FORECASTING MAJOR SUBSIDIES OF THE CENTRAL GOVERNMENT

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I. INTRODUCTION

"A forecast or a prediction", as Theil (1975) puts it, "is generally defined as a statement concerning unknown, in particular future, events" (p.1). They can relate to events or values. Economic forecasts are those which relate to variables which fall within the scope of economics. Quantitative economic forecasts are those which forecast a certain value for a certain economic variable at (during) a certain point (period) of time.

The value of quantitative forecasts for policy-making is being increasingly recognised now. Of course, the value of forecasts is dependent on their accuracy, and it is the improvement in accuracy in recent years which has made policy-makers less sceptical about forecasts. The advantages of having reasonably reliable forecasts in hand while determining policies are enormous. The greatest, of course, is the consequent ability to choose a 'good' or optimal policy. Another advantage is that it allows policy-makers to prepare, within the constraints, for expected difficulties and thus minimise their adverse consequences.

Forecasts can be scientific or intuitive. Without belittling intuitive forecasts, one can argue that it is scientific forecasts which should be the basis for policy. By scientific forecasts one generally means those forecasts the methods of which are clearly specified and are capable of being replicated or checked by others.

Quantitative forecasting, economic or otherwise, is based generally on either an explanatory or a time-series framework. Explanatory forecasting denotes the specification of cause and effect relationship (s) between the inputs and outputs of the system. Time-series forecasting, on the other hand, treats the system as a 'black box' or an unknown generating process but uses the fact that the variable to be forecast shows a certain pattern relating to time.

It is obvious that for quantitative forecasting, three preconditions must be met:

i) There is information about the past.

ii) This information can be quantified in the form of data.

iii) It can be assumed that the discernible pattern relating to the data for the past will continue into the future.1/

The last condition is a vital one and is known as the assumption of constancy. All forecasts, irrespective of the type, are based on this. Of course, once the parameters of the system are established, any extraneous information about the likely value or behaviour of these parameters (based on declared policy or judgement) can be used, but essentially this will be a modification of the original forecasting method.

1/ See Makridakis and Wheelright (1978 p.7).

In what follows, we forecast the major subsidies of the Government of India during the period 1984-85 to 1988-89. We use the time-series method as well as the explanatory method to arrive at these forecasts. The level of statistical sophistication varies among the methods used to forecast the three major subsidies depending on the amount and nature of the inputs available. Whenever possible, we have also tried to take into account extraneous information. We have also tried to give forecasts based on alternative methods and have indicated preferred ones on the basis of our judgement, extraneous information and accuracy. No formal tests of accuracy for different sets of forecasts have been used, as they did not seem to be worthwhile in this particular exercise, but informal tests, by comparing predictions to actuals, have been undertaken to judge the usefulness of each method in forecasting exercises.

II. FOOD SUBSIDIES

1. Definitions and the Descriptions

Food subsidies arise basically due to government intervention in the foodgrains market. Such intervention has the twin objective of ensuring at least a minimum rate of return to the foodgrain producers and keeping foodgrain prices low to benefit the consumers. This results in the purchase price of foodgrains paid by the government agency being higher than the issue price (the price at which the consumers get them through the public distribution system) and the difference can be called price subsidy. Besides, the government incurs certain costs in carrying out these obligations which are not realised from the consumers and these constitute what can be termed as cost subsidy. The price subsidy, the cost subsidy and the subsidy to cover the purchase of foodgrains acquired but not sold together constitute the total food subsidies during a given year. The following identities express these definitions:

$$SF1 = P_iQ + P_mM - Pd^D, \quad \ldots (1.1)$$

$$SF2 = c^bBS, \quad \ldots (1.2)$$

$$SF = SF\ 1 + SF\ 2, \quad \ldots (1.3)$$

where

P_i = internal purchase price of foodgrains,

Q = amount of foodgrains procured,

P_m = import price of foodgrains,

M = amount of foodgrains imported,

P_d = issue price of foodgrains,

Q = quantity of offtake through the public distribution system (PDS),

c^b = costs of running the stock including transport, storage costs, loss in storage and transit etc.,

BS = closing stock of foodgrains,

SF = total food subsidies, and SF1 and SF2 are the two components of total food subsidies.

