [97] has pointed out, Raj Krishna's results imply that the output elasticity of consumption on the farm increases as output, and hence farm income, increases: a proposition which certainly is empirically untenable for India at all farm income levels.[82] Thus, it is only if these samples farms have income from *other* sources that increment in output of the foodgrain crop (rice or wheat) would not imply increment in *overall* farm income and hence would make Raj Krishna's results appear tenable.

But if then Raj Krishna's results for a *single* crop are to be considered to have

come from *diversified* farms, it is not surprising that they are not consistent with Dharm Narain's results which relate to the *entire* agricultural produce from all landholdings by size–classes. If we were to assume that Raj Krishna's statistical results have validity over a wider range of foodgrains and area within the country, despite his careful caveat that they apply only to his extremely limited sample, there would clearly be important economic implications: for, from certain economic points of view, the supply of the marketed surplus of direct wage–goods such as foodgrains may be crucial but the supply of the surplus of overall agricultural produce may not be.

Apropos of this distinction between foodgrains and agricultural produce, we may also note that the precise definition of the marketed surplus is also relevant and would have to be adapted to the policy problem being considered. Thus, for example, Dharm Narain carefully states that his definition relates to the quantities that the cultivating families *directly* market. Thus, insofar as these families may themselves buy agricultural produce from the market or make payment of rent or wages in kind which, in turn, seeps into the market, the measured surplus will differ from the surplus that becomes available for *nonfarm* use. An important consequence is that, insofar as we are interested in the availability of agricultural produce for nonfarm consumption, Dharm Narain's definition will understate the marketed surplus ensuing from the larger farms which make wage payments in kind and whose purchase of agricultural produce is likely to be proportionately lower in relation to their output.

We may also remark that the Indian discussion of the marketed surplus, while it has taken different size–classes of holdings into account as a relevant variable, has not considered the possibility that al-

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[82] $(M/Q)E_{MQ} = 1 - (C/Q)E_{CQ}$, where E_{MQ} and E_{CQ} are the output elasticities of marketed produce and of consumption respectively and C is the consumption. Thus if E_{MQ} decreases with output, as a linear relation between M and Q ($M = a + bQ$) with a negative intercept 'a' would imply, then E_{CQ} must rise with output [97].

ternative forms of land tenure may also affect the overall level of the marketed surplus and its price elasticity. This may be via the efficiency and/or the price response of *production* varying under alternative forms of tenure (such as share cropping and peasant proprietorship). It could also result from differences in *consumption* patterns, for any given level of farm output, that may arise from differences in the distribution of the farm income among rents, wages and imputed self–incomes under alternative tenure systems. Where the tenure systems, in turn, overlap with size–classes (as, for example, when "small" farms are characterized by peasant proprietorship and the "large" farms by tenancy), the causal explanations may also overlap.

Behavior of Production

In contrast to the analysis of the marketed surplus problem, the Indian analysis of agricultural production has been empirically more systematic and analytically more interesting. As with marketed surplus, two of the major problems analyzed have been (1) the elasticity of price response and (2) the relationship of farm size to productivity. At the same time, however, the efficiency of production and investment has been discussed in the context of alternative tenure systems such as share cropping and of agrarian organizations such as cooperative farming.

(A) *Price Elasticity of Production:* There is an important, empirical distinction between the elasticity of price response of total agricultural production and of single crops or subgroups thereof. Furthermore, the elasticity of response to change in the relative price of outputs needs to be distinguished from the elasticity of response to change in the relative price of inputs to output. Each of these behavioral relationships has a bearing upon the Indian policy discussion, although it is only recently that

careful distinction among these alternative concepts has begun to emerge in the policy debates.

Furthermore, practically the bulk of the systematic, empirical literature in this area has been confined to the estimation of production, or rather acreage, response of *specific crops* to changes in the relative price of *outputs*. Recently however Minhas and Srinivasan [115] have investigated the interesting question of farmers' potential response to fertilizer availability at specified prices, using crop–cutting experimental data on fertilizer productivity and *assuming* profit maximization; their work is thus aimed at predicting product response to alternative fertilizer prices but does not estimate it from observed data.[83] We should however note that the fertilizer response functions used by Minhas and Srinivasan cannot be necessarily generalized to Indian agriculture as a whole since they were obtained from experimentation done by the Indian Council of Agricultural Research and there is no reason to treat these as "typical" response functions. Hence the accuracy of predictions based on the Minhas–Srinivasan exercise is likely to be limited, despite its value in providing a systematic analytical framework for doing so.

Among the empirical examinations of the responsiveness of production to change in relative output price are: Raj Krishna's [81] estimation of *acreage* response functions for several crops in the Panjab for the pre–Partition period; Dharm Narain's [121] analysis, stopping short of econometric estimation, of shift in acreage under different crops in response to price change during 1900–39; and Venkataramanan's [173] estimation of jute areas elasticity, with respect to the relative price of jute with rice for 1911–1938. Among the other

[83] Minhas and Srinivasan also investigate the effect of share cropping on fertilizer absorption. We turn to this question later in the present section.

attempts in this direction, we should also note: Rath and Patwardhan's [144] estimation of acreage response functions for wheat for 1950–51 to 1961–62, in connection with their analysis of the impact of P.L. 480 imports on the domestic production of wheat; and Jai Krishna and Rao's [79] estimation of alternative acreage allocation functions for wheat in Uttar Pradesh for 1950–51 to 1962–63.

Other contributions of interest in this area, which depart from the focus on *acreage response to price change*, are (1) by Mann [98] who has estimated the price elasticity of *supply* (as distinct from acreage) of *cereals* (as distinct from a single crop) at 0.275 during 1952–63 in the framework of a simultaneous equations model designed to study the impact of P.L. 480 imports of wheat on domestic foodgrains production; and (2) by Hanumantha Rao [64] who has analysed the Farm Management Studies data on crop patterns in the States of Madhya Pradesh, West Bengal, Madras, Uttar Pradesh, Panjab and Bombay to find correspondence between the relative profitabilities of crops (defined in terms of income per acre) and their relative shares in the gross cropped area:[84] an empirical relationship that is compatible with, but does not necessarily follow from, the assumption that farmers respond to profit incentives.[85]

Quite apart from the differences in the period, area and crops examined, the acreage response studies by Raj Krishna, Dharm Narain and others vary in (i) their methods of estimation, (ii) the specification of the relevant price of the crop, and (iii) the selection of the relevant, *relative*

price. On the method of estimation, for example, Raj Krishna as also Jai Krishna and Rao have used Nerlove–type "adjustment" models which permit separate computation of the short–run and long–run elasticities of response. The other contributors, on the other hand, have used simple, lagged regressions of acreage upon price. As for the specification of the relevant (absolute) price of the crop, different possibilities have been experimented with Jai Krishna and Rao who have tried several alternative prices—preceding year's post–harvest mean and modal prices, three month pre–sowing prices and average of three month pre–sowing and lagged three month post–harvest prices—find, for example, that their best results are with the three year averages of the pre–sowing price of wheat and consider this to be more appropriate in forming the farmers' price expectation than the *post–harvest* prices (used by Raj Krishna and by Rath and Patvardhan) or annual average prices. However, in choosing the most appropriate *relative* price deflator, the general practice has been to take weighted averages of relevant "substitute" crops. The majority of the analyses further distinguish between irrigated and unirrigated acreage, as the substitution possibilities are different for them. Further, many of them introduce overall crop acreage, rainfall and relative yields of the different rival crops as additional explanatory variables.

Among the principal conclusions to emerge from these studies is that Indian farmers vary their acreage under most crops when relative prices change. But can we really claim, with Dharm Narain, that the response is more obvious, and elastic, for pure cash crops than for cereals? The evidence on this issue does not appear to be at all clear. The elasticities of response are certainly large on some of the pure cash crops such as cotton, though not as

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[84] Rao's analysis also differentiates between landholdings by size–class of holdings.

[85] Thus, consistent with profit maximization, it is easy to imagine production functions for rival crops which imply that, in equilibrium at any stated commodity price vector, the shares of these crops in total acreage are inversely (rather than positively) related to income *per acre*.

large on others such as jute and sugar cane. Further, on cereals such as rice and wheat, the elasticities estimated by these authors seem to diverge.

Raj Krishna's estimates, for example, are at 0.08 and 0.14 for irrigated acreage for *wheat*, for short–run and long–run periods respectively. In this result, he is supported by Dharm Narain's finding that, in the four major areas producing wheat in India during 1900–1939, no significant relationship could be discovered between acreage under wheat and its relative price.[86] The work of Jai Krishna and Rao, for the more recent period 1950–51 to 1962–63 for Uttar Pradesh, however, has produced long–run elasticities for wheat acreage which range up to 0.72. Similarly, for *rice*, in Panjab, Raj Krishna's estimates of the short–run and long–run elasticities are 0.31 and 0.59 respectively, indicating again a fair degree of response, whereas Dharm Narain fails to discover significant price–induced shifts in rice acreage for Bengal, Bihar, Madras and Orissa.

The divergent estimates for cereals seem to imply that empirically there is no reason to believe that the acreage response for movements into and out of cereals will be any less than that for the pure cash crops. Nor, indeed, does there seem to be any theoretical reason for such an asymmetry. Indeed, the technological constraints on shiftability of land seem to be the relevant factors in determining the magnitude of the acreage response to price change quite irrespective of the classification of the pro-

duced crops as cereals or pure cash crops. Thus, for example, Dharm Narain did find that for the Aus rice in Bengal, which directly competes with jute for acreage, acreage was indeed responsive to relative price change; and Venkataramanan has estimated the elasticity of jute acreage at 0.46.

We may further observe that if our primary interest is in the elasticity of supply or production response, the acreage response is only an incomplete guide to the total picture. The elasticity of supply response is the sum of the elasticity of acreage and productivity–per–acre responses to price change. Thus the elasticity of supply response is certain to be understated by the acreage elasticity for those crops which have no "substitute" crops landwise but where production can be increased via application of more inputs. Moreover, even if we were to consider a completely neoclassical model with factors (including land) freely adaptable to alternative crop production, a shift to a more profitable crop will generally raise its land productivity if it is intensive in the use of nonland factors and these factors are not in perfectly elastic supply to all crops taken together.

(B) *Production and Size–Class of Holdings:* The focus on production response to prices in the Indian literature has been nearly matched by the economic analysis which has resulted from the finding of the Farm Management Studies (for Uttar Pradesh, Madras, West Bengal, Bombay, Panjab, Madhya Pradesh and Andhra, during mid–1950's) that an inverse relationship obtains between farm size and productivity per acrea. This relationship, which has an obvious bearing upon the policy issues pertaining to land ceilings[87]

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[86] Since Dharm Narain has not undertaken statistical estimation, and his analysis proceeds on the basis of graphical methods, comparison of his work with the econometric results of other authors can only be tenuous. Further, phrases such as "significant relationship" must be construed in a nonstatistical sense when we are referring to Dharm Narain's work. For pertinent criticism of Dharm Narain's omission of statistical techniques, and the dangers of having failed to avoid false conclusions thanks to the presence of serial correlation and an inability to face up to the identification problem, see Lipton's [91] interesting review.

[87] We may also refer to a rather different type of analytical treatment of the question of land ceilings by Khusro [76] who has ingeniously attempted to examine the efficacy of such a measure in terms of the theory of rationing.

and land grouping under cooperative farming and other forms of agrarian organization, has led to attempted explanations by Khusro [74], Mazumdar [111] and Sen [157] and further empirical work by Hanumantha Rao [66] and A.P. Rao [142], among others.

We may note at the outset that much of the important statistical evidence that is available points rather strongly towards the existence of an inverse relationship between farm size and productivity. The Farm Management Studies indeed yield this relationship, whether grouped by size-classes or taken on an individual farm basis as Hanumantha Rao [66] has done for Bombay. Independent survey for Andhra by Rao has also yielded similar results.[88]

Assuming that the results of the Farm Management Studies are statistically valid, what are the possible explanations? For, the implications for policy would generally vary with the explanation accepted. Whether higher productivity per acre also goes with greater *economic efficiency* of the smaller farms will depend critically on the explanation of the phenomenon of higher productivity.

(1) The explanation offered by Sen [157] of an inverse relationship is based on the argument that the smaller farms are characterized by peasant family cultivation and the larger farms by capitalist cultivation. Cultivation is thus carried on the small farms right up to the point where the marginal product is zero (or at least below the ruling market wage) and stops on the capitalist farms at the point where the marginal product equals the market wage. Hence the small farms have higher productivity per acre and are more efficient in the economic sense.[89]

This argument, however, raises conceptual difficulties and is also empirically untenable. If the two agrarian systems *co-exist*, one may ask whether the opportunity cost of peasant family labor is not the wage that the market offers for employment by atomistic capitalist farmers. Thus, if the family is taking a decision on *overall* income derived from input of work-hours by the family as such, then will not the opportunity cost of work on *both* types of farms be equalized and the inverse relationship therefore not explained? The inverse relationship therefore will hold only insofar as we explicitly postulate that the peasant family labor cannot necessarily find alternative employment at the given wage, which is not further flexible downwards, on the capitalist farms and that the probability attached therefore to finding such an alternative employment is less than unity thus making its opportunity cost less than the wage on the capitalist farms. Mere coexistence of the two agrarian systems is not sufficient therefore for the explanation of the inverse relationship.

Furthermore, Sen's argument runs into *empirical* difficulties on two grounds. Several studies show that the small farms, not far from the bottom of the scale,

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[88] On the other hand, we should note here that a few village studies, in depth, seem to throw up results which are at variance with these. Thus A. P. Rao's [142] study of data for six villages in Uttar Pradesh and Panjab shows for example that, if adjustment is made for the fallow lands and the availability of irrigation, output per acre tends to be constant by size-class of holdings. Further, C H. Shah's [161] study of the small farmers in Kodinar Taluka for 1952–53 shows that, for the principal crops: "yields per acre for the small farmers were, in the year under survey, 12.3 per cent lower compared to that of big farmers. Compared to that of medium farmers they were 7.2 per cent lower. In other words, lands in possession of small farmers were less intensively utilized to that extent." Shah does not explicitly state that this ranking would hold for *all* output and therefore it is not *certain*, although quite plausible in view of these crops covering nearly 75 per cent of the cropped area on farms in *each* category, that his results are contrary to the findings of the Farm Management Studies.

[89] The asymmetrical nature of these two agrarian systems, with respect to effects on the efficiency of production, is well known in the trade theoretic literature on domestic distortions and was earlier noted by Bhagwati [8], among others.

themselves hire labor at the margin[90] and even derive income from employment of family members in other occupations,[91] so that the opportunity cost of labor on the small farm is likely to be very real and cannot be dismissed. Moreover, Hanumantha Rao's work shows that the inverse relationship holds even when the larger (presumably capitalist) farms are ranked, so that Sen's suggested explanation is at best incomplete.

