

Working Paper no - 40

A

Scheme for formulating an annual
plan for India

By

S. Chakravarty

DELHI SCHOOL OF ECONOMICS

DELHI SCHOOL OF ECONOMICS

WORKING PAPER NO. 40

**A SCHEME FOR FORMULATING
AN ANNUAL PLAN FOR INDIA**

by

S. Chakravarty

April 1968

NOTE : This working paper is duplicated for private circulation and should not be quoted or referred to in publications without the permission of the author.

**Department of Economics
Delhi School of Economics
University of Delhi**

A SCHEME FOR FORMULATING AN ANNUAL PLAN FOR INDIA

1. The purpose of an annual plan

An annual plan can be looked upon from many different points of view. The point of view that we adopt here is based on two basic considerations. First, an annual plan should be a method of linking current decisions on economic policy with the long-term objectives of economic development. This is particularly important in India where the very problem of economic development requires significant changes in the economic structure which can only be phased over a long period of time. Secondly, an annual plan should deal with the special problems pertaining to a particular year. Thus, unexpected changes in strategic areas such as agriculture, foreign trade, including availability and utilization of foreign aid do call for adjustments which can be best done by an annual plan. In addition, an annual plan can operate sequentially so that the availability of new information such as the widespread use and acceptance of fertilizers, or better variety of seeds in agriculture, can also be reflected in the set of current economic decisions that may be considered desirable to adopt. Sometimes these adjustments may even call for changes in long-term objectives which, then, might require an adaptation of the long term plan.

2. What sort of an annual plan do we need for India?

For many Western economies, an annual plan is based on stabilization objectives in mind. These typically involve maintaining

a high level of employment, reasonable price stability and balance of payments equilibrium. The plan is based on an econometric model of the economy. These econometric models consist of important behaviour relationships on a high level of aggregation. Sectoral composition of output and investment is generally a minor consideration. The role of public investment may or may not be a very important question. The econometric models are used for short-term forecasting, on the one hand, and through an inversion in the point of view, for deciding on policy questions as well.

In the Indian context, an annual plan has to be more detailed in scope. And the nature of the objectives should also be somewhat differently spelt out. Further, there are important structural differences. The most important of these structural differences would consist in the relative importance of agriculture in the Indian economy and ⁱⁿ the different type of economic organization that prevails in the greater part of Indian agriculture, as distinct from industry. Thus, it is necessary to treat agriculture separately from the industrial sector. Even in the industrial sector, the composition of industrial output is likely to alter fast if the long term plan is taken seriously. Thus, detailed input-output considerations should play a greater role in the industrial part of the annual plan.

As regards objectives, full employment in the Western sense does not mean very much in the Indian case, although as recent experience suggests, it is by no means automatic that Keynesian unemployment would be negligible in the Indian situation.

3. The structure of the economy for drawing up an annual plan

In this section, we describe the structure of the economy with the help of a system of equations which would form the building blocks of an annual plan. The equations themselves do not obviously constitute a plan. That is done only when the objectives and the investments of an annual plan have been spelt out. This we would take up in the next section.

A. Industrial sector

(1) Equations of price formation:

$$P_i = (1 + r_i) \sum_j p_j a_{ji} + w_i l_i + \sum_j p_j b_{ji} + t_i$$

$$i = 1, \dots, n$$

$$j = 1, \dots, n$$

Here p_i indicates price of the i th product. (a_{ij}) 's are current input-output coefficients. w_i is the money wage rate in the i th sector. l_i is labour needed per unit of gross output in the i th sector. b_{ij} is the matrix of intersectoral capital-output ratios. t_i is indirect tax per unit of gross output.

Notice that this equation, which says that price of the i th sector should include raw material costs, wage, profits and indirect tax on its product, does not assume that the wage rate and the profit rate are the same for all sectors. Thus, we can take into account different degrees of monopoly and trade union pressure in our system of equations. If we assume that short-term funds necessary to buy raw materials are made available at a common rate through the banking system, then in the first term on the right hand

side, we can replace $\hat{\lambda}_i = \hat{\lambda}_0$, a common number.