All the prices (values) are (at) nominal prices.

The purchase price P_i can be interpreted as a weighted average of the different prices actually paid by the government for different foodgrains and in different places. Q would then be total amount of foodgrains procured. The import price, P_m, and quantity imported (M) can be similarly interpreted. So can be P_d and O.

Identity (1.1) includes the price subsidy and the subsidy to cover increase in stocks. If we rewrite the identity,

$$SF1 = [(p_p - p_d)Q] + [p_p(Q+M-O)],$$

where p_p represents a weighted average of the purchase price of foodgrains (domestic procurement and imports). The second term within square brackets represents subsidy to cover increase in stocks. In a year when O is greater than (Q+M) the second term should have p_d instead of p_p as stocks will be reduced by selling at the issue price. But this possibility is also covered under identity (1.1) without necessitating any change. The first term within square brackets represents price subsidy.

2. The Structural System

Aside from the three identities noted above we can specify a number of other equations, which together form an interlinked system of relationships which influence the scale of food subsidies. In this exercise, our interest lies in forecasting, and for that purpose it is important to identify the exogenous/predetermined variables that determine the food subsidy through a chain of effects. Unless we can do that, our forecast may go wide of the mark, for example, if an exogenous variable that we do not take into account changes in such a way as to upset our calculations thoroughly. A relationship estimated with only exogenous/predetermined variables as the explanatory variables can be used provided we have independent information telling us how these variables are expected to change over the forecasting horizon. With this end in view we hypothesise the structural equations below. The purpose of these equations is to allow us to ultimately formulate and estimate an equation that explains the variations in food subsidies in terms of a set of exogenous/predetermined variables, which are not interdependent, unlike the ones in the identities above.

$$P_i = f_1(P_f, C^C, PF/PM), \qquad \ldots(1.4)$$

$$P_f = f_2(Y, F, P) \qquad \ldots(1.5)$$

$$Q = f_3(F, BS^*, BS_{-1}) \qquad \ldots(1.6)$$

$$M = f_4(BS^*, BS_{-1}, Q, O), \qquad \ldots(1.7)$$

$$P_d = f_5(P_i), \qquad \ldots(1.8)$$

$$O = f_6(F, P, CPI), \qquad \ldots(1.9)$$

$$BS = f_7(BS^*, F), \qquad \ldots(1.10)$$

$$BS^* = e \quad (P, F)$$

F_m is defined as the minimum expected foodgrains output calculated as $\hat{F}$ (output projected through linear trend) multiplied by the minimum F' (actual foodgrains output divided by the linear trend value) which obtained during the last 20 years. Since minimum F' is a constant, the BS* equation reduces to

$$BS^* = f_9 (P, \hat{F}) \qquad \ldots(1.11)$$

The notations are as follows:

P_f = free market price in the absence of government intervention,

C^c = cost of cultivation index,

PF = price index for agricultural commodities,

PM = price index for manufactured commodities,

Y = gross national product at current prices,

P = population,

F = output of foodgrains,

BS* = desired level of closing stocks, and

CPI = consumer price index for urban manual workers.

All prices (values) are (at) nominal prices.

Now the structural system consists of identities (1.1) to (1.3) and equations (1.4) to (1.11). There are eleven equations and eleven endogenous variables — SF1, SF2, SF, p_i, Q, M, P_f, p_d, O, BS and BS*. The exogenous/predetermined variables are: p_m, c^b, C^c, PM, Y, P, BS_{-1}, F, CPI and $\hat{F}$. Thus, the system is determinate and exactly identified. The choice of variables and equations merits some elaboration.

The purchase price function (1.4) is based on the declared policies of the govdrnment. According to various statements made on these policies (especially those by the Agricultural Price Commission in their reports), the hypothetical free market price, costs of cultivation and terms of trade as between food articles and manufactured articles are the factors taken into account while fixing procurement/ minimum support prices. The free market price of foodgrains is postulated to be a function of familiar demand and supply forces, demand represented by Y and P and supply represented by F (1.5).