(2) Khusro [74] has noted, in particular, that the decline in productivity per acre is reduced significantly when the acreage is "standardized" on the basis of land revenue ratings (which are presumably related principally to soil fertility). Thus, one of the major explanations advanced for the inverse relationship is that the fertility of the soil is lower on the larger farms.

This argument, if accepted, raises the question whether this fertility difference is exogenous or manmade and hence, in turn, to be explained by the fact that the small farms are more efficient economically. If the fertility factor is exogenous, it could be explained by the hypothesis that the larger farms are put together by purchase of land undergoing "distress sale" and that the poorer lands are sold and the better lands retained: thus making the larger farms less fertile on the average than the smaller farms. Further, if the large farms contain an element of conspicuous consumption, the possession of land itself (regardless of quality within a range) conferring status and psychic satisfaction on these large landowners, then it could also be economically profitable for them to purchase lower quality land from the market. An implausible hypothesis is that historically the *fertile*, large farms may have broken down into smaller farms owing to a

more rapid population growth. Sen, who has put forth this last hypothesis, however, forgets that this argument conceals an important indeterminacy which arises from the fact that the size of the family itself may vary by farms owing to migration or other endogenous factors and, if so, the equilibrium pattern of fertility by size–classes may not be characterized by an inverse relationship between farm size and productivity.

(3) Two other explanations related to the hypothesis of "distress sales" of land resulting in the buildup of larger farms, can be advanced. On the one hand, the enlargement of farms by acquisition of plots of land from such sales could well lead to the larger landholdings being characterized by fragmentation of the cultivated area and its being scattered over large distances, thus adversely affecting average productivity per acre and lowering that of the larger farms.[92] On the other hand, the possibility that the smaller farms are in distress could lead to their being more efficient in their use of resources, especially labor and management (the alternative being *ruination*) whereas, as Hanumantha Rao [63] has suggested, the larger farms are less efficient from the viewpoint of production, as they trade off marginal profitability against *leisure*.

(4) Another hypothesis, put forth by Khusro, is that "If there are tenurial disincentives resulting in lower input and output per acre among the tenanted holdings and if the proportion of area leased in increases with size, then the decline in output per acre with size could be partly explained by the operation of tenurial isincentives" [66]. However, as Hanumadtha Rao notes, the evidence on this issue is conflicting: while Khusro has found evidence in support of this hypothesis to

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[90] This is shown by the Farm Management Studies. See Hanumantha Rao [66] and Khusro [74].

[91] This is shown by the All-India Rural Credit Surveys. For details, see Dandekar [31].

[92] This hypothesis could be readily tested through village studies designed to estimate the fragmentation of the farms by size–class of landholdings.

the extent that the proportion of land taken on lease rises as the farm size increases, the findings are just the opposite in the Farm Management Studies.

(5) A possible explanation, similar in spirit to the tenancy explanation of Khusro's, is that the larger farms are characterized by *absentee landlordship*, which results in reduced efficiency through inadequate exercise of managerial and entrepreneurial functions. While this explanation will not explain the findings of the Farm Management Studies, which relate to owner–cultivators *in residence*, it may well explain the inverse relationship in other samples.

Since many of the new hypotheses that we have suggested have not yet been tested whereas none of the traditional explanations we have surveyed appear to fit entirely any of the empirical data (wherever tests have been attempted), it is difficult not to be sceptical about the precise policy implications of this area of analysis.[93] At an a priori level, however, we may reiterate that the question is of considerable relevance to the problem of the optimal agrarian structure. In this context, we may note that Dandekar [30] has drawn upon Georgescu–Roegen's earlier work [57] to argue that, for India where there is (according to him) overpopulation in the sense that the shadow rental of labor falls below the subsistence (and hence the market) wage, the capitalist form of wage–labor organization will lead to inefficient aggregate output and the peasant family system implied by individual peasant proprietorship would be superior. Ideally, this argument would lead to an agrarian structure based on peasant families owning

land in the same ratio as the overall family–land ratio. Such a view however rules out possible indivisibilities, relating to inputs, which may make *cooperation* desirable.[94] Further, as a policy prescription, it is inadequate as it does not take into consideration the economic problems of the transition from one system to the other. We may further observe that, while such an agrarian structure can be demonstrated to be statically efficient, its effect on long–run growth may be deleterious if induced savings are adversely affected and there are political limits to the governmental ability to tax (as there certainly is in India, especially with respect to the agricultural sector). This may happen via savings in agriculture being directly affected through shift in the internal distribution of income within agriculture or via income distributional changes between agriculture and other sectors as the terms of trade between them change in response to the primary improvement in agricultural output and the possible change in the consumption pattern that may be associated with the changed distribution of income within agriculture under the new agrarian structure.[95]

(C) *Tenancy, Share Cropping and Efficiency of Production:* We have already seen how the literature on farm size and productivity has led Indian economists to focus on the relative efficiency of alterna-

[93] Further, we should emphasize that the ranking by private and social profitability of the farms by size-classes may diverge from their ranking by acreage productivity. Also the static efficiency of the smaller farms, if demonstrated, may be consistent with their dynamic inefficiency from the viewpoint of savings, investment and innovation.

[94] Dandekar notes, however, that if the cooperative societies act in a capitalistic manner, they will make the system revert to the inefficiency of the capitalist, agrarian system.
[95] Again, therefore, if we are interested in the related question of what would happen to agricultural output when we have a shift in agrarian structure, we should ideally consider the problem in a *general equilibrium* framework (even if we are considering comparative static analysis). Thus, for example, a primary improvement in agricultural output due to agricultural efficiency could be overcompensated by the secondary reduction in output brought about by an agricultural price reduction induced by a consumption shift away from agriculture, thus leaving us with a net reduction of agricultural output in the new equilibrium.

tive forms of owner–cultivation: the peasant family system and the capitalist employment–for–wage system. Indian analysis of agrarian organization has also been addressed, however, to the question of the effects of tenancy, including certain important forms of it such as share cropping, on the efficiency of production.[96]

In fact, tenancy legislation has been extensively enacted in different States in India, reflecting and in turn stimulating the literature that we presently survey. Indeed, as Dandekar [29] has noted, the Indian planners have increasingly shifted their policy proposals away from the First Plan emphasis on restructuring of land holdings into efficient sized units backed by cooperative organization where scale effects make it desirable (with tenurial, land reform undertaken largely as a transitional means towards this reform of the agrarian structure), towards the Third Plan's exclusive attention to tenurial reform, inclusive of tenancy legislation.

The Indian analytical literature on tenancy has considered, among others, two principal questions of some interest: (i) where the tenant is subject to insecurity of tenure as a result of the threat of possible eviction, does the grant of permanence of tenure by legislation improve efficiency via investment in capital inputs; and (ii) are certain forms of tenancy, particularly share cropping, suboptimal from the viewpoint of efficient factor use?

Among the empirical studies aimed at examining whether the legislative grant of security of tenure to the tenants, where effectively implemented, improves the

efficiency of factor use via investments which would otherwise not be undertaken by the tenant, Khusro's [72] investigation of such land reform in Hyderabad during the period 1948–49 to 1953–54 is noteworthy.[97] He hypothesizes, among other effects, that the land reform legislation would lead to a narrowing of the gap in the productivity per acre between the owner–cultivator and the tenancy groups of landholdings, presumably as the latter group improved its efficiency via increased investments induced by the tenancy reform. Khusro indeed observes that such a narrowing of the gap had occurred by 1953–54. However, the real test is whether the tenancy group had improved its productivity and it turns out that, as Dandekar [28] has noticed, the narrowing of the gap has occurred through a decline in the productivity of the owner-cultivator farmers instead. Insofar as the latter phenomenon is due to factors applicable *only* to the owner–cultivator group (as would be the case, for example, if other provisions relating to the tenancy legislation may have depressed the incentive to invest by this group of farmers),[98] then the observed narrowing of the gap would not support the hypothesis being tested. Furthermore Dandekar has pointed to the wide variations in the acreage productivity of the two groups through the period, thus mak-

[96] There is also a considerable amount of literature on the problems of (1) rural indebtedness and (2) land revenue administration, which we have not considered in this survey. Land reform discussion in India has embraced both these problems. For a reference to the major studies of the latter problem, in the light of the legislation enacted by different States such as Andhra Pradesh and Gujarat to abolish these intermediaries, Dandekar's [28] critical survey is an excellent source.

[97] Dandekar [28] has critically surveyed Khusro's study and three other similar studies, sponsored by the Research Programmes Committee of the Indian Planning Commission, to investigate the working of land reform legislation.

[98] Khusro [72, pp. 61–163] himself offers a different type of reason, also specific to the owner–cultivator group, which is of some interest: "It is well known . . . that land reforms had led to a good deal of resumption of land by owners partly because they wanted to cultivate the extra land and largely owing to expectations and psychological attitudes which this reform had led to. If the land so resumed had in fact been resumed with the intention of cultivation with at least the same standards as already existed in owner–cultivated tracts, the productivity of the owner–cultivators would have remained at least constant. . . . On the contrary it is resumed for institutional and legal reasons to safeguard

ing it unreliable to base any conclusions on a two–year comparison. On the other hand, we should note that Khusro's alternative hypothesis that the increased security of tenure would lead to a shift in the *composition* of the tenant–cultivators' investments towards investments maturing over a longer period seems to be consistent with the developments over the period.[99]

Khusro's study and other similar investigations are thus indicative but not entirely decisive in providing evidence consistent with the hypothesis relating efficiency on the tenant–farm to security of tenure and further empirical work seems called for in this area. Furthermore, we may note that the theoretical basis for this hypothesis, plausible as it seems, may be weak insofar as it is possible to argue at a purely a priori level that the implicit assumption that the cash lease tenant must finance the investments while the landlord may evict him from the lands on which he has carried out improvements may be partially or entirely invalidated by either (1) institutional arrangements for compensation to the tenant for these improvements, or (2) financing of these improvements by the landlord himself, with the return to the tenant's inputs being determined by the marginal productivity thereof. This could happen as the net payoff ensuing from such arrangements ought to induce their acceptance; and the probability of such acceptance may be

high as there would be only two, readily identifiable negotiating parties involved. Whether in fact such arrangements tend to exist in practice and, if so, whether they are extensive is of course an empirical matter on which systematic evidence does not appear to have been collected over a long period and covering much of the country.

A similar theoretical objection applies to the traditional view that share cropping is an inefficient tenurial system, even when the tenancy is fully secure. We have already noted Hanumantha Rao's [67] ingenious defense of the "rationality" of share cropping when the technological possibilities of factor and product substitution are insignificant; and we have already seen how a recasting of such an explanation can reconcile the share cropping system with optimality of factor use. However, even if we were to revert to the traditional frame of analysis, we should not rule out the possibility of suitable arrangements being worked out by the negotiating parties if there is a net pay off to an otherwise blocked act of investment.

At an empirical level, in any case, no systematic attempts appear to have been undertaken so far in India to test for the alleged inefficiency of share cropping. The work of Minhas and Srinivasan [115] which we have already noted, instead tries to *predict* whether, on the assumption of profit maximization and specified technological relationships and prices of output and inputs, the share croppers (with observed shares) will have incentive to absorb fertilizers.[100] In undertaking this analysis, they are careful to note that the uncertainty of the outcome from fertilizer inputs, owing to exogenous reasons (such as weather failure or shortfalls in related inputs such as public sector irrigation) or

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against future encroachments by tenants. Thus the re-sumer has no intention of making any investment on the land immediately or growing crops on it with the same efficiency with which he has been cultivating his other tracts. The result is to push up owner–cultivated acre-age without simultaneously pushing up the production of this class." However, Dandekar has shown that this argument is not supported by Khusro's data, which register no significant change in the acreage cultivated by the owner–cultivators.

[99] This may also account partly for the fact that while the investment per acre *does* show a perceptible increase on the tenant–cultivated farms, their productivity per acre remained stagnant over the short period of the operation of the land reform.

[100] This inquiry was prompted by the shift in India's agricultural strategy, with the end of the Third Plan, towards fertilizer–intensive agricultural growth.

inaccurate application of the implied new technique, would have to be allowed for in predicting the fertilizer absorption levels at the assumed prices. This is important particularly since the application of fertilizers may lead to higher average output but greater variance of output. They also assume perfectly elastic supply of credit at a common interest rate for everybody: hence, credit is not related to farm size and status, as is probably the case in practice. Further, in making their prediction, they assume (with other analysts of this problem) that the *tenant* will be making the investments, so that the higher the crop share accruing to him the greater the fertilizer absorption. However this assumption, often made by the proponents of land reform who recommend higher crop shares for the tenant, may be empirically invalid. If the investment decisions are made, and financed, by the landlords—and politically *they* may have control over the governmental lending institutions in the rural areas, for example—then higher shares for the landlord, *ceteris paribus*, would lead to greater, rather than lower, fertilizer absorption. This issue is an empirical one and does not appear to have been treated systematically in the literature.[101]

The literature on behavioral relationships in Indian agriculture that we have surveyed so far has had direct relevance to the lively policy debate on the appropriateness of the governmental policies relating to pricing, procurement, imports and distribution of food in India. This debate has raised questions, and led to analysis, of considerable interest. It is to these questions that we now turn.

Price Policy and Production

With respect to the effects of agricultural price policy on production, two different questions can be distinguished in the Indian debate. On the one hand, the question of agricultural prices, as such, has been discussed, largely in relation to their *stability* and impact thereof on investment. On the other hand, the question of the *relative* terms of trade between agriculture and other sectors and own–inputs has also received attention. We consider each question in turn.

(A) The desirability of having "guaranteed, minimum prices," announced prior to the sowing season, has been widely emphasised in the Indian literature.[102] Legislative and executive action in this area has, however, only recently begun: with the announcement since 1966 of minimum support prices for several major agricultural commodities such as paddy, *jawar*, wheat and maize, and the setting up in January 1965 of an Agricultural Prices Commission to assist in formulating these prices and the Food Corporation of India in making the necessary purchases to make these prices effective where necessary.[103]

The underlying theoretical basis for the guaranteed minimum price approach seems to have had numerous elements. (1) Dantwala [34], among others, has referred to the "insurance" aspect of such a policy and its resulting elimination, via the provision of a floor price, of that aspect of uncertainty which might deter investment. Whether, however, open market operations in the agricultural market, designed

[101] Some of the land reform studies, however, have distinguished between investments made by the tenants and by the landlords. See, for example, the examination of the working of the Bombay Tenancy Act, 1948, by Dandekar and Khudanpur, surveyed in Dandekar [28].