(ii) Equation of income formation:

$$\sum W l_i X_i + \sum r_i (\sum p_j b_{ji}) X_i = Y$$

This says that total wages plus profits constitute total factor income. Separate estimation procedure may be used here without requiring an estimate of the value of capital stock.

(iii) The savings equation:

$$S_w = s_w [W(\sum l_i X_i) - T_w]$$

$$S_p = s_p [P - T_p]$$

These equations make a distinction between profits and wages. T_w and T_p stand for taxes on wages and profits respectively. Notice that we do not make any distinction between corporate and non-corporate taxes because of data difficulty.

These are rather simple minded savings functions. But they may be used as a first approximation.

(iv) Consumer demand equations:

$$C_i = C \frac{\alpha_i - \beta_i}{p_i}, \quad \text{where } C = Y - S$$

We have used a model involving constant elasticities with respect to aggregate consumption and own prices. This is rather simple minded. There are two simple schemes of calculation which take into account cross price elasticities but may be readily computable. One is the approach of Frisch and Johansen, which is based on the assumption of additively separable utility functions and the other is the

approach of R. Stone, which relies on a linear expenditure system. Rudra, Bhattacharya and others have already done a certain amount of work using a linear expenditure system. Their work may be utilized for this purpose.

According to a linear expenditure system, the total expenditure incurred on the i th commodity can be written as

$$P_i q_i = P_i \bar{q}_i + b_i (C - \sum_{j=1}^n P_j \bar{q}_j) \quad \begin{array}{l} i = 1, \dots, n \\ j = 1, \dots, n \end{array}$$

Clearly $\sum b_i = 1$.

This system of equations has the great virtue of simplicity but does suffer from certain conceptual limitations well-known in the literature. But if adopted they would at least build into an annual plan a certain amount of price responsiveness.

(v) Investment equations:

Here there are several possibilities. First, we can estimate on econometric considerations an equation for private investment. However they are usually very unstable and the data difficulty is quite serious. The second possibility is to use business anticipations data. This has been tried out, extensively in U.S.A. and Germany. The third possibility is to use investment figures from long-term plans. Here, we should make a distinction between investments which are already in process and new starts. New starts constitute our relevant degrees of freedom in an annual planning problem.

We should, in addition, have separate equations for "active" inventory accumulation. A fixed inventory for each sector-output ratio

may not be a bad starting assumption.

(vi) We have the following equations for exports and imports.

Equation for exports:

$$E_i = E_i^0 (p_i/P_w)^{-\alpha_i} (Y_w)^\beta$$

Here P_w is the world market price. Y_w is world income.

Equation for imports:

$$M = M_1 + M_2 + M_3 = \sum m_i X_i + m_2 I + m_3 C$$

A more disaggregated treatment of investment goods imports and consumption goods imports may also be easily provided.

We have the following balance equation relating to foreign aid.

Equation for foreign aid:

$$I - S = M - E = F.A. \text{ where F.A. denotes foreign aid.}$$

(vii) Equations for tax revenue:

We divide total tax revenue into three categories: one based on domestic gross production levels, the other on items entering foreign trade as exports or imports and the third based on incomes derived from profits and wages. We have no equation for land revenue. I believe that there is a clear case for raising land revenue through a progressive land tax, but since the present level of earnings on this score is insignificant, it is not considered here. Thus

$$T = t_1 X_i + W \frac{\gamma_1 \gamma_2}{P} + t_1' M_i + t_1'' E_i$$

Here the first term denotes excise revenue, the second term denotes direct taxes on income, the third term stands for import duty and the fourth one is export duty.

(viii) Earnings from public enterprise:

$S = \bar{S}$ where \bar{S} is taken directly from public enterprise accounts.

(ix) Government current expenditure:

Government expenditure G equals $G_1 + G_2$ where G_1 is a term which depends on per capita income, population growth, an index of urbanization, an index of health services, an index of the educational programme that is envisaged. G_2 may stand for defence outlays and such other items which are determined independently of the usual indices of social welfare.

(x) Balance equation for the industrial sector:

$$X = AX + C + I_{\text{started}} + I_{\text{new}} + G - M + X_{\text{exogenous}}$$

The last term stands for delivery to the agricultural sector by way of input supplies both on current and capital account. Similarly, supplies received by the industrial sector from the agricultural sector will figure in the inputs into the industrial sector.