The amount of foodgrains procured (Q) is hypothesised to be a function (1.6) of foodgrains output, desired level of stocks,and opening stocks. The reason why output is included is obvious; but the other two may require explanation. The desired level of stock is one which, by definition, is optimum; the partial derivative is obviously positive. However, procurement will vary depending on the level of opening stock. If opening stock itself is quite high, procurement operations are likely to ease since optimum level can be reached without much difficulty. Conversely, if it is low, vigorous procurement has to be undertaken to try and reach the optimum level. Thus, BS_{-1} should have a partial derivative.

Imports are assumed (1.7) to be more or less residual in the sense that the government imports only when it is found, after domestic procurements are over, that the desired level of stocks may not be reached, after meeting the estimated demand for foodgrains through PDS (offtake). The quantity imported will depend on the shortfall. But for the fact that

import decisions are not taken at the end of the year but earlier, which causes them to be based on expected values of the explanatory variables, the function could probably be substituted by an identity.

Various budget documents and other relevant government publications contain statements like "consequent upon the increase in procurement prices, the issue prices of wheat were raised ----" (Economic Survey: 1982-83, p.40). This prompted us to formulate equation (1.8) in a way such that procurement prices determine issue prices, though the latter may not adjust fully to a change in the former.

Offtake of foodgrains is taken to be a function (1.9) of foodgrains output, population, and consumer price index. Output of foodgrains reflects the availability of foodgrains from alternative sources. The effect of population is obvious. Higher prices in general are hypothesised to drive more and more people into the fold of the PDS in an attempt to reduce expenditure while keeping real consumption the same. Those who preferred to buy in the open market and could afford to do so, may also turn to the PDS. Such preferences can be explained in terms of relative quality of foodgrains from different sources and the relative convenience of purchases from the free market as compared to the public distribution system.

The actual stock is hypothesised to be a function (1.10) of the desired level of stock and the foodgrains output which needs no explanation.

The desired stock is assumed to be decided on the basis of what will be needed to feed the population in case the worst experienced crop failure is repeated (in percentage terms). Equation (1.11) represents this.

The 'reduced form' of this system (in the sense that the dependent variable is expressed as a function of only exogenous and/or predetermined variables; the reduced form is not strictly derived) can then be written as:

$$SF = f(p_m, c^b, C^c, PF/PM, Y, P, F, BS_{-1}, CPI, \hat{F}).$$

3. Data Availability

Out of these ten explanatory variables, time-series data on c^b were not available except for a few years towards the end of the sample period, forcing us to drop it. A proxy could have been tried, but it was felt that CPI would in all probability be a good proxy since it is likely to have moved together with c^b, and it was already included in the specification. Hence our estimating equation excluded c^b to start with.

For the rest of the variables data were collected from various sources for the years 1960-61 to 1981-82. For the foodgrains stock variable, an annual average figure would have been ideal, but, barring a few recent years, monthly stock figures were not readily available. Hence, we have used the closing stock figures. The latter are not very inferior substitutes because closing stock figures (as inspection of available monthly data shows) are neither the maximum not the minimum during the year.

As regards the data relating to foodgrains output or price, we have considered only wheat and rice for convenience, ignoring the other foodgrains. This was done to reduce the burden of calculations, in view of the fact that other foodgrains constitute a very small percentage of state intervention in the foodgrains market. The import price index (p_m) is weighted accordingly.

We should also mention that all the data do not refer to a uniform accounting year. The agricultural data refer to the agricultural year and the budget data refer to the financial year, but we have ignored the difference.

The cost of cultivation index used is a crude index prepared by taking into account only agricultural wages (in Punjab) and the wholesale price index of fertilisers.

4. The Estimated Function

Since the forms of the structural equations are unknown, the form of the 'reduced form' equation also is unknown. Therefore, we made the simplifying assumption that the form is linear and estimated the equation. As an alternative, we also tried the log-linear format, but it turned out to be far inferior.

The estimated regression was confounded by a great deal of multicollinearity which is not altogether unexpected. A number of variables included in the specification are known to have an increasing trend with respect to time and hence are highly intercorrelated, and two of the variables (P, and F) were functions of time because of the way they were estimated.