[102] Cf. Dantwala [34], the Report of the Agricultural Prices Commission on Price Policy for Kharif Cereals for 1965–66 Season [176] and the Report of the 1966, [Venkatappiah] Foodgrains Policy Committee [177].
[103] As happens with many such bodies, the Food Corporation of India has managed to multiply its activities well beyond this area and has even involved itself in fertilizer distribution. Cf. the Foodgrains Policy Committee Report [177].

to mop up supplies when the price tends to sag below the floor price, is a preferable alternative to an insurance scheme which, among other differences, does not involve direct State trade in agriculture has not been debated in the Indian literature. (2) The notion that the minimum guaranteed price, on the other hand, is part of a *stabilization* policy aimed at evening out fluctuations has also been explicitly developed by other economists, including Dandekar [32]. However, the distinction between price and income stabilization for agriculture or foodgrains has been made all too rarely.[104] Nor has the problem raised for buffer stock operations (on which the proposed stabilization measures must rely) by the *trend* rise in agricultural prices been discussed.[105] In turn, the critical question as to whether private speculation itself tends to be stabilizing or destabilizing in the field of agriculture in general, and specific foodgrains in particular, has not received the attention it deserves. The view that private trade is destabilizing (in some sense) and inefficient (in eliminating spatial price differentials, among other things) seems to have been widely accepted as obvious. In this connection, at least two empirical investigations are of

interest. Venkataramanan [174], who has examined the data on spot and futures price quotations at the East India Cotton Exchange, which of course represents a fairly developed market, and stocks of cotton in Bombay, has found that the Keynes–Hicks theory of "normal backwardation" is consistent with the observed facts. Moreover Uma Lele [90], who has studied the sorghum trade in Maharashtra State, for five primary markets in Sholapur district and two terminal markets, has found that much of the regional price differentials (where not illusory and accountable by differences in grain quality) can be accounted for by factors such as transportation bottlenecks, freight costs and governmental restrictions and bans on movements. (3) Finally, nearly all economists writing in this area [32] [34] have expressed the view that, in addition to the "insurance" element, the guaranteed minimum prices should include a margin intended to "help in assuring the progressive farmer that additional effort and expenditure for the purpose of increasing output will bring him an adequate return." [177, 54]. This view amounts to arguing, *ceteris paribus* for improved terms of trade between agriculture and other sectors,[106] which would permit the (relative) influx of resources into agriculture. What would be the optimal policy for bringing about a shift in the agricultural terms of trade and what would be their optimal level are issues which this line of policy analysis opens up. These are also the issues which belong to the second class of questions, relating to *relative* agricultural prices, to which we now turn.

(B) Much of the Indian literature and debate has inevitably dealt with this class of problems, although the discussion has

[104] Dandekar [32, 27] notes the difference but opts for a rather strange solution which aims at *both* price and income stabilization for foodgrains, without considering any alternatives: ". . . , in the interest of the producers, any measures of stabilization of prices such as through operating support and ceiling prices, should be accompanied by measures of income stabilization through appropriate credit and insurance policies."

[105] In deciding on the optimal level of the buffer stock, it would be necessary also to consider the possibility of holding free foreign exchange reserves, with pipelines set up for activating imports when necessary, since instability is likely to arise in respect of commodities other than foodgrains as well. A decision to hold buffer stocks for *each* item (including agricultural produce and foodgrains) where instability will arise may be suboptimal and the holding of foreign exchange reserves instead, or some combination of the two measures, may be superior. This question has been neither posed nor explored in the Indian literature.

[106] This should include improvement in the relative price of agricultural output vis-a-vis agricultural inputs.

been confined to the question of whether Indian agriculture has been subjected, over the first three Plans, to a *trend* situation of price disincentives. Much of this debate has centered on the behavior of the agricultural terms of trade in general, although the foodgrains terms of trade have been distinguished. Furthermore the question of input prices and the net burden of taxation on the agricultural sector vis–a–vis other sectors has also been raised.

Dantwala [34], in an important contribution which surveys the entire range of governmental policies over the period of the three Plans, has critically examined the prevailing view that agricultural prices have had a strong disincentive element. He finds this view inconsistent with the facts insofar as the recorded time series of the agricultural terms of trade fail to register a deterioration over the period.[107] In fact, relative stability over the period, with the exception of a sharp dip in 1955–56 (which led to a rather slow stepping up of public sector investments), seems to have characterized the terms of trade between agricultural and nonagricultural commodities. On the other hand, if we examine the terms of trade between *foodgrains* and nonagricultural commodities, or between foodgrains and the overall index of wholesale prices, there is certainly evidence of a more distinct deterioration during the first Plan period which is eliminated towards the end of the period.

While these facts are interesting in themselves, they beg the more relevant question as to *which* level of the terms of trade, whether between agriculture and the rest of the economy or between food-

grains and other commodities, should be considered *optimal* and whether, in relation thereto, the recorded terms of trade for agriculture or foodgrains were "unfavorable." Dantwala raises this issue tangentially when he argues that, in relation to 1939 prices, the cereals index was already 444 (with 1939 = 100) and the general price index only 380.6 in 1952–53, the baseyear of the new price indices. Hence, *in relation to the 1939 terms of trade*, the evidence over 1951–1966 indicates "favourable terms of trade for agriculture."[108] Similarly, Dandekar's [32] contention that the terms of trade for cereals show distinct improvement during the Third Plan largely in the drought years at the end is also implicitly raising the same unanswered question as to the optimal level of the terms of trade.

It is interesting however that the participants in this debate have not come to direct grips with the fundamental question of determining the *optimal* level of agricultural prices vis–a–vis other prices. Thus, for example, there has been no attempt at determining how these internal terms of trade compare with the international rates of exchange between agricultural and other commodities and whether exchange rate and trade policies conferred an excessive, in the sense of suboptimal, incentive for resources to flow into the nonagricultural sector.

At the empirical level, however, greater sophistication has been introduced into the discussion by examination of the relationship between agricultural output and input prices and the net burden of taxation on agriculture relative to other sectors. Dantwala [34], after making the valid point that little empirical evidence is

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[107] Dantwala [34] makes the important observation that: ". . . For some commodities like cotton, there has been a statutory ceiling on prices, and though in reality the ceiling has never been operative, the office of the Economic Adviser which prepares the index series records only the ceiling prices. Thus, for commodities like these, the index number under-estimates the rise in prices."

[108] Dantwala [34] then notes that "This would perhaps explain why in January 1957, when the [new] cereal price index stood at 95, the Government of India thought it fit to set up a high powered committee "to examine the causes of the rise in prices and to suggest remedial measures."

available and, where available, it does not indicate a high elasticity of response of agriculture *as a sector* to its terms of trade with respect to other sectors, proceeds to examine the available information for input/output prices for Assam, Panjab, Kerala, Orissa and West Bengal and finds conflicting evidence in relation to 1939, while noting the unusually unreliable character of these series. The information on the relative tax burdens, however, is sound and Dantwala quotes Ved Gandhi's [56] thorough work to show that sectorwise agriculture has received exceptionally favorable treatment. This is particularly because of the direct agricultural taxes amounting on the average to no more than 2 per cent of the value of agricultural production during the planning period.[109]

Price Policy, Distribution and Imports

Regardless, however, of the issue as to whether Indian agricultural production was discouraged by governmental failure to provide the optimal terms of trade, the question persists as to whether the entire set of governmental policies, designed to deal with a continuing situation where at constant prices *foodgrains* production was short of the demand fed by income and population growth, were optimal. This question, in turn, has provoked a considerable amount of controversy.

The governmental policy package has essentially involved reliance on largescale P.L. 480 imports to supplement overall supplies of wheat and distribution thereof through a public sector system of fair price

shops. Further for wheat, and more so for rice where there has been no equivalent P.L. 480 program, internal procurement of foodgrains from the producers has been attempted. Furthermore, since 1964, the country has been divided into several food zones which rule out interzonal free private trade: and the perpetuation of this system has been largely defended by reference to the government's procurement and distributional policies.

The policies just described have been severely criticized by Indian economists. However, while there is general agreement that the governmental procurement of internal foodgrains for public sector distribution to the low income groups was totally inadequate and the reliance instead on P.L. 480 imports for this purpose was excessive, the critics have been divided on almost everything else. Thus, for example, Raj [137] has argued that the zonal system has accentuated the reliance on imports whereas Dantwala [34] and the Foodgrains Policy Committee (which included D.R. Gadgil) [177] have contended that the zonal system facilitates greater procurement, implying that, *ceteris paribus*, it reduces reliance on imports. The zones have also attracted considerable controversy in relation to other issues such as their impact on economic efficiency and political integration: Raj Krishna [84] [176] and Raj have been among the principal critics.

(1) The view that the reliance on food imports was excessive and that India could and should have managed without P.L. 480 imports has been variously argued. Raj [137] has argued that imports could have been moderated, even eliminated, as there was enough foodgrain to go around "if distributed equitably."[110] While this is

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[109] Quite aside from the fact that politically it is difficult to tax the agricultural sector, when the bulk of the votes are in that sector, there may be another problem here. From an income distributional point of view, the agricultural sector possibly has a relatively larger proportion of its income originating on the small farms belonging to an income level which cannot be taxed on equity criteria. On the other hand, this implies that taxation (which is necessarily not lump-sum), and hence incentives on that account, will be biased against the non agricultural sector, *ceteris paribus*.

[110] Raj refers to nutritional standards to arrive at an average per capita consumption figure of $13\frac{1}{2}$ ounces as minimum cereal intake and finds that "except in two years (1951–52 and 1952–53), it would have been possible to ensure this from domestic production alone."

a correct statement of fact, it does not rule out the existence of excess demand at a given price for foodgrains, and hence the important question as to whether imports *should* not after all have been permitted (or sought, under the aid program) to moderate a rise in the price. In assessing this question, it is necessary to remember at least two pertinent points: (1) if excess demand for cereals were to be diverted, thanks to rationed distribution for instance, this demand could spill over into other consumption (instead of turning into involuntary savings) and, in turn, cut into exports, for example, and thereby affect the foreign exchange position much as imports of foodgrains would; and (ii) if acceptance of P.L. 480 imports led, in the ultimate analysis, to a *greater* total inflow of foreign assistance, this in turn would be a positive factor in favor of such a policy, *ceteris paribus*. In short, whether self-sufficiency in foodgrains is an acceptable objective of short–term or long–term agricultural policy is itself an issue which must be assessed in the light of a general equilibrium analysis of the entire economic position, including aid flow sensitivity to alternative policies, instead of being regarded as axiomatic.[111]

Raj Krishna's [84] indictment of the governmental failure to step up internal procurement, while imports under the

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[111] Dantwala [34] makes a similar point when he notes, with respect to the possible adverse effect of P. L. 480 wheat imports on wheat production, that: "The major component of P.L. 480 imports was wheat and it is reasonable to assume that these imports affected the prices of wheat or at best also of other substitutable cereals from the consumer point of view, but could not have had much impact on the prices of commercial crops. The expected consequence of this relative shift in prices in favour of commercial crops would be a shift in agricultural inputs for their production. Assuming that this is exactly what happened, would such a development be necessarily injurious to Indian agriculture or the Indian economy as a whole? It is, of course, true that higher foodgrains production is very vital to India's economy, but a stimulated growth of non–foodgrain crops is of no less importance for the overall national economy . . . ."

P.L. 480 program continued, raises similar questions. It is indeed true that the facts on imports and local procurement of grains show a greater amount of procurement in the first Plan than in each of the subsequent Plans (when P.L. 480 imports became available), despite the easier food situation during most of the first Plan. And it is also correct to maintain that such a policy violated the public pronouncements with respect to the achievement of self reliance in foodgrain availability. On the other hand, it does not follow that the policies actually followed were suboptimal if one assesses them in terms of economic efficiency rather than in relation to self–sufficiency as an objective.

(2) We have already noted that the question of the effect of zonal arrangements on the food deficit and import levels has been raised, in this connection, by Raj. In fact, this issue leads us directly into the entire range of questions relating to the economic efficiency of zonal arrangements and their role in a national foodgrains policy.

The zonal arrangements in India sprang up largely thanks to the action of the so–called "surplus" States such as Andhra Pradesh, Panjab and Madras whose primary motivation appears to have been to maintain artificially low prices (in a situation of rising prices) within their boundaries by curtailing the normal outflow of grain through private, interState trade. This phenomenon raises the natural, but unexplored question as to whether the rural interests in the "surplus" states, which are thus being denied the advantages of more favorable terms of trade, are really less influential politically than the urban consumer groups to whose interest the zonal policies appear to cater. Two possible explanations, however, may be worth exploring. (i) On the one hand, it is possible for the more influential, larger landlords to make greater profits under

zonal arrangements by getting access to scarce, State–distributed licenses to export their output of foodgrains to deficit States which have higher prices under these zonal arrangements than otherwise. Such a practice also redounds to the benefit of the politicians who thus develop another area of patronage and possibly even direct profit to themselves. There is some evidence that this explanation might have relevance in Andhra Pradesh. (ii) An alternative explanation may be that the political situation is based in the States on a balance of urban and rural interests. Thus, while food prices are kept low by zonal restriction on the ouflow of grains, the not–so–poor farm groups are "compensated" by the provision of negligible tax rates on agricultural income.[112] The danger in this kind of politico–economic pattern is that ultimately the whole operation would imply that the marginal tax effort, for investment and other purposes, would have to come to rely on the extremely narrow base provided by non-agricultural, urban classes outside of the group sheltered by the Fair Price Shops.

While, however, the zonal system has originated in the actions of the "surplus" States, it has found some distinguished supporters among the economists despite the severe criticism direct at it by several economists. The defence of the system is best summarized in the Foodgrains Policy Committee Report [177]. Arguing that the interState movement in foodgrains should be undertaken only through State operations, and that zonal restrictions on private movement should continue, the Committee have claimed the following advantages for such an arrangement:

First, this is necessary for ensuring equitable distribution to different States;

trade, if untrammelled, would tend to move the surpluses of one State to points of highest purchasing power in another and not to those of greatest need. Second, it would enable Government to keep prices at levels, which are reasonable for both consumer and producer; private trade, by catering for the well–to–do consumer, would be in a position to push up prices, if allowed to compete with Government. Third, if the trade is allowed to purchase within the State and sell outside it on its own account, it would not be possible to ensure maximum procurement by Government and Government agencies.

These arguments, however, are untenable. While it is true that the market system will not in itself correct an undesirable income or consumption distribution, it is a nonsequitur to deduce that the optimal way of achieving a desired distribution is to eliminate the market system and substitute governmental trade instead. The second argument is also a distributional one insofar as we can make any sense of it, and subject to the same criticism.

The final argument, which constitutes really the central defense of the zonal arrangements, is incomplete, even if factually correct,[113] and must be dismissed if the zonal arrangements are looked upon from the viewpoint of economic efficiency. In order to appreciate this, it is necessary to examine the main features of the policy package advocated by the Foodgrains Policy Committee.

They have recommended that procure-

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[112] Similarly, the deficit States "compensate" their urban groups by distribution of Central supplies of imported foodgrains through Fair Price Shops at subsidized prices.