B. Equations for the agricultural sector

(i) Agricultural supply equation:

$$S^A = a_0 + a_1 S_{-1}^a + a_2 p_{-1}^A + a_3 F + a_4 t$$

where S_{-1} is the production of the preceding year, P_{-1} is the price

received by the farmer in the earlier years. F stands for the use of new inputs, t for a general time trend showing the growing monetization of the agricultural sector.

$$P^A = b_0 + b_1 P_{-1} + b_2 \sum_{-t}^t St^A + b_3 d_1$$

$$St^A = S^A + M^A - D^A$$

Here prices depend on previous prices, on cumulated stock changes over a preceding time interval, d_1 is a dummy for weather changes, taking values of 0 and 1. We can use a similar dummy variable for the supply equation. St^A denotes stock change of agricultural produce. M^A is the import of agricultural produce referring specially to P.L.480 imports.

It may be worthwhile to make a distinction between food crops and cash crops, to indicate the impact of relative price changes on the cropping pattern. In that case the equation should be separately estimated for both.

Further disaggregation may also be useful on certain occasions.

4. The functioning of the model

We shall now indicate how the model would function in a given situation. It should be clear from our discussions that the policy variables for our problem would be the tax rates, customs duties, autonomous government expenditure, new investment starts. In the Indian situation, an important policy variable may be the amount of P.L.480 supplies that the government would like to negotiate. Changes in direct taxes would be reflected in the parameters γ_1 and γ_2 .

Now suppose that the planner can estimate the final demand items for the industrial sector which will include trade with the rest of the world as well as with the agricultural sector.

Then total demand for industrial output as a vector will be given by our equation as

$$X_{\text{demand}} = [I - A]^{-1} F_{\text{est.}}$$

Now this X_{demand} may be compared with X_{cap} . In all probability,

$$(X_{\text{demand}})_i \neq (X_{\text{cap}})_i$$

for every i . In some sectors, there will be demand pressure and in certain other sectors, there will be excess capacity.

Now, the government may wish to initiate a certain course of action which will lead to minimization of a criterion function such as

$$\min. \frac{1}{n} \sum (X_i^{\text{demand}} - X_i^{\text{capacity}})^2.$$

The policy instruments will be the ones mentioned before. Instead of using an unweighted average, the government may decide to adopt a weighted average indicating the special importance of certain sectors. It is also possible that the government would like to impose certain additional restrictions on the variability of the policy variables.

It is also possible that quite different objective functions would be employed by the government. In any case, the model has sufficient flexibility to handle a wide variety of problems.

5. Data Requirements of the Model

It should be quite clear from our discussion of the equations constituting the model that the data requirements for an annual plan are not negligible. While we have tried to use very simple forms of relationships, at times at the cost of oversimplification, we still have to work out equations of price formation for the industrial sector, commodity consumption, demand equations, equations for income and savings, the equation pertaining to direct taxes, and the export-import equations. On top of this, we have to estimate the equations constituting the agricultural sub-model.

I have the impression, however, that if we use the N.S.S. and various other sources, it should not be difficult to estimate these equations with a reasonable degree of accuracy.

Price equations for manufactured consumer goods as formulated right now would require value of capital data. But if it becomes too difficult to collect such data, different equations may be used instead.

If data permit, we should estimate separate savings equations for the non-corporate business sector. Further, separate urban and rural equations may be set up for commodity demand equations as well as for the savings-investment balance.

For an integrated micro-macro model of the type used here, we should have comparable commodity classifications for the input output coefficients as well as for the final demand estimates. It would be essential to ensure such comparability.

6. Limitations of the Model

The main limitation of the present exercise is the lack of a system of equations which would describe the behaviour of monetary and financial variables. In other words, the problem of portfolio choice has been left out and attention concentrated on the "real" components of an annual plan. From the predictive point of view, this is certainly a serious limitation. But for its possible use as an annual planning model, the limitation is not equally serious. The main reason for my reluctance to include such considerations in the present model is an almost complete ignorance of structural relationships falling into this category. It is possible that at a later stage we may be able to do better.

S.Chakravarty

Delhi School of Economics