Eliminating multicollinearity requires either dropping some variable(s) or adding to the observations. The latter option was not open to us, and hence we adopted the former. Even when multicollinearity became less severe, some variables remained insignificant statistically and/or had 'wrong' signs. After further pruning the specification, we finally settled on the following estimated function:

$$FS = \underset{}{6879.67} + \underset{(3.07)}{47.04Y} - \underset{(-2.29)}{458.85F} + \underset{(3.21)}{117.01\,pm}$$

$$R^2 = 0.9585 \quad F = 131.01 \quad DW = 1.74$$

It may seem a little unusual that six of the nine explanatory variables have been dropped. Actually, three were dropped to avoid multicollinearity (P, F, CPI), and the other three were dropped as their coefficients turned out to be statistically insignificant and resort to other usual statistical practices also confirmed their negative contribution to explanation.

However, even with just three variables, the explanatory power is quite good, as indicated by the R^2 and its F-value. The D-W statistic does not indicated serial correlation. Examining the residuals or errors, it is gratifying to find that these are quite small, particularly for the recent years, which is a good sign for forecasting purposes.

5. The Forecasts

Now, to use this estimated function for the purpose of forecasting, we first need estimates of the independent variables. Hence, we estimated GNP, F, and p_m for the

forecasting horizon by simple linear extrapolation using data for the 22 years that we have.[2/] As least for the GNP, the Planning Commission provides estimates for 1984-85 as well as 1994-95, so that required figures could be estimated using an annual growth rate. But these are provided more as targets than as probable achievements. Moreover, these are in 1979-80 prices, which means one will have to estimate the movements in GNP deflator (a kind of overall price index) to translate them into current prices. Hence we preferred to estimate GNP ourselves along with the other two variables.

The forecast series of food subsidies are presented in Table 1 below in the column with the heading "Through multiple regression". The second and third columns in the table present two alternative sets of the estimates arrived at using different methods.

The second column under the heading "Through Constant Rate Method" gives the food subsidies estimated by assuming that the unit costs of stocks and the rate of consumer subsidy will remain constant at the estimated 1983-84 level. These figures are available from the budget. Unit cost of stocks, as is obvious, is per unit of stock carried, and rate of consumer subsidy is per unit of offtake. Thus, to arrive at total subsidies, unit cost of stocks has to be multiplied by total stocks, and the product has to be added to the product of the rate of consumer subsidy and the offtake. Total offtake during the year is an unambiguous concept, but stocks are not because the figures will very depending on the point of time at which we measure it. We use the closing stock for this purpose. Last, the estimates for the closing stocks and offtake for the forecast horizon are arrived at through linear extrapolation.

2/ The extrapolation is based on the adjusted intercept method which would yield a zero-error estimated value for the last observation.

The third column gives estimates based on a simple linear time-trend, which fits best among various types of time-trends tried. As before, while calculating these estimates, we have added the value of the error term in the last year of the observations to the constant term of the regression. This has been done to obtain the best possible forecasts using this method.

TABLE I.1

Estimates of Food Subsidy for the Years 1984-85 to 1988-89

(Rs lakh)

Year	Through multiple regression	Through constant rate method	Through time-trend
1984-85	80708.97	97943.66	80207.23
1985-86	84361.15	101420.77	83609.64
1986-87	88013.33	104894.69	87012.05
1987-88	91665.51	108371.80	90414.46
1988-89	95317.68	111848.91	93816.87

a. The rate of consumer subsidy (on offtake) is Rs 35.10 per quintal - weighted average of those on wheat and rice for the year 1983-84 (Q.E) - and the cost of carrying the stock is Rs 31.90 per quintal.

As can be seen, the constant rate method yields the highest forecasts consistently, and the time-trend method yields the lowest. The forecasts arrived at through the multiple regression method are between these. However, the forecasts based on time-trend and on multiple regression do not differ very much. The constant rate method yields

substantially higher estimates. In fact, the estimate for 1984-85 arrived at by using this method is higher than the estimates for 1988-89 using either of the other two methods.

To make a choice among the various methods, we undertook a simple exercise. We reestimated the regressions on a data set which excluded the last two years, 1980-81 and 1981-82. We then forecast the 1980-81 and 1981-82 values of food subsidy using the three methods and compared the results with the actual values. The actuals are used for values of the predetermined variables in the cases of the multiple regression and the constant rate method. In the case of the latter method, the rates of subsidy are those estimated for 1980-81, as given in the budget document. The following table compares the predicted values to the actuals.