[113] The argument of the Committee that, thanks to the zonal arrangements, the governmental procurement of rice during the 1965–66 season has been higher than during the 1964–65 season, "in spite of a reduction of 17 million tonnes in foodgrain production caused by drought," surely cannot be accepted at its face value. Indeed, the very fact that there was a drought and hence a great demand for fair priced cereals during 1965-66 might have prompted more procurement of rice (as distinct from wheat, where we may note that P.L. 480 imports were undertaken instead); whether the procurement would (as also *should*) have been more or less if the zonal arrangements had not existed remains an open issue.

ment of foodgrains must be undertaken, apart from buffer stock purchases, for distribution at fair prices to certain classes of low income consumers in both rural and urban areas. Furthermore, they have argued that the procurement must be undertaken at prices *below* the market prices in order to prevent the government having to find the resources for financing the subsidy that would otherwise be entailed. Thus the Committee's recommendations effectively involve subsidizing the foodgrains consumption of certain low income groups and financing this subsidy by taxation of the farmers producing these cereals, this taxation being implicit in the fact that procurement would be at less–than–market prices. In this context, the restrictions on private interzonal trade are looked upon primarily as a means of making this procurement "easier," presumably because the apparent element of taxation would be smaller, *given* the fair-price at which procured foodgrains are to be sold, if the open market price in the "surplus" States (where procurement will presumably be carried out) is kept lower by ruling out interzonal private trade.

This view of the policy package, which seems to rationalize the zonal restrictions, is however open to serious objections. There are two particular aspects of this policy which are controversial: (i) the method of subsidising the low income groups; and (ii) the method of financing the subsidy.

Concerning the former question, it is not clear that an outright financial subsidy to the specified low income groups, index–linked to the cereals price index, may not be a less expensive system than a distributive system based on Fair Price Shops, governmental trade and distribution.[114] In assessing this question, we would have to consider (i) the relative efficiency of a public distribution system, from the viewpoint of waste in storage for example;[115] (ii) the administrative costs and feasibility of either system; and (iii) the possible, though not necessarily considerable, advantage of having a State distributional system which can be readily exploited to handle sudden emergencies such as the Bihar Famine of 1967, when an enormous operation to shift foodgrains to this area had to be mounted.

The question of the optimal method of financing the subsidy to the low income groups raises still more complex issues which have not received the attention they deserve. Before we discuss these alternatives, however, we may note the objections to the Foodgrains Policy Committee's assumption that, if one is to levy an implicit tax on the farmers to pay for the subsidy, zonal restrictions make this task "easier." Raj Krishna has argued, in a brilliant note of dissent to the Agricultural Prices Commission's 1965–66 Kharif Cereals Report's similar ideas, that this view focusses merely on the fact that procurement in the surplus States (by the Centre) would be cheaper but ignores the fact that *more* would have to be procured since, with interzonal private trade removed, "the responsibility of meeting the *entire* deficit of deficit States falls on the Central Government." [176, 38]. Raj Krishna has in mind the possibility that politically the deficit States would have to be "compensated" for the eliminated, private inflow of foodgrains. But even if we rule out such a direct "compensation," the problem remains. For as open market prices in the deficit States rise to levels higher than what they would have been if zonal restrictions were eliminated, demand for

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[114] Identification of recipients eligible for the "dole" would be as difficult or easy as their identification for a ration card.

[115] Sundaram's [168] careful analysis of the suboptimality of the existing P.L. 480 landings at different Indian ports, given the ultimate destination points, is also of relevance in assessing this issue.

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foodgrains would be diverted to the Fair Price Shops, thus raising the offtake from these shops and hence also the need for procurement. This would happen insofar as those entitled to access to these shops are not already utilizing it fully in the no–zonal–restrictions situation: as is indeed likely to be the case.[116] Furthermore, even if this were not the case, the rise in the open market price level could certainly lead to politically effective demands to let more income groups have access to the Fair Price Shop system facilities. However, against this, we must balance the fact that, in the surplus States, demand would be diverted *away* from the Fair Price Shop system; hence the *overall* need for procurement, to service the Fair Price Shop system, may reduce rather than increase—a possibility which is ignored by assuming unrealistically that the Fair Price Shops system applies only to the deficit States. The question as to whether procurement will be "easier" under the zonal restrictions system is thus a complex one and cannot be answered unless the analysis takes into account the strength of the low income groups and demand diversion to, and away from, Fair Price Shops as a result of the zonal restrictions in *both* surplus and deficit States: a priori, it is impossible to rule out the possibility that the quantities to be procured will increase under the zonal system.

But, even leaving this question aside, the zonal arrangements conceived as an instrument for securing procurement involving a hidden tax element represent a method of levying taxation that is ethically inequitable, economically inefficient and politically injurious to national integration. Raj Krishna [176] has correctly pointed out that there are "surplus" farmers and not "surplus" States. A policy

which aims at concentrating tax–element–inclusive procurement in surplus States, while ignoring the fact that prosperous or surplus farmers exist even in deficit States, is an inequitable one. Moreover, the tax–element–inclusive procurement of foodgrains which are demanded by the low income groups is economically inefficient insofar as it discriminatorily taxes farmers who happen to be producers of these specific commodities and thereby pulls away resources, *ceteris paribus*, from the production of these commodities. Even if tax–element–inclusive procurement is considered to be the only *feasible* method of taxation,[117] to finance the subsidies for the low–income groups, there is no reason why it should be confined to the commodities which happen to be demanded by the low income groups.[118]

Finally, the zonal system, on which such a procurement system is grafted, must inevitably lead to political disintegration. The cynical reluctance of the surplus States to let their grain be procured for transfer to Bihar during the 1967 famine is only an extreme example of the inward looking approach of these States to a national food policy. A condoning of the

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[116] There seems to be evidence that only the extremely low income groups generally utilize the Fair Price Shops even though more groups have the right to do so.

[117] This is often asserted in the Indian policy debates. However, it is by no means clear that where procurement has succeeded, the price paid has always included a tax element or, when such tax element is present, an alternative form of agricultural taxation would not have been feasible (and possibly preferable on efficiency grounds). This is an important, neglected area of empirical research. We may also mention in this context, while we are essentially discussing alternative forms of agricultural taxation, that Dharm Narain [119], Sen [154] and Bhagwati [4] have discussed the Preobrazhensky-type problem of how the terms of trade between agriculture and industry could be adjusted in order to extract a "real" surplus from agriculture to "finance" capital formation in industry.

[118] We may also note the further point, made by Khusro [75], that, even if the zones were not accompanied by tax–element–inclusive procurement, they would have adverse allocational effects by discouraging the production of foodgrains in the surplus States (which presumably have comparative advantage in such production) and encouraging it in the deficit States.

zonal system would only accentuate these fissiparous tendencies. In fact, as Raj Krishna had predicted, the zoning system has spread to *within* States, with districts turning into *de facto* zones in States such as Madras and Kerala. The argument of the Food Policy Committee [177] in this connection is interesting:

> Another criticism of the restrictions on inter–State movement of foodgrains is that they undermine the unity of the Nation. We do not consider this to be a valid criticism. The system does not envisage a ban on the movement of the surplus from the surplus States to the deficit States. What the system implies is that the inter–State transfers will be effected on a regulated basis by a public agency which is amenable to social control and discipline. In a situation of overall shortage, if inter–State movement of foodgrains is allowed to be undertaken in an unregulated and uncontrolled manner, it would indeed create scarcity conditions in the relatively poorer regions of the country. Such a development can have a far more damanging influence on the unity of the Nation.

This argument, however, has little practical relevance. In practice, for the very reasons that the surplus States have pushed for zonal restrictions, they have frustrated the Central Government's attempts, via the Food Corporation of India, to procure foodgrains for shipment to deficit States and have generally forced the Central Government to resort instead to P.L. 480 imports for such supplies (thus lending substance to Raj's argument that the zones have led to increased imports of foodgrains). To argue therefore for a zonal policy, knowing fully well that the chief supposed advantage from it contradicts the very purpose for which it is politically designed and adopted, is somewhat naive and has inevitably, even if unwittingly, strengthened the interests op-

posed to a truly national food policy.[119]

In fact, it is significant that the move to abolish, or at least enlarge, food zones to include *both* deficit and surplus States in single zones, has come from many surplus States themselves during the bumper crop of 1967–68. With prices sagging in these States, there has been a reversal of their attitudes: the producer pressure groups appear to have become more important and have sought freer access to the deficit State markets. At the same time, procurement has been permitted only at exceptionally favorable prices, leading to an exasperated critique of politicians by the leading zone supporting economist, Dantwala [36]. Clearly, the political assumptions that the zonal system would permit procurement at *tax–element–inclusive* prices, in the interest of a *national* food policy, have been shown up to be, at best, tenuous. However, instead of taking this opportunity to eliminate the zonal restrictions altogether, the Central Government is now in the role of zone supporter, opposing several surplus States' desire to let the zones widen or perish.

Existence of Surplus Labor or Disguised Unemployment

Prior to concluding our survey of the Indian literature on agricultural policy, we must examine the important issue as to whether there is surplus labor (or disguised unemployment) in the Indian economy. The assumption that this is indeed the case has formed the basis, as we have already seen, for much analytical thinking in India.

[119] In this connection, however, we may note (1) that the Central Government's ability to force the surplus States to fall into line and eliminate zonal restrictions might have been seriously inhibited by the fluid political situation within the Congress Party and the critical role played in Prime Ministerial successions, by the Chief Ministers of these States; and (2) the fact that, even if these zonal restrictions were abolished, we could not have ruled out altogether the imposition of numerous clandestine restrictions, on export of foodgrains, by the recalcitrant, surplus States.

Although the existence of surplus labor is regarded as almost self–evident by many Indian economists, and was discussed in early writings of economists such as Bhabatosha Datta, the unorthodox view of Schultz [151] who has used Indian data to argue that the phenomenon does not exist, has prompted renewed interest in the subject. In reviewing this literature, we must begin by differentiating among the numerous alternative definitions of, and hence presumed evidence in support of, the presence of surplus labor which are to be found in the literature in this area.

There are many alternative definitions, sometimes explicit but often implicit, of "disguised unemployment" in the literature, which do not necessarily coincide in scope even within the context defined by the Indian economic and institutional structure. (1) We have the definition due to Arthur Lewis which defines disguised unemployment as a situation under which it is possible to get a supply of labor from agriculture to the industrial sector at a constant real wage. (2) We also have the definition of disguised unemployment as a situation under which the social marginal productivity of labor in a sector such as agriculture is less than the wage rate at which labor can be hired: the wage rate is inflexible downwards because of the biological subsistence requirements. (3) Disguised unemployment has also been defined as a situation where the private marginal productivity of labor is zero in agriculture, so that the withdrawal of labor from agriculture would result in a fall in agricultural output. Even here, it is necessary to make a distinction between a *ceteris paribus* withdrawal and a *mutatis mutandis* withdrawal, as these two alternative varieties of withdrawal would lead to different effects on agricultural output in general. (4) Finally, disguised unemployment may be defined simply as a situation where, given the social objective of maximizing the value of current income, the combination of techniques and resources is such that the shadow wage, and hence the social marginal productivity (SMP), of labor is zero. Our analysis will be concerned with this specific definition: we will review the Indian literature on surplus on the assumption that the objective of the analysts is to discuss and test the proposition that, in the Indian context, the SMP of labor is zero.

Note first that zero social marginal product (SMP) will not necessarily involve zero private marginal product (PMP). If we assume a single sector (e.g. agriculture), a peasant family system of farming and a system of allocation of labor time which involves maximization of family–group income (even if the division of product may be on different principles), zero social marginal product will naturally lead to zero private marginal product. On the other hand, if we were to assume a capitalist system of farming, where landless labor is hired for a wage which institutionally exceeds the zero shadow wage, we would observe a positive marginal product (which would equal the market wage).

Similarly, zero SMP will not *necessarily* imply that, if the labour force were reduced in a sector, that sector's output would fall. Thus in a model where the real wage of agricultural labor is institutionally fixed in terms of a constant utility level derived from consuming both agricultural and manufactured goods, factors are immobile between sectors, there is capitalist farming in agriculture, and the SMP of agricultural labor is zero (with income distribution keeping the unemployed alive), a reduction (say, by influenza) in the agricultural labor force would have no primary impact on agricultural output. On the other hand, it would imply that the expenditure otherwise made by the deceased labor force would now be made by others. If, as a result of this implied income redis-

tribution, the demand for, and hence the relative price of, manufactures falls, we would then have a reduction in the binding nature of the institutional wage constraint and hence greater output of agriculture in the new equilibrium. Conversely, it is possible to show that, even when there is positive SMP in agriculture, the effect of reduction in the labor force may well be to maintain agricultural output constant.

Furthermore, zero SMP does not imply that the supply of labor from the sector where this is so will necessarily be perfectly elastic at some real wage. Thus, for example, if zero SMP (and zero PMP) obtains in a peasant family agriculture, with individual rather than group income maximization such that each individual will equate his average product on the farm with his marginal product in manufactures (a la Arthur Lewis), then successive supplies of labour to manufactures will raise the average product on the farm, consistent with zero PMP and SMP in agriculture continuing, and thus the marginal cost of labor supply from agriculture will continually rise (instead of being constant).

Finally, we may note that the common assumption that surplus labor must be in the agricultural sector, leading to predictions such as the elastic supply of labor to the nonagricultural sector and the constancy of agricultural output as labor moves out of agriculture, is itself restrictive. In essence, we can think of labor carrying a zero shadow wage for the economy *in toto*. If we look at the empirical situations, it is not unrealistic to postulate an economy with a common, institutionally determined wage (which exceeds the zero shadow wage) at which employment is undertaken in capitalist agriculture and capitalist manufactures. In practice, it is also possible to find in fact the coexistence of "family" and "capitalist" modes of production in *both* agri-

cultural and urban areas: so that, in this instance as well, zero SMP may obtain with respect to *all* sectors.

The institutional features of an economy thus have a critical relevance to the manner in which zero SMP "accommodates" itself in the system. Hence, the "tests" and "measures" of surplus labor, which have been devised in the Indian and other contexts, have to be treated with great care.

(1) Thus, for example, it has been argued that there cannot be surplus labor in India because labor is hired at a positive wage in all farms, whether small or large. This argument presumes implicitly that the surplus labor is to be found on the peasant family farms and ignores the possibility that capitalist hiring of landless labor at an institutionally determined wage on all farms is compatible with zero SMP.

(2) Schultz's [151] famous test, on the other hand, has proceeded along a different route. He takes the influenza epidemic in India during 1818–19, arguing that the sudden and significant reduction in the labor force that it entailed provides a laboratory type experiment to discover surplus labor in India. On finding that agricultural acreage (and output) declined in consequence, in the year 1919–20, Schultz concludes that labor was not in surplus in agriculture.

Schultz, however, has another supplementary argument at this stage. He hypothesizes an agricultural production function of the following type:

$$(34) \qquad Q = A \cdot (L)^\alpha$$

where

> Q = output
> L = labor force
> A = technological constant
> α = "labor coefficient"

Arguing that certain unpublished sample studies indicate the value of the "labor

coefficient" to be 0.4, Schultz further fits a regression equation on the data for the reduction in acreage (taken as proxy for output) and in labor force during 1919–20 in ten different States to find that the indicated labor coefficient is 0.349, and the hypothesis of 0.4 lies well within the confidence interval based on twice the estimated standard error of this estimate. Schultz further seems to derive greater confidence in this coincidence (between the values of the labor coefficients in his regression and in the unpublished sample studies) because a study of the share of agricultural income going to labor in Panjab during 1947–48 yields the figure 0.34 which happens to be consistent with the competitive implications of the hypothesised production function for agriculture. How does this argument strengthen the first argument which depends exclusively on showing that agricultural acreage (output) declines with the decline in the labor force? Clearly, if Schultz can produce evidence that the data for the ten States are consistent with the hypothesized production function with coefficient $\alpha > 0$, then he can argue that surplus labor *cannot* exist at all since labor would *always* have a positive (social) marginal product in agriculture. Thus, the second argument is aimed at a stronger hypothesis (namely, that surplus labor cannot exist at all in India, with the given technology) than the first argument (which would only show that, for the range of variation in the labor force which the influenza epidemic entailed, there was a decline in output and hence there was presumably no surplus labor).

At the empirical level, Schultz's argument is tenuous on at least two grounds. (i) The coincidence of results at different points of time (such as 1919–20 and 1947–48) and for different parts of India (which are not exactly integrated in terms of their land or labor markets) does not necessarily reveal a regularity. (ii) Furthermore, Sen's

[159] recalculation of the Schultz regression, adjusting for three omitted States and for errors in estimation of the labor force, yields a labor coefficient which does *not* coincide with the coefficient in the unpublished sample studies and the estimate of labor share in agricultural income. On the other hand, if Schultz is willing to concede the irrelevance, to his 1919–20 test, of the evidence produced for sample villages and different periods, it would be possible for him to contend that his evidence is consistent, as it stands, with the hypothesis of an agricultural production function of the type: $Q = A \cdot (L)^{\alpha} \ (\alpha > 0)$, so that the Indian experience during the influenza epidemic (even when corrected for statistical errors and omissions) is consistent with there being no surplus labour (for any labor-level altogether). In this connection, it is relevant to note Harwitz's result, cited in Schultz [152], that if these Indian data are examined for the null hypothesis of zero marginal product of labor, the null hypothesis is rejected because "the observed data have one or two chances in a hundred of having come from an uncorrelated population, under the rather conservative test of the null hypothesis"; and Schultz's conclusion is valid (only) up to a 5% level of significance on this test.

Furthermore, there are serious objections to Schultz's use of the influenza epidemic as an *experiment crucis*. (1) The influenza epidemic naturally raises doubts (considered to be unimportant by Schultz [152] in light of "medical judgments" obtained, but contested by Reports written at the time) about the debilitating effects on those who survived. This doubt is particularly enforced when we recognize that the epidemic continued, in some degree, into 1919–20 itself. (2) It is also a matter of judgment, left unsettled by Schultz, whether the lapse of just a year, with some continuation of epidemic conditions, was adequate to obtain an adequate test of

whether the "disorderly conditions" still continued and therefore a later year might not have provided a better guide to the required comparison.

Quite aside from these two rather obvious objections (both anticipated by Schultz), which render the conclusions drawn from the experiment fairly tenuous, there are two major critiques which can be advanced against Schultz's conclusions. (3) Shakuntala Mehra [112] has made the significant statistical finding that, if we break down the post–epidemic agricultural year into the two major Indian harvesting seasons, *rabi* and *kharif*, then there is ample evidence that the immediate harvest (*kharif*) after the epidemic registered no significant decline in the output (acreage) level, whereas the decline was concentrated in the later, *rabi* harvest (which, in any case, fluctuates widely owing to seasonal factors). It would appear therefore that Schultz's inference that Indian agricultural output declined with the influenza epidemic is, at best, dubious. In any event, Schultz's failure to take the two seasons into account, and the absence of systematic quantitative analysis of the two harvests, make it impossible to attach any significance to Schultz's conclusion that the Indian agricultural output declined with the epidemic. (4) There is also an analytical difficulty with the argument that decline in the agricultural output with the decline in the labor force implies that surplus labor is zero: the argument is just a nonsequitur, as a general proposition (as we have already seen). Thus consider the case where there is peasant family farming, co–existing with capitalist farming. Let the total labor supply be such that the shadow wage of labor is zero: so that we have "surplus" labor in its fundamental sense. Let further the peasant family work under the rule that the average product of an individual member is equated with the marginal product on the capitalist farms: and let the PMP on the peasant family

farms be zero. If then the labor force declines on the peasant family farms, due to influenza, but the shadow wage of labor still continues to be zero, we would have a higher average product on the family farms, therefore a higher real wage at which labor will be employed on the capitalist farms, therefore a reduction in the agricultural output on the capitalist farms, and hence a reduction in the total agricultural output. Thus, we have again shown the compatibility of a zero shadow wage for labor and decline in the agricultural output as the population (labor force) declines.[120] Nothing can be concluded, therefore, about the existence of "surplus" labor without a careful investigation of the institutional structure of the sector within which surplus labor is assumed to inhere.

(3) There have also been *direct* measures of surplus labor in India, following the classic methods of Paul Rosenstein–Rodan

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[120] Admittedly, this result depends on the twin assumptions (1) of the division of the given supplies of land (and other factors) into two groups: peasant family farms and capitalist farms, and (2) that the individual, rather than the group, on the family farm maximizes income. If we were to relax the second assumption, for example, and assume that the group maximizes income, then the market would equalize the marginal products on both sets of farms and, with the supplementary assumption that each peasant family has sufficient income for subsistence from own–farming, the wage could fall to zero with zero SMP. In such a case, the Schultz test would be perfectly adequate, of course: zero SMP would imply that a decline in the labor force would not affect agricultural output.

We might touch incidentally upon one particular critique of Schultz's test [159] on the ground that the effect of influenza in causing a decline in the labor force is indiscriminate whereas, with a selective withdrawal of the labor force (from farms where there is surplus labor presumably), there might have been no effect on agricultural output. This argument does not seem to be valid. The assumption here is that the withdrawal of labor (in *some* fashion) with zero impact on agricultural output is necessary or sufficient evidence that there is zero SMP to labor in the economy. But, in the particular example that we have used in the text, labour withdrawal *cannot* but help reduce output even though there is zero shadow wage for labor: and it will make no difference to this qualitative proposition whether the reduction in the population (labor) occurs in the capitalist or the peasant families. Conversely, the fact that labor

who ranks (with Arthur Lewis and Ragnar Nurkse) as the early proponent of the notion of surplus labor. The procedure involved is to take detailed surveys of agricultural output and occupations at the village level, with a view to finding out whether, with unchanged agricultural techniques, and taking full account of the seasonal peaks in demand for labor during harvesting seasons, there exists an excess of labor availability over labor requirements.

This kind of exercise, in essentially the fashion described here, has been deployed in the Indian context by Bhattacharjee [15] for the State of Bihar, during 1957–58 in the course of comprehensive farm management investigations. His estimate of "surplus" labor, fully allowing for the seasonal demand for labor at peak level, runs up to 8.6 per cent of the labor force for North Bihar and 19.8 percent for South Bihar, on application of the Rodan method to male labor alone.

The advantage of this method over the others (insofar as it takes into consideration all opportunities for raising output) is that it goes *directly* to the relevant question: namely, whether there is too much labor in relation to existing availability of techniques (which is what zero SMP or

shadow wage of labor means). The real difficulty with the method, on the other hand, is in identifying labor requirements and (in particular) labor availability. The determination of labor availability raises the tricky question of how many hours of work should be fed into the exercise: this is not an easily identifiable technological datum. And the problem could become empirically intractable if we introduced the notion of elastic supply of labor services with respect to rewards.[121] In practice, the estimates have involved adjusting for holidays, festivals, environmental constraints (e.g. "in the month of May the extreme heat makes it physically impossible for any worker to work more than six hours per day in the field" [15]), and then estimating an approximate number of hours which may be expected to be "normal" as far as work is concerned. Shakuntala Mehra [112] has adopted essentially the same approach, in making her estimates of surplus labor in India (from data on labor utilization for 1956–57 and on labor availability for 1961): the only difference consists in explicitly taking her "normal" hours from the "large, capitalist" farms where such normalcy is assumed to obtain (on the ground that surplus labor, and resulting work-sharing, would arise only on the small farms without hired labor). Her estimates also point to the existence of significant amounts of surplus labor in different States (with the exceptions of Gujarat, Maharashtra and Andhra Pradesh). We might note, however, that her actual method is likely to understate the amount of surplus labor, in relation to Bhattacharjee's [15] application of the

can be reduced on some farms without affecting their output may merely reflect the fact that they are totally isolated from the rest of the economy with own factors of production which are not mobile, and the shadow wage of labor for the sector as a whole may be positive (implying "absence of surplus labor").

We may finally note, in reference to the Schultz test, that on examination of the labor force and agricultural output data for the period of the Second World War, for districts in Panjab where there was a significant military draft resulting in declines in the labor force, there appears to have been (according to unpublished work of Manmohan Singh) no impact on the agricultural production in these districts. Clearly, a careful study of this experience (adjusting systematically for trend growth of output resulting from mechanization and impact of possible improvements in the agricultural terms of trade during the War) would be more fruitful than of the influenza episode with its possible complications from factors such as the impact of the epidemic on efficiency.

[121] In this context, we may note that Rosenstein-Rodan and his followers have always noted explicitly that, if those "left behind" did not in fact work the number of hours postulated, in view of "preference for leisure" or on "status" grounds, the actual removal of the estimated surplus labor would reduce output. The recent explorations of the preference-for-leisure hypothesis [158] were thus clearly foreseen by these economists.

Rosenstein–Rodan method at village level, because she estimates the amount of surplus labor on the farms alone: insofar as the landless labor also work less than the postulated "normal" hours, *their* "surplus" labor would be missed out.

Having thus reviewed the literature relating to the major issues in Indian agricultural policy, we now proceed to the final section of our Survey, addressing ourselves to the foreign trade sector.

III. *Foreign Trade*

The Indian policy literature with respect to the foreign sector has been concerned primarily with issues raised by foreign aid, private foreign investment, and trade and exchange rate policies.

(A) *Foreign Aid*

We have already discussed, in Part I, the major issues raised in the Indian literature, relating to the implications of foreign aid for planning investment allocations. The use of "aid to end aid" by a specified time horizon has been the framework within which some important planning exercises have been cast. The political counterpart to such economic analysis has been the appealing notion of ultimate "self reliance"; its conflict with the view that foreign aid must continue as long as the income gap between the affluent and the underdeveloped countries is not drastically reduced has not been noticed. At the same time, economists such as Sengupta [160] have plausibly argued that there is little evidence that the Indian planners have taken seriously their continually receding terminal dates for the net inflow of aid to cease. Both the savings and the trade implications of such a program have been shown by Sengupta to be unrealistic.

The Indian literature has also been concerned with the question of aid tying, by project, by commodity and by source. The prevalence of excess industrial capacity since the Second Plan has been attributed

by many economists, including Reddaway [145], to the fact that the foreign aid to India was excessively tied to projects and thus led to creation of more capacity even when the existing capacity was not fully utilized.[122] On the other hand, since the devaluation of June 1966, several Indian economists have felt that there has been too much nonproject, and too little project, aid: a viewpoint which emphasizes that the efficiency of the aid flow may be jeopardized as soon as the aid is tied, whether to projects or to "maintenance" imports.

The source tying of aid has also been widely considered wasteful, although analytical work on this issue is only recent. While there are as yet no quantitative estimates for India, of the cost of source tying when switching possibilities have been exploited, Lal [89] has recently shown, using data supplied by the Imperial Chemical Industries, that these costs may be quite significant in the chemicals sector. Moreover, at an analytical level, Bhagwati [13] has argued that (i) measuring the costs of aid tying by source via estimation of the excess cost of the actual bundle purchased may under–or over–estimate the "true" cost in the Hicksian sense of compensating variation; and (ii) a sharp distinction needs to be drawn between the observed costs and the *minimum* costs that would have been incurred if the recipient country were to exploit fully its switching possibilities (as, in practice, it rarely does). Thus, for example, with reference to the latter point, Bhagwati has argued that India's import licensing system, which specifies items on licenses by source and then makes these licenses totally nontransferable in all respects, results in *double* tying (by source *and* specification) even

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[122] On the other hand, other economists such as Bhagwati and Padma Desai [14] have pointed to other, domestic policy induced factors which may have also accounted for such excess capacity. We discuss these factors later, when we survey the trade policy literature.

when the donor country does not itself insist on commodity specification; and that such double tying increases the possible monopolistic charging of prices on aid financed goods beyond what mere source tying might have brought about.[123] Furthermore, both Bhagwati and Honavar [69], who draws upon Indian experience, have highlighted important respects in which the costs of aid tying by source may be understated by such excess cost estimates: distortions of priorities owing to nonavailability of priority items from a tied source when all switching possibilities are exhausted; recurrent excess costs on maintenance, spares and inputs; social waste inherent in techniques unsuitable to local conditions, and other similar factors.[124]

The tying of aid by commodity, essentially P.L. 480 imports, has also attracted considerable controversy. We have already discussed the literature which is concerned with the impact of P.L. 480 wheat imports upon distribution, as also production. We may however observe at this stage (i) that while P.L. 480 imports certainly reduced wheat prices in particular, and foodgrain prices in general, below what they would otherwise have been, *ceteris paribus*, and (ii) that wheat production, being generally responsive to price change, must have been therefore below what it would otherwise have been, *ceteris paribus*, it would be a

nonsequitur to argue that therefore imports of wheat under the P.L. 480 program were "undesirable." This question cannot be assessed unless a framework has been devised to examine the optimal prices and quantities of agricultural and foodgrains outputs, in the light of the international and domestic possibilities (including aid availability). In any case, the indictment levelled at P.L. 480 imports by many Indian economists appears to have been, not that aid was tied to these commodities *beyond* what Indians wanted (a possibility that has not been fully investigated in the literature[125]), but that the Indian government itself was keen to get the P.L. 480 aid and that the availability of such aid was determental to the economic interest of the country.[126] Aside from the depressing effect on the resource allocation to agriculture, which we have already touched upon, economists critical of the P.L. 480 program have alleged that the sheer availability of such aid has prevented the government from pushing ahead on the agricultural front organizationally. Insofar as it can be shown that mere drive and organizational energy could have increased agricultural productivity, and that this opportunity–costless gain to the economy

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[123] Bhagwati has shown how *both* priorities in respect of what commodity imports should be allowed *and* satisfaction of source constraints could be achieved, without the ill effects of double tying, merely by making the licenses swappable for imports of the specified items from different sources: $100 worth of U.K. lathes, for example, being turned into $100 worth of French lathes, and $100 worth of the French diesel engines into $100 worth of U.K. diesel engines.

[124] Honavar in particular has noted how, in consequence of source tying by most donors, many Indian factories look like "international exhibitions" of machinery from different parts of the world. He emphasizes the fact that such a building up of plants will frequently add to maintenance and inventory costs by eliminating possible economies of scale which follow from plants put together more homogeneously.