TABLE I.2

Predicted Values of Food Subsidy and Actuals

(Rs lakh)

Year	Through multiple regression	Through constant rate method	Through time-trend[a]	Actuals
1980-81	69461.09	71330.57	50359.30	65000
1981-82	73891.55	75397.53	53549.94	70000

[a] The figures given here are calculated in a slightly different way from the previous table. The constant term, unlike in the previous table is unadjusted, since the same is not done in the case of the multiple regression method.

The Table clearly shows that the multiple regression method performs best among the three alternative. Therefore, our choice in Table I.1 would be the forecasts derived from the same.

III. EXPORT SUBSIDIES

The figures reported in the budget as revenue expenditure on foreign trade and export promotion consist primarily of subsidies in various forms to exporters. Since no proper break-up of this is available and since the non-subsidy elements are relatively insignificant, we consider the total figures on export promotion as export subsidy.

1. The Composition and Determinants of Export Subsidies

The major elements in these are three: Cash compensatory support, Grants-in-aid and interest subsidy.

Cash compensatory support is given to exporters basically to compensate for the difference in the export price and a 'remunerative' price for them. However, the way this is disbursed, it is alleged, does not really reflect any underlying principle or rule behind it. The government fixes different rates for different commodities (with an upper limit of 25 per cent) with respect to the FOB value. Generally speaking, the rate is higher for non-traditional exports. But all the studies on export promotion measures are unanimous in branding the system as *ad hoc* in the sense that no fixed norms seem to be in use while deciding the amount of CCS to be given to a particular exporter.[3/] There may be too many considerations (probably changing over time) to be put in the form of regulations, which cause this. However, actual losses are usually made up through subsidies. Hence, one can postulate the following function:

$$CCS = F(P_x, P, X) \qquad \ldots(2.1)$$

3/ See, for example, report of the Tandon Committee (1980, pp. 189-191), and Birla Institute of Scientific Research (Undated, pp. 12-13).

Where CCS = amount of cash compensatory support, P_x = overall export price index, P = wholesale price index, and X = value of exports. Ideally, the composition of exports should also determine CCS, but given the erratic nature of CCS, it is not used in the above formulation. If the allegations about the irrationality in giving CCS are correct, P and P_x would have insignificant coefficients.

Grants-in-aid are given to an even greater extent on ad hoc basis, which is inherent in them. These are grants given to export promotion bodies and individual exporters to lighten the burden of export promotion measures undertaken by them and have to be decided on the basis of the merits of each case separately. As such, one can only try to explain these through a general kind of function. We postulate the following:

$$G = F(TB_{-1}, Z_{-1}) \qquad \ldots(2.2)$$

where G = Grants-in-aid, TB = Trade balance of India, and Z = India's share in world exports. It is hypothesised that export promotion measures are encouraged through grants when exports are lower relative to imports and to world exports.[4] The urgency is less when exports are relatively higher.

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4 Since the trade balance has a direct and important effect on the foreign exchange reserve of the country, it does not need any justification as an explanatory variable. The concern with the other (share in world exports) stems from the belief that India should be able to take full advantage of the expanding international trade. See the Report of the Committee on Export Strategies - 1980s, better known as Tandon Committee (1980, pp. 65-66), for confirmation.

Interest subsidy for export houses directly depends on the borrowing of exporters which is turn depends on their production for export primarily. Hence, we can write

$$IS = f(X) \qquad \ldots(2.3)$$

Bringing (2.1), (2.2) and (2.3) together

$$ES = f(P_x, P, X, TB_{-1}, Z_{-1}) \qquad \ldots(2.4)$$

where ES = total export subsidies.

Although total export subsidies contain some elements other than the three mentioned above, the five explanatory variables are expected to explain the rest of the variation too among themselves.

2. The Estimated Function

The empirical exercise that was carried out to test the hypothesis put forth above in the form of equation (2.4) was beset with a number of problems.

We estimated the function above assuming it was linear and it resulted in very high standard errors for some coefficients, the cause of which, as suggested by the correlation matrix, was multicollinearity. We tried to avoid this problem by redefining some of the explanatory variables. Instead of using P_x and P as separate variables, we combined them into a new variable $(P-P_x)$. After all, it is the difference in the domestic and the export price which calls for the subsidy. Putting it in a different way, the earlier

specification allowed the coefficients of P_x and P to be estimated independently. The change constrained the value of their coefficients to be the same. We also tried other forms of the same variables, e.g., ratios.