[125] The fact that the Indian government was often keen to sign the P.L. 480 agreements does not rule out the possibility that one, and perhaps a principal, motivation (in some years at any rate) might have been a recognition of the possibility that it was easier to get P.L. 480 aid rather than other forms of aid.

[126] Political objections to reliance on P.L. 480 aid have also been numerous. It is, for example, widely felt that the country must feed itself from domestic production. "Food and freedom" is the title of a reputable economist's work on the problem; and it has been argued, again by an academic economist, that genuine independence is impossible if one eats foreign foodgrains! A more respectable political objection has been raised in relation to the use of counterpart rupee funds: it is felt that the availability of such funds, and the desire not to see them accumulate too rapidly, makes it possible for the donor country to incur expenditure within India which would be ruled out for other, ideologically–oriented donor countries. This is believed by some critics to be the case, for example, with respect to expenditure on Indian education out of P.L. 480 rupee proceeds.

was lost, thanks to the P.L. 480 availabil-
ity, this would be a valid criticism indeed
of that aid program—or of *any* aid pro-
gram which permitted, either directly or
through switching, foodgrains to be im-
ported readily. However, such a case is
empirically difficult to establish and has
not been persuasively made so far despite
its plausibility for many economists in the
country.[127]

(B) *Private Foreign Investment*

Although private foreign investment in
India, whether gross or net of the outflow
of (mainly) the pre–Independence British
investments, has been relatively unimpor-
tant in relation to the official capital trans-
fers, it has attracted considerable atten-
tion from the economists. There are basic-
ally two types of questions that have been
asked: (1) is private equity investment
superior to official loan transfers; and (2)
what restrictions must be placed on the
inflow of private capital, from the view-
point of social welfare?

(1) The first question is somewhat aca-
demic in view of the fact that private in-
vestment and official transfers have hardly
ever been substitutes in Indian planning:
official transfers have nearly always been
accepted to the full amount offered and
private foreign investment has always
fallen short of levels projected in the
official documents. Any choice between
them is therefore unreal. Nonetheless, Raj
[135] has raised this question at an aca-
demic level in the Indian context,
prompted by the attempt of the Finance
Ministry and private industrial interests
to liberalize the rules on private foreign in-
vestment on strength of the argument,
among others, that private equity invest-
ment is less expensive than official loan

capital. The rather strange proposition
which Raj has criticized involves asserting
that "since in the case of loan capital . . .
both the principal and interest have to be
paid over a defined period it is more
economic, from the point of view of saving
foreign exchange, to depend on foreign
equity capital from private sources since
only remittances of profits have to be met
in foreign exchange and these too will be-
come large only after the enterprises con-
cerned have matured and begun to yield
large profits." [135, pp. 21–22]. Raj has
countered this view by examining the
actual rates of return on equity capital
which are available for India and else-
where, against the average terms of official
aid. In any case, it does not seem sensible
to argue that aid terms which conceal
varying amounts of real transfers of re-
sources should work out in general to be
less attractive than commercial terms (or
equity capital) if one evaluates the alter-
natives in terms of an objective function
other than the unacceptable one of reduc-
ing the short–run outflows of interest and
amortisation.

(2) The question of the restrictions on
private foreign investment has raised at
least two issues of wider interest.

(a) Should there be any restrictions on
the *areas* which private investment could
enter? While such restrictions have often
been urged on political grounds, several
economists have also sought them for
economic reasons. The notion that private
foreign investment should be confined to
only the "priority" areas has been wide-
spread in policy discussions. However, this
view must be qualified in three ways. (i)
Insofar as the investment consists in buy-
ing up *existing* capital stock, even in non-
priority areas, the inflow of foreign ex-
change can always be utilized for "pri-
ority" uses. (ii) If the investment involves
fresh creation of capacity in "low-priority"
sectors, again it must be remembered that
if the overall Plan allows for the creation

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[127] A notable sceptic of this argument, and the general
thesis against the advisability of P.L. 480 imports, is
Dantwala [34]. On the other hand, a different, though
not overly critical view, is presented by Streeten and
Hill [166].

of such capacity anyway, it does not matter whether foreign or domestic investment goes into it. (iii) Where, however, the foreign investment is being offered for areas which are "nonpriority" and hence ruled out from domestic production and availability, there is a real dilemma which cannot be resolved unless again the economist is prepared to estimate the cost (if any) of foregoing the act of foreign investment—assuming that the alternative is the loss of this capital inflow—and ask the planner or the politician whether the presumed noneconomic advantages from ruling out such commodities from domestic production or availability outweigh these economic costs.[128]

On the other hand, some important factors in the Indian context have made governmental restrictions on the entry of foreign capital into specific areas necessary. (i) Since, as we shall presently see, the Indian trade regime has worked on the principle of automatic grant of protection to domestic industries, combined with restrictions on domestic entry operated through industrial licensing, monopoly rents accrue to investments in several activities. Hence, there exists a second best case for regulating entry into areas where the monopoly rents are likely to make the returns to foreign capital exceed its social marginal product.[129] (ii) Furthermore, in a

system reliant on foreign aid for maintenance imports, significant linkages can exist between the level of aid inflow and the level of inflow of private capital.[130] Foreign investors often become powerful pressure groups for increasing aid for maintenance imports to keep their capacities better utilized and hence their investments more profitable. In Indian experience, aid loans have thus been secured from donor countries, with commodity specification *combined with provisions for allocations to the firms from these donor countries*. In such a case, provided such provisions are effective despite switching possibilities, there may exist again a case for ensuring that private foreign capital flows into "priority" areas so that the attendant, discriminatory aid allocation is biased towards, rather than against, the priority sectors. Thus, there are *both* domestic and foreign policy distortions which may make regulation of the sectoral *composition* of the private capital inflow desirable. (iii) Yet another argument which has come up in Indian discussions, for regulating the inflow of capital into certain sectors, follows from the fact that the foreign investing interests in some sectors are monopolistic, as in oil, and governmental intervention may help to increase the net payoff accruing to the country from the proposed act of investment. This is a case where governmental intervention becomes necessary, not because of policy induced distortions, but owing to the presence of endogenous distortions (such as the fortuitous presence of monopoly power). How far such governmental regulation is likely to help is of course an issue on which one might be sceptical; this is part of the more general problem arising when, as Dudley Seers has shrewdly put it, "small countries" face "big companies."

[128] Cf. Bhagwati and Desai [14] on these and the other issues we review in the text.

[129] In relation to this question of domestically created monopoly, Bhagwati [11] has also argued that, where components are sold for assembly, the monopoly profits may be made by "overpricing" the components along with raising the product price to a monopolistically-profit–maximizing level. This has the dual advantage of making the latter price look "reasonable" (since the costs can be shown to be higher this way) and also masking the repatriation of profits (which otherwise attract hostile attention). Another aspect of such a phenomenon is that [12] [14] the economist may then observe "value subtracted" or negative value added at international prices, such an observation implying then, not that the process is not worthwhile *in itself*, but that its possible contribution to national income is outweighed by the monopolistic "exploitation" by the investor.

[130] Hence, private capital inflow may have an externality effect in the form of additional aid flow, thus increasing the optimal level at which private capital would be useful to have.

(b) Another area in which governmental regulation has been proposed by several Indian economists relates to the occasional imposition by foreign investors, on their local counterparts, of a contractual prohibition of export to third markets. Kidron [77] has perceptively noted that the bulk of the new quantitative–restrictions–jumping foreign investment in India is by firms who wish to retain their Indian sales *without jeopardising their third country exports.* This is also the case with firms which are basically selling *both* technology and product, who while selling knowhow to India wish at the same time to safeguard their export of products to other markets. In either case, the effect is to interfere with India's export potential, particularly as India is increasingly relying at the margin on the exports of her newer manufactures. Economists such as Raj have therefore pressed for the prohibition of clauses restricting exports from India.

(C) *Trade and Exchange Rate Policies*

The literature on India's trade and exchange rate policies, involving the entire effective exchange rate system, has also raised some issues of general interest. Among other things, it has cast additional light on the drawbacks of a regime involving continued reliance on quantitative restrictions (especially when operated so as to provide automatic protection) and a pattern of reluctant exchange rate adjustments.

Import Controls: Beginning essentially with the 1956–57 foreign exchange crisis, India has been on a strict import and exchange control system. Furthermore, this system has been administratively operated (at least until the June 1966 devaluation of the Indian rupee) such that (1) all industrial capacity creation has been regulated by industrial licensing, extending to the so–called CG licensing of imported capital goods and (2) most input and raw material allocations have been allocated via the so-called "actual user" (AU) licenses, directly to producers.[131]

The allocations under the AU category, to which in particular considerable attention has been directed by economists [162] [14], have been worked on two basic principles: (i) "essentiality" and (ii) indigenous nonavailability". For every AU import, some specified agencies of the government must certify that they are "essential" for production *and* that they are not available from domestic sources. Since the latter principle has been operated virtually without reference to the cost of domestic production, it has amounted to giving automatic and anticipatory" protection to domestic industries. Panchmukhi, Bhagwati and Padma Desai [126], who have estimated the resulting effective rates of protection, for different Indian industrial processes for 1961 and 1962, have found these protective rates going up to levels as high as over 10,000 per cent, with others at almost as high negative values: the range thus being enormous. These results merely underline the totally unpredictable, extreme and often bizarre nature of protection given by a QR–regime operated on the principle of automatic protection.[132] In this connection, the devalued role of the Tariff Commission, whose work has been studied in depth by Padma Desai [44], and the critique of the new era of indiscriminate protection through QR–policy in his Presidential Address to the Indian Economic Association by Lakdawala [87], are of some interest.

Bhagwati and Desai [14] have further noted that the principle of automatic protection issuing from QR's creates a bias in

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[131] In addition, of course, there have been licenses for export promotion under the import entitlement schemes, and other minor categories. For detailed description, see Shourie [162] as also Bhagwati and Desai [14].

[132] Panchmukhi, Bhagwati and Desai [126] also raise some conceptual questions of importance relating to the notion of effective protection when the calculations are based on import–premia–determined implicit rates of tariff.

favor, *ceteris paribus*, of industries with imported, as distinct from domestically produced, inputs. Insofar as the *quantity* of import allocations tends to be inversely related to the availability of indigenously produced inputs, under such a system, there would result a bias in the effective incentive provided to the processes using relatively more imported inputs: they would be able to get relatively greater allocations of imports under AU licenses and hence obtain these inputs at import–premium–*exclusive* prices (which would include only the explicit tariff duty) whereas the other industries would have to buy import substitute, indigenous items at premium *inclusive* prices (since these items would fetch a price equal to the c.i.f. price plus the import premium). The effective incentive given to the former industries or processes would thus be greater, *ceteris paribus*.

Furthermore, aside from the traditional discussion of delays, lack of coordination among different licensing agencies and similar administrative deficiencies which reduce the efficiency of a QR–regime, the Indian import control policy has also been alleged to have operated, in the ultimate analysis, without any *economic* criteria [14] [162].[133] Economists investigating these criteria have argued that these are rarely defined; that (in view of the multitude of activities which demand these import allocations) they could hardly be defined; and that in practice rules of thumb have had to be used, these rules often (though not always) taking some notion of "equitable" distribution as the operative guiding

principle. This finding has its counterpart in the conclusions of the Raj Committee's Report of Steel Control [178], and indeed in nearly all the empirical studies relating to the working of the controls of scarce materials.[134]

Concerning the particularly widespread rule of thumb which related the AU allocations of materials to installed capacity, it has further been argued [14] that this procedure creates a bias towards the creation of capacity despite the underutilization of existing capacity. This may be because an entrepreneur who wishes to extend capacity utilization may not be able to do so as legal access to more materials is virtually ruled out by the import licensing system (except since recently, on a limited account, through the import entitlement licenses marketed by exporter). However, even if access to such materials were freely available, the fact that additional capacity installation would result in *pro rata* grant of import–premium–exclusive imports under AU licenses whereas additional utilization of existing capacity must be through purchase of import–premium–inclusive materials from the market, would bias the choice at the margin in favor of the former course.

Moreover, the fact that the reliance on QR's also implies a loss of "revenue," in relation to an import rate change which would mop up the premium, has been among the principal motivating factors behind the Indian literature proposing an exchange auction system, which was sug-

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[133] Whether even the Mahalanobis–type strategy has been consistently followed in this area has been a matter of some controversy. Hazari [68] has argued for instance that Indian luxury goods production (and hence consumption) has been allowed to absorb, directly and indirectly, a fraction of the available foreign exchange which is not negligible. Of course, whether the luxury expenditure would not otherwise have been diverted into other areas where it might have cut into exports, for example, needs to be investigated in order to arrive at a more adequate picture.

[134] In this general connection, the following quote from Raj Committee [178] is particularly revealing: "As regards priorities, the Iron and Steel Controller gives different ratings of priority according to the nature of each case. Thus some indents receive 'over-riding' priority and others 'top priority'; the categories of priority have further proliferated and we understand that there is now even a category of 'red hot priority'! As already pointed out, the Iron and Steel Controller's Office does not have with it data relating to outstanding orders with the producers classified according to priority and non–priority indents ... there is no systematic checking as to whether the priorities are in fact being respected by the producers."

gested by Bhagwati [5] after examining its compatibility with Indian planning objectives, and the alternative proposal to use tariffs more freely for this purpose, as indeed Indian budgets have recently been designed to do.

Export Policy: However, these proposals will not directly moderate, or eliminate, the disincentive against exports that an over-valued exchange rate constitutes. The governmental measures aimed at eliminating this bias against exports have taken the form principally of import entitlement schemes (under which premium earning import licenses are given to eligible exporters on a *pro rata* basis related to f.o.b. export values). These schemes have come in for scrutiny from economists such as Gulati [60] and Bhagwati [12]. The ad hoc manner in which the resulting export incentives were granted to a whole range of industries has been argued to have provided a parallel to the "indiscriminate" protection from imports conferred on domestic production by the QR's. The allocative inefficiency of these schemes as export promotion measures has been underlined by pointing to the extreme phenomenon of negative value added (at international prices) which can and did arise in the Indian context, thanks to the difference between the f.o.b. value of exports and the c.i.f. value of imports (and import substitutes) being made up by export subsidies [12].[135]

Exchange Rate Policy: An appreciation of these and other inefficiencies underlying the governmental policies designed to simulate, but avoid, a formal devaluation via export subsidies and tariffs has prompted some Indian economists to press for formal parity changes. While the economists' attitudes towards devaluation have undergone a change on the Indian scene, simultaneously with a greater ap-

preciation of the role of the price mechanism even in a socialist framework,[136] there has been a certain degree of scepticism about the timing of the devaluation in June 1966 and a much greater degree of political opposition in view of the fact that the pressure for it was brought largely by the donor countries through the I.B.R.D. Aid Consortium (even though all influential economists within the country were by no means opposed to the measure). The second, severe agricultural drought which overlaid the devaluation must have led to a significant rise in the domestic prices of agricultural and agriculture–based items, which in turn impeded any significant improvement in exports, thus creating the impression that the devaluation had *caused* the rise in prices and had *failed* because exports continued to stagnate. In point of fact, it is arguable that many Indian exports would have been priced out internationally were it not for the devaluation, as the price rise was largely thanks to the second drought and thus autonomous of the exchange rate change.[137] Unfortunately, no serious empirical analysis of this important policy decision has yet been forthcoming, the field having been left in the popular debate to economists whose analysis leaves much to be desired[138] but

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[135] An extended evaluation of the entitlement schemes from the viewpoint of their *economic* efficiency is contained in Bhagwati and Desai [14].

[136] Raj's [136] thoughtful piece on this general problem makes interesting reading. The controversy in 1962 between Bhagwati [7], who argued for a freer use of exchange rate changes in the shape of a devaluation, and Bardhan [1] and Dasgupta [38] who argued the opposite case, is also of some interest in this general context. Bardhan's general position that a devaluation can be simulated by equivalent import duties and export subsidies, and hence is not necessary, has been later discussed in Bhagwati [12].

[137] Further, the reduction of overinvoicing of exports of the newer manufactures, whose export subsidies were withdrawn with the devaluation (as part of the general rationalization, the *net* devaluation being therefore much less than the apparent one), must also be considered. The devaluation must also be judged as a measure of rationalization, the older methods of *de facto* devaluation having been largely scrapped with its introduction.

[138] Thus, for example, it is not uncommon to compare the twelve–monthly returns *immediately* after the June

whose critical views have been expressed with considerable conviction.

IV. Concluding Remarks

In conclusion, it is perhaps worth emphasizing the selective nature of our Survey. We expect, however, to have reviewed much of the policy literature with an analytical base and related literature that has developed against the backdrop of policy issues.[139]

It is clear that the Survey highlights both the similarity of the Indian analyses of policy issues with that in many other developing countries, as also some striking differences endemic to the Indian economy and scene. On the one hand, we have noted the concern of Indian economists with familiar issues such as trade and exchange rate policies, foreign aid and private foreign capital, and response of agricultural production to price change. On the other hand, the *structural* planning models, the analysis of choice–of–technique problems on the assumption of a *labor surplus* economy and the debate on foodgrains policy in terms of *zonal restrictions* (emphasizing India's federal setup) underline the somewhat uncommon character of India's economy and political structure.

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devaluation with the preceding twelve months, with no awareness of lags. Nor is any notice taken of the factors mentioned in the text and in the previous footnote. Nor is there any awareness of the fact that, at least for three months subsequent to the devaluation and the attendant elimination of the import entitlement schemes for exporters, the Minister for International Trade was keen to restore these schemes and went around saying that he would succeed in doing so: the effect of this on the export performance in the period after the devaluation should not be ignored.

[139] Among the issues which have been prominent, but which we have decided to omit from the Survey, are (1) whether income and wealth inequalities have been accentuated during the three Plans, with related questions about the trends in the real income of *agricultural* landless labor and in the concentration of *industrial* capacity and invested capital in the hands of a few top "industrial houses," and (2) whether decentralization in rural administration and planning, via the so–called *Panchayati Raj* system, has been beneficial for agricultural planning and growth [62].

REFERENCES

1. P. K. BARDHAN, "The Case Against Devaluation," *The Economic Weekly*, Sept. 1962, *14*, 1448.
2. F. M. BATOR, "On Capital Productivity, Input Allocation and Growth," *Quart. Jour. Econ.*, Feb. 1957, *71*, 86–106.
3. C. BETTELHEIM, "On the Problem of Choice Between Alternative Investment Projects," *Soviet Studies*, July 1950, *2*, 22–42.
4. J. BHAGWATI, "Unemployment, Relative Prices and the Saving Potential," *The Indian Economic Review*, Aug. 1958, *4*, 71–82.
5. ———, "Indian Balance of Payments Policy and Exchange Auctions," *Oxford Econ. Papers*, Feb. 1962, *14*, 51–68.
6. ———, "On How to Decide What to Import and What to Produce," *Oxford Econ. Papers*, Feb. 1962, *14*, 114–116.
7. ———, "The Case for Devaluation," *The Economic Weekly*, Aug. 1962, *14*, 1263–1266.
8. ———, "The Theory of Comparative Advantage in the Context of Underdevelopment and Growth," *The Pakistan Development Review*, Autumn 1962, *2*, 339–353.
9. ———, *The Economics of Underdeveloped Countries*. London 1966.
10. ———, "Review of A. H. Hanson: The Process of Planning: A Study of India's Five Year Plans, 1950–1964," *Public Administration*, Summer 1967, *45*, 214–217.
11. ———, "Fiscal Policies, The Faking of Foreign Trade Declarations, and the Balance of Payments," *Bulletin of the Oxford University Institute of Economics and Statistics*, 1967, *29*, 61–77.
12. ———, *Theory and Practice of Commercial Policy: Departures from Unified Exchange Rates*. Princeton 1968.
13. ———, "The Tying of Aid," *UNCTAD Secretariat* (New York), TD/7/Supp. 4, 1967.
14. J. BHAGWATI AND PADMA DESAI, *Planning for Industrialization: India's Trade and Industrialization Policies (1950–1966)* Oxford 1970, forthcoming.

15. J. P. BHATTACHARJEE, "Underemployment Among Indian Farmers: An Analysis of Its Nature and Extent Based on Data for Bihar," *Artha Vijnana*, Sept. 1961, *3*, 246–279.

16. A. K. BISWAS, "Optimal Technique in Multi–sector Economy," *The Economic Weekly*, Aug. 1957, *9*, 1055–1058.

17. ———, "On a Model of Planned Growth," *Arthaniti*, Nov. 1957, *1*, 40–56.

18. P. R. BRAHMANAND, "The General Theory and the Problem of Development of Backward Areas," *Journal of the University of Bombay*, July 1952, *21*, 53–83.

19. ———, and C. N. Vakil, *Planning for an Expanding Economy*. Bombay 1956.

20. S. CHAKRAVARTY, "The Mahalanobis Model of Development Planning," *Arthaniti*, Nov. 1957, *1*, 57–69.

21. ———, "The Mathematical Framework of the Third Five Year Plan," in P. N. Rosenstein–Rodan, ed., *Capital Formation and Economic Development*, London 1964, pp. 11–22.

22. ———, "Optimal Programmes of Capital Accumulation in a Two–Sector Model with Non–Shiftable Capital," Jan. 1967 (mimeographed).

23. ———, "Alternative Preference Functions in Problems of Investment Planning on the National Level," in E. Malinvaud and M. O. L. Bacharach, ed., *Activity Analysis in the Theory of Growth and Planning*, New York 1967, pp. 150–169.

24. S. CHAKRAVARTY AND R. S. ECKAUS, "An Approach to a Multi–Sectoral Intertemporal Planning Model," in P. N. Rosenstein–Rodan, ed., *Capital Formation and Economic Development*, London 1964, pp. 110–127.

25. S. CHAKRAVARTY AND L. LEFEBER, "An Optimizing Planning Model," *The Economic Weekly*, Feb. 1965, *17*, 237–252.

26. S. CHAKRAVARTY AND P. N. ROSENSTEIN–RODAN, *Linking Food Aid With Other Aid*. Rome 1965.

27. V. M. DANDEKAR, *Use of Food Surpluses for Economic Development*. Poona 1956.

28. ———, "A Review of the Land Reform Studies Sponsored by the Research Programmes Committee of the Planning Commission," *Artha Vijnana*, Dec. 1962, *4*, 291–329.

29. ———, "From Agarian Reorganisation to Land Reform," *Artha Vijnana*, Mar. 1964, *6*, 51–70.

30. ———, "Economic Theory and Agrarian Reform," *Oxford Econ. Papers*, Feb. 1962, *14*, 69–80.

31. ———, "Prices, Production and Marketed Supply of Foodgrains," *Indian Journal of Agricultural Economics*, July–Dec. 1964, *19*, 186–195.

32. ———, "Minimum Support Prices for Foodgrains: Guidelines for a Policy and a Programme," *Artha Vijnana*, Dec. 1965, *7*, 273–284.

33. ———, "Agricultural Price Policy: A Critique of Dantwala," *Economic and Political Weekly*, Mar. 1968, 454–459.

34. M. L. DANTWALA, "Incentives and Disincentives in Indian Agriculture," *Indian Journal of Agricultural Economics*, April–June 1957, *22*, 1–25

35. ———, "Impact of Redistribution and Pooling of Land on Agrarian Structure and Efficiency of Resource Use," *Indian Journal of Agricultural Economics*, Dec. 1959, *14*, 80–85.

36. ———, "Growing Irrelevance of Economics in Planning: Case of Procurement Prices," *Economic and Political Weekly*, Oct. 1967, 1945–1947.

37. ———, "Agricultural Price Policy: Reply," *Economic and Political Weekly*, Mar. 1968, 459–461.

38. A. K. DAS GUPTA, "Export Promotion Through Devaluation," *The Economic Weekly*, Sept. 1962, *14*, 1146–1447.

39. M. DATTA-CHAUDHURI, "Regional Specialisation in Metallurgical and Machine–Building Industries in India in the Framework of a Planning Model for Optimum Use of National Resources," *The Indian Economic Review*, Oct. 1967, *2* (New Series), 219–270.

40. D. K. DESAI, *Increasing Income and*

Production in Indian Farming. Bombay 1963.

41. P. DESAI, "A Short–term Planning Model for the Indian Economy," *Rev. Econ. Stat.*, May 1961, *43*, 193–200.

42. ———, "The Development of the Indian Economy: An Exercise in Economic Planning," *Oxford Econ. Papers*, Nov. 1963, *15*, 308–317.

43. ———, "Fiscal and Monetary Equilibrium in the Formulation of National Plans," *Economia Internazionale*, Aug. 1968, *21*, 3–15.

44. ———, *Tariff Protection in India*, Delhi School of Economics 1969.

45. P. N. DHAR AND H. F. LYDALL, *The Role of Small Enterprises in Indian Economic Development*. Delhi 1961.

46. A. K. DIXIT, "Optimal Development in the Labour Surplus Economy," *The Rev. Econ. Stud.*, Jan 1968., *35*, 23–34.

47. E. D. DOMAR, "A Soviet Model of Growth," in *Essays in the Theory of Growth*, New York 1957, pp. 223–261.

48. R. C. DUTT, *Economic History of India in the Victorian Age*. London 1956.

49. R. S. ECKAUS, "Planning in India," in M. F. Millikan, ed., *National Economic Planning*, New York 1967, pp. 305–378.

50. R. S. ECKAUS AND L. LEFEBER, "Capital Formation: A Theoretical and Empirical Analysis," in P. N. Rosenstein–Rodan, ed., *Capital Formation and Economic Development*, London 1964, pp. 83–109.

51. R. S. ECKAUS AND K. S. PARIKH, *Planning for Growth*. Cambridge, Mass. 1968.

52. T. S. EPSTEIN, *Economic Development and Social Change in South India*. Bombay 1962.

53. R. FRISCH, "Oslo Decision Models," 1957 (mimeographed).

54. ———, *Planning for India: Selected Explorations in Methodology*. Calcutta 1960.

55. D. R. GADGIL, *Planning and Economic Policy in India*. Poona 1961.

56. V. GANDHI, *Tax Burden on Indian Agriculture*. Unpublished Doctoral Dissertation, Harvard University, May 1964.

57. N. GEORGESCU–ROEGEN, "Economic Theory and Agrarian Economics," *Oxford Econ. Papers*, Feb. 1960, *12*, 1–40.

58. A. GHOSH, "Mathematical Models in Research Related to Planning in India: A Review," *Economics of Planning*, 1966, *6*, 154–178.

59. D. GHOSH, "Technique of Production and Employment in an Underdeveloped Economy," *The Economic Weekly*, Aug. 1956, *8*, 919–920.

60. I. S. GULATI, "Export Promotion Through Import Entitlement," *The Economic Weekly*, May 1965, *17*, 859–864.

61. S. C. GUPTA, "Agricultural Economics in India," *International Journal of Agrarian Affairs*, Dec. 1966, *5*, 1–51.

62. A. H. HANSON, *The Process of Planning: A Study of India's Five Year Plans 1950–1964*. London 1966.

63. C. H. HANUMANTHA RAO, "Farm Size and Economies of Scale," *The Economic Weekly*, Dec. 1963, *15*, 2041–2044.

64. ———, *Agricultural Production Functions, Costs and Returns in India*. Bombay 1965.

65. ———, "The Marketable Surplus Function for a Subsistence Crop: Comments," *The Economic Weekly*, Apr. 1965, *17*, 677–678.

66. ———, "Alternative Explanations of the Inverse Relationship Between Farm Size and Output per Acre in India," *The Indian Economic Review*, Oct. 1966 *1* (New Series), 1–12.

67. ———, "Entrepreneurship, Management and Farm Tenure Systems," Feb. 1967, mimeographed.

68. B. R. HAZARI, "Import-Intensity of Consumption in India," *The Indian Economic Review*, Oct. 1967, *2* (New Series), 155–176.

69. R. M. HONAVAR, "Aid–Tying by Source and Industrial Efficiency," *Economic Development Institute* (I.B.R.D.), mimeographed, 1967.

70. W. D. HOPPER, "Allocation Efficiency

in a Traditional Indian Agriculture," *Jour. Farm Econ.*, Aug. 1965, *47*, 611–624.

71. D. R. KHATKHATE, "Some Notes on the Real Effects of Foreign Surplus Disposal in Underdeveloped Economies," *Quart. Jour. Econ.*, May 1962, *76*, 186–196.

72. A. M. KHUSRO, *Economic and Social Effects of Jagirdari Abolition and Land Reforms in Hyderabad*. Planning Commission (Research Programmes Committee), Unpublished 1960.

73. ——, *Economic Development with No Population Transfers*. New Delhi 1962.

74. ——, "Returns to Scale in Indian Agriculture," *Indian Journal of Agricultural Economics*, Oct.–Dec. 1964, *19*, 51–80.

75. ——, "The Pricing of Food in India," *Quart. Jour. Econ.*, May 1967, *81*, 271–285.

76. ——, "Economic Theory and Indian Agricultural Policy," in A. M. Khurso, ed., *Readings in Agricultural Development*, Delhi 1968.

77. M. KIDRON, *Foreign Investments in India*. London 1965.

78. R. KOMIYA, "A Note on Professor Mahalanobis' Model of Indian Economic Planning," Feb. 1959, *Rev. Econ. Stat.*, *41*, 29–35.

79. J. KRISHNA AND M. S. RAO, "Price Expectation and Acreage Response for Wheat in Uttar Pradesh," *Indian Journal of Agricultural Economics*, Jan.–Mar. 1965, *20*, 20–25.