Z_{-1} and TB_{-1} were also highly correlated and the collinearity led to high standard errors. We tried them alternately, but both had coefficients with the wrong sign, and that for Z_{-1} was even statistically significant.

In all probability, both these variables were not significantly affecting the export subsidies in the way we have hypothesised, but were simply representing the rise or fall in value of exports. That is because, by definition, the effect of a rise in the value of exports, ceteris paribus, would be to raise both TB_{-1} and Z_{-1}. Hence, we finally decided to adopt a function with X as the only explanatory variable:

$$ES = \underset{(17.69)}{5595.25 + 7.06\ X}$$

$$R^2 = 9456 \quad D.W. = .95$$

As is evident from the value of R^2, the explanatory power is quite high, even with just one independent variable. The price variables also turned out to be insignificant, contributing little to the explanation of the changes in export subsidies. This result supports the allegations made about the irrational system of granting these subsidies, though it may be rational if we take into account other considerations.

After estimating this function, the last step in forecasting the subsidies remains. This involves estimating values of the independent variable to forecast these subsidies for the years 1984-85 to 1988-89.

No independent estimates of X (value of exports) for the abovementionod years are available. However, the Committee on Export Strategy - 1980's (Tandon Committee) expected a rate of growth of 21 per cent per annum. This growth rate can be used to estimate values of X for the years mentioned above using the latest actuals. However, this growth rate of 21 per cent seems too high for various reasons. The increasing protectionism of the developed countries (our major export markets), increasing competition from other countries having similar exports, recessionist trends in the developed countries, and lower exportable surpluses in India are the major ones. The export performance in the recent years has been quite good, but still the rate of growth is not near 21 per cent, and it is unlikely that such a high rate of growth will be attained in the next few years. A growth rate of 15 per cent appears more reasonable, and this is a rate which has been approximately the growth rate in the last year.

Using this growth rate on the latest available (1981-82) figure for X to start with, we estimate the values for the years 1984-85 to 1988-89 as: Rs 11190.74, Rs 12869.35, Rs 14799.75, Rs 17019.71, and Rs 19572.67 crores.

3. The Forecasts

Another way to approximate future subsidies is much simpler. During the three years 1979-82, export subsidies have been 6.5 per cent of the value of exports on an average.

One can forecast subsidies simply on the basis of this percentage, given the estimates of the value of exports.

A third way would be to fit a trend function with respect to time only and extrapolate the trend in the amount of the subsidies.

To decide on the relative merits of these methods, we predicted the 1980-81 and 1981-82 values using observations upto 1979-80 only to estimate the parameters, and actuals of value of exports to predict export subsidies for the last two years of observed values. For the second method, the parameter is given. These predictions are compared to the actuals in the following Table.

TABLE II.1

Predicted and Actual Values of Export Subsidy

Year	Through simple regression	Through percentage method	Through time-trend	Actual
1980-81	40226.9	42746.6	32105.7	42642
1981-82	45651.9	47827.6	34186.0	58944

From this comparison, it appears that the percentage method yields the best prediction and the time-trend method yields the worst among the three methods under comparison. Of course, we still cannot be certain that the percentage method will yield better forecasts, because the differences in the predictions generated by it and those given by the

simple regression method are not large enough to warrant categorical conclusions about the relative superiority of one over the other for a longer forecast horizon. Hence, we calculate our series of forecasts based on both these methods. The results of our calculations are given in the Table below.

TABLE II.2

Estimates of Export Subsidies from 1984-85 to 1988-89

(Rs crore)

Year	Through simple regression	Through percentage method
1984-85	734.11	727.39
1985-86	852.62	836.50
1986-87	988.91	961.98
1987-88	1145.64	1106.28
1988.89	1325.88	1272.22

It can easily be seen that the simple regression method results in the higher estimates. In Table II.1 it was the other way round. This is because the rate of increase implied by the estimated function is greater than that implied by the percentage method.