80. R. KRISHNA, "A Note on the Elasticity of the Marketable Surplus," *Indian Journal of Agricultural Economics*, July–Sept. 1962, *17*, 79–84.

81. ——, "Farm Supply Response in India–Pakistan: A Case Study of the Panjab Region," *Econ. Jour.*, Sept. 1963, *73*, 477–487.

82. ——, "The Marketable Surplus Function for a Subsistence Crop: An Analysis with Indian Data," *The Economic Weekly*, Feb. 1965, *17*, 309–320.

83. ——, "The Marketable Surplus Function for a Subsistence Crop: Reply to Comments," *The Economic Weekly*, Nov. 1965, *17*, 1665–1668.

84. ——, "Government Operations in Foodgrains," *Economic and Political Weekly*, Sept. 1967, 1695–1706.

85. K. KRISHNAMURTY AND D. U. SHASTRI, "Inventories in the Organised Manufacturing Sector of the Indian Economy: A Disaggregative Study," 1966, mimeographed.

86. T. N. KRISHNAN, "The Marketable Surplus of Foodgrains: Is It Inversely Related to Price?", *The Economic Weekly*, Feb. 1965, *17*, 325–328.

87. D. T. LAKDAWALA, "Aspects of Trade Policy in India," *Indian Economic Journal*, Oct.–Dec. 1964 *12*, 89–110.

88. D. T. LAKDAWALA AND J. C. SANDESARA, *Small Industry in a Big City: A Survey in Bombay*. Bombay 1960.

89. D. LAL, "Cost of Aid–Tying: A Case Study of India's Chemical Industry," *UNCTAD Secretariat* (New York), 1967.

90. U. LELE, "Market Integration: A Study of Sorghum Prices in Western India," *Jour. Farm Econ.*, Feb. 1967, *49*, 147–159.

91. M. LIPTON, "Should Reasonable Farmers Respond to Price Changes?", *Modern Asian Studies*, Jan. 1967, *1*, 95–99.

92. I. M. D. LITTLE, "A Critical Examination of India's Third Five Year Plan," *Oxford Econ. Papers*, Feb. 1962, *14*, 1–24.

93. ——, "Real Cost of Labour, and the Choice Between Consumption and Investment," in P. N. Rosenstein–Rodan, ed., *Pricing and Fiscal Policies*, London 1964, pp. 77–91.

94. ——, "Tax Policy and the Third Plan," in P. N. Rosenstein–Rodan, ed., *Pricing and Fiscal Policies*, London, 1964, pp. 30–76.

95. P. C. MAHALANOBIS, "Some Observations on the Process of Growth of National Income," *Sankhya*, Sept. 1953, *12*, 307–312.

96. ——, "The Approach of Operational Research to Planning in India," *Sankhya*, Dec. 1955, *16*, 3–130.

97. I. M. MAJUMDAR, "Marketable Surplus Function for a Subsistence Crop: Further Comments," *The Economic Weekly*, May 1965, *17*, 820–822.

98. J. S. MANN, "The Impact of P.L. 480 Imports on Prices and Domestic Supply of Cereals in India," *Jour. Farm Econ.*, Feb. 1967, *49*, 131–146.

99. A. S. MANNE, ed., *Investments for Capacity Expansion*. London 1967.

100. A. S. MANNE AND J. BERGSMAN, "An Almost Consistent Intertemporal Model for India's Fourth and Fifth Plans," in I. Adelman and E. THORBECKE, ed., *The Theory and Design of Economic Development*, Baltimore 1966, pp. 239–256.

101. A. S. MANNE AND A. RUDRA, "A Consistency Model of India's Fourth Plan," *Sankhya* (Series B), Feb. 1965, *27*, 57–144.

102. A. S. MANNE AND T. E. WEISSKOPF, "A Dynamic Multisectoral Model for India: 1967–1975," Dec. 1967, mimeographed.

103. S. A. MARGLIN, *Approaches to Dynamic Investment Planning*. Amsterdam 1963.

104. ———, "Industrial Development in the Labour–Surplus Economy: An Essay in the Theory of Optimal Growth," Jan. 1966, mimeographed.

105. ———, *Public Investment Criteria: Benefit–Cost Analysis for Planned Growth*. London 1967.

106. E. S. MASON, *Economic Development in India and Pakistan*. Harvard 1966.

107. P. N. MATHUR, "Time Pattern and Quanta of Purchase and Sale of *Jawar* by the Peasants of Vidarbha (Bombay State)," *Artha Vijnana*, 1959, *1*, 61–69.

108. ———, "Differential Effects of Price Increase on Small and Big Cultivators —A Case Study," *Artha Vijnana*, 1962, *4*, 44–51.

109. ———, "An Efficient Path for the Technological Transformation of an Economy," in T. Barna, ed., *Structural Interdependence and Economic Development*, London 1963, pp. 39–56.

110. P. N. MATHUR AND H. EZEKIEL, Marketable Surplus of Food and Price Fluctuations in a Developing Economy," *Kyklos*, 1961, *14*, 396–408.

111. D. MAZUMDAR, "On the Economics of Relative Efficiency of Small Farmers," *The Economic Weekly*, July 1963, *15*, 1259–1263.

112. S. MEHRA, "Surplus Labour in Indian Agriculture," *The Indian Economic Review*, April 1966, *1* (New Series), 111–129.

113. B. S. MINHAS, "Measurement of Agricultural Growth: Rapporteur's Report," *Indian Journal of Agricultural Economics*, Oct.–Dec. 1966, *21*, 165–182.

114. ———, "Water Requirements of Crops and Efficiency of Irrigation Water in India," Indian Statistical Institute (Planning Unit), Discussion Paper No. 24, Aug. 1967, mimeographed.

115. B. S. MINHAS AND T. N. SRINIVASAN, "New Agricultural Strategy Analysed," *Yojana*, Jan. 1966, 20–24.

116. B. S. MINHAS AND A. VAIDYANATHAN, "The Growth of Agricultural Output in India, 1951–54–1958–61: An Analysis of Component Elements," *Journal of the Indian Society of Agricultural Statistics*, December 1965, *17*, 230–252.

117. A. MITRA, "A Note on the Mahalanobis Model," *The Economic Weekly*, Mar. 1957, *9*, 372–374.

118. D. NAOROJI, *Poverty and Un–British Rule in India*. Delhi 1962.

119. D. NARAIN, "Ratio of Interchange Between Agricultural and Manufactured Goods in Relation to Capital Formation in Underdeveloped Economies," *Indian Economic Review*, Aug. 1957, *3*, 46–55.

120. ———, *Distribution of the Marketed Surplus of Agricultural Produce by Size–Level of Holdings in India: 1950–51*, Bombay 1962.

121. ———, *Impact of Price Movements on Areas Under Selected Crops in India: 1900–1939*. Cambridge 1965.

122. N. V. A. NARASIMHAN, *A Short–term Planning Model for India*. Amsterdam 1956.

123. V. F. NOWSHIRVANI, "Allocation Effi-

ciency in a Traditional Indian Agriculture," *Jour. Farm Econ.*, Feb. 1967, *49*, 218–221.

124. ———, "A Note on the Elasticity of the Marketable Surplus—A Comment," *Indian Journal of Agricultural Economics*, Jan.–Mar. 1967, *22*, 110–114.

125. ———, "A Note on the Fixed–Cash Requirement Theory of Marketed Surplus in Subsistence Agriculture," *Kyklos*, 1967, *20*, 772–773.

126. V. R. PANCHMUKHI, J. BHAGWATI AND P. DESAI, "Effective Rates of Protection in India: 1961 and 1962," Feb. 1968, mimeographed.

127. A. PARIKH, "Statewise Growth Rate in Agricultural Output—An Economic Analysis," *Artha Vijnana*, Mar. 1966, *8*, 1–52.

128. R. P. PATWARDHAN AND D. V. AMBEKAR, ed., *The Speeches and Writings of Gopal Krishna Gokhale. 1*, Bombay 1962.

129. P. H. PRASAD, "Sectoral Models of Growth—A Critique," *The Indian Economic Review*, Apr. 1966, *1* (New Series), 104–111.

130. K. N. RAJ, "Small–Scale Industries—Problems of Technological Change: Part I," *The Economic Weekly*, Apr. 1956, *8*, 420–421.

131. ———, "Small-Scale Industries—Problems of Technological Change: Part II," *The Economic Weekly*, Apr. 1956, *8*, 435–438.

132. ———, *Employment Aspects of Planning in Underdeveloped Economies.* Cairo 1957.

133. ———, *Some Economic Aspects of the Bhakra–Nangal Project.* Delhi 1960.

134. ———, "Growth Models in Indian Planning," *The Indian Economic Review*, Feb. 1961, *5*, 242–261.

135. ———, *Indian Economic Growth: Performance and Prospects.* Delhi 1965.

136. ———, "What Does Socialism Imply for Economic Policy Now?", *Mainstream*, Jan. 1964, *2*, 19–22.

137. ———, "The Current Economic Crisis," *Times of India*, Feb. 1966.

138. ———, *India, Pakistan and China: Economic Growth and Outlook.* Delhi 1966.

139. ———, "Investment in Livestock in Agrarian Economies: A Theoretical and Empirical Analysis," Dec. 1967, mimeographed.

140. K. N. RAJ AND A. K. SEN, "Alternative Patterns of Growth Under Conditions of Stagnant Export Earnings," *Oxford Econ. Papers*, Feb. 1961, *13*, 43–52.

141. M. G. RANADE, *Essays on Indian Economics.* Bombay 1898.

142. A. P. RAO, "Size of Holdings and Productivity," *Economic and Political Weekly*, Nov. 1967, 1989–1991.

143. V.K.R.V. RAO, "Investment, Income and Multiplier in an Underdeveloped Economy," *The Indian Economic Review*, Feb. 1952, *1*, 55–67.

144. N. RATH AND V. S. PATWARDHAN, *Impact of Assistance Under P.L. 480 on Indian Economy.* Poona 1967.

145. W. B. REDDAWAY, *The Development of the Indian Economy*, London 1962.

146. ———, "*The Development of the Indian Economy:* The Objects of the Exercise Restated," *Oxford Econ. Papers*, Nov. 1963, *15*, 318–332.

147. J. ROBINSON, "The Choice of Techniques," *The Economic Weekly*, June 1956, *8*, 715–718.

148. P.N. ROSENSTEIN–RODAN, "Contribution of Atomic Energy to a Power Programme," in P.N. Rosenstein–Rodan, ed., *Pricing and Fiscal Policies*, London 1964. pp. 165–174.

149. A. RUDRA, "The Problem of Technological Choice," *The Economic Weekly*, May 1956, *8*, 556–558.

150. J. SANDEE, *A Demonstration Planning Model for India.* Calcutta 1960.

151. T. W. SCHULTZ, *Transforming Traditional Agriculture.* New Haven 1964.

152. ———, "Significance of India's 1918–19 Losses of Agricultural Labour—A Reply," *Econ. Jour.*, Mar. 1967, *77*, 161–163.

153. A. K. SEN, "Labour Cost and Economic Growth," *The Economic Weekly*, September 1956, *8*, 1159–1160.

154. ———, "Unemployment,   Relative

Prices and the Saving Potential," *The Indian Economic Review*, Aug. 1957, *3*, 56–63.

155. ——, "A Short Note on the Ambar Charkha," *The Economic Weekly*, Oct. 1957, *9*, 1357–1358.

156. ——, *Choice of Techniques: An Aspect of the Theory of Planned Development*, 2nd ed. Oxford 1962.

157. ——, "Size of Holdings and Productivity," *The Economic Weekly*, Feb. 1964, *16*, 323–326.

158. ——, "Peasants and Dualism with or without Surplus Labour," *Jour. Pol. Econ.*, Oct. 1966, *74*, 425–450.

159. ——, "Surplus Labour in India: A Critique of Schultz's Statistical Test," *Econ. Jour.*, Mar. 1967, *77*, 154–161.

160. A. SENGUPTA, "Foreign Capital Requirements in India's Perspective Planning," *The Economic Weekly*, Aug. 1965, *17*, 1267–1276.

161. C. H. SHAH, "Problems of Small Farmers: A Report on an Enquiry into the Problems of Low Income Farmers in Kodinar Taluka," Unpublished Paper prepared for the Research Programmes Committee, Planning Commission, India. 1965

162. A. SHOURIE, *Allocation of Foreign Exchange in India*. Unpublished doctoral dissertation, Syracuse University, 1966.

163. M. SINGH, *India's Export Trends and the Prospects for Self-Sustained Growth*. Oxford 1964.

164. N. V. SOVANI AND N. RATH, *Economics of a Multiple-Purpose River Dam*. Poona 1960.

165. T. N. SRINIVASAN, "Critique of the Optimizing Planning Model," *The Economic Weekly*, Feb. 1965, *17*, 255–264.

166. P. STREETEN AND R. HILL, "Foreign Aid to India," in P. Streeten and M. Lipton, ed., *The Crisis of Indian Planning*, London 1968.

167. R. STROTZ, "Myopia and Inconsistency in Dynamic Utility Maximization," *Rev. Econ. Stud.*, 1956, *23*, 165–180.

168. K. SUNDARAM, "P.L. 480 Imports: Efficiency in Purchase and Distribution," *Economic and Political Weekly*, Mar. 1967, 487–490.

169. P. THAKURDAS (*et. al*), *A Plan of Economic Development for India*. London 1945.

170. J. TINBERGEN, *The Design of Development*. Baltimore 1958.

171. ——, "Mill Versus Cottage Industries," *The Economic Weekly*, Jan. 1957, *9*, 81–83.

172. S. TSURU, "Some Theoretical Doubts on the Plan Frame," *The Economic Weekly*, Jan. 1957, *9*, 77–79.

173. L. S. VENKATARAMANAN, "A Statistical Study of Indian Jute Production and Marketing with Special Reference to Foreign Demand." Unpublished doctoral dissertation, University of Chicago, June 1958.

174. ——, "Hedging Stocks and Futures Contract in India: Cotton Industry," in D. Kumar, S. P. Nag and L. S. Venkataramanan, *Resource Allocation in the Cotton Textile Industry*, Bombay 1965, pp. 135–185.

175. T. E. WEISSKOPF, "A Programming Model for Import Substitution in India," *Sankhya* (Series B), Dec. 1967, *29*, 257–306.

176. GOVERNMENT OF INDIA, MINISTRY OF AGRICULTURE, *Report of the Agricultural Prices Commission on Price Policy for Kharif Cereals for 1965–66*, Delhi 1965.

177. GOVERNMENT OF INDIA, MINISTRY OF FOOD, AGRICULTURE, COMMUNITY DEVELOPMENT AND COOPERATION, *Report of the Foodgrains Policy Committee*, Delhi 1966.

178. GOVERNMENT OF INDIA, MINISTRY OF STEEL AND HEAVY INDUSTRIES, *Report of Steel Control*, Delhi 1963.

179. GOVERNMENT OF INDIA, PLANNING COMMISSION, *First Five Year Plan*, Delhi 1952.