The difference between the two methods should be clearly spelt out. The percentage method and the simple regression method can be shown equivalent to the following equations respectively:

$$ES = b_1 X,$$

$$ES = a + b_2 X.$$

In the first (percentage method), the parameter b_1 takes an assumed value. In the other the parameters are statistically estimated on the basis of available data. The forecasts are based on the assumption that the parameters will have more or less the same values in future too. How far the assumption will hold in actual practice depends on policy decisions and institutional factors. Given these observations, the choice among these two sets of forecasts is a matter of judgement. These sets, it should be noted, do not differ from each other by very big amounts relative to the absolute amounts of the forecasts. However, the statistically estimated parameter which is based on past behaviour may be a little better for forecasting purposes, and hence we prefer the series of forecasts based on the simple regression method.

IV. FERTILIZER SUBSIDIES[5]

It is conceptually possible to construct a model for fertilizer subsidies, as has been done for food and exports. But it is practically impossible to test any model on the basis of available data because of certain characteristics.

1. Determination of and Trends in Fertilizer Subsidies

Fertilizer subsidies are primarily dependent on production and import of fertilizers, of which the latter is likely to be affected by demand (or consumption) for fertilizers. As yet, production has not been affected by demand because supply constraints have kept demand above production. Consumption, in turn, is determined by a host of factors like increase in cultivated area, progress of irrigation, progress of high-yielding variety seeds, prices of fertilizers, prices of agricultural commodities, cost of substitutes like organic manures, availability of agricultural credit, to name a few important ones. With a model including so many variables, proper testing of it would require a large number of observations. Fertilizer subsidies, on the other hand, are quite recent; at least the overt ones. Imported fertilizers have been subsidised for long though the budget does not show it as subsidy but as trading loss. However, the fact remains that overt fertilizer subsidies were given only in 1977-78 for the first time. Since then, it has been going up by leaps and bounds, and according to the budget estimates for 1983-84, it is going to cost the exchequer almost as much as food subsidy and much higher than export subsidy. Thus, the time series data

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5/ Most of the information used in this chapter is from three sources : Fertilizer Association of India (FAI), Ministry of Fertilizers and Chemicals, and the Planning Commission.

on fertilizer subsidies show a very irregular pattern and they are very difficult to model due to the policy change since 1977-78. Moreover, even if one was able to explain the variations, - which are quite extreme in the last few years- forecasting with the estimated function would be probably ill-advised since these subsidies have now reached a kind of stable level and are not expected to go up as steeply as in the last few years.

For the same reasons, one cannot even find a proper growth rate (with respect to time only). The figures would suggest that prior to 1977-78, there was a more or less linear trend growth. Between 1977-78 and 1982-83, the trend growth shot up tremendously. It is expected to become lower again henceforth. Thus, forecasting on the basis of a growth rate is also rendered impossible, due to the instability of the estimate.

2. The Estimation Method

For these reasons the method adopted here to forecast fertilizer subsidies is less rigorous and based to a great extent on judgements and certain approximations, as outlined below.

To start with, we make the assumption that the implicit rate of subsidy (per physical unit) is going to be pegged or kept constant at the 1982-83 level. This assumption is supported by the observation that fertilizer prices have exhibited an upward trend in recent years, reflecting increase in costs of production and import prices, though not fully. We believe that the rate of subsidies is unlikely to rise

much now. Moreover, there has been a fair amount of import substitution going on in this industry, reducing the imports. It is likely to gather momentum in the future years, so that imports will be very small, relatively speaking. And the price policy which has been recently adopted for indigenous fertilizers is based on a target rate of return which implies that costs will automatically get reflected in the retention price. Thus, our assumption may not be as arbitrary as it seems at first glance.

The other assumption that we make is probably less likely to be objected to and also less significant; it is assumed that changes in stock (inventory) are negligible. In other words, imports are equal to consumption less production.[6/]

With these two assumptions, subsidies on fertilizers can be predicted once estimates of demand for and domestic production of fertilizers are available.

Estimates of indigenous production by the Planning Commission placed them at 42 lakh tonnes and 14 lakhs tonnes in 1984-85, for nitrogenous and phosphatic fertilizers, respectively. As against this, the latest available figures place the 1982-83 production at 34.24 and 9.8 lakh tonnes, respectively. These figures can be compared to those for 1981-82, which were 31.44 and 9.5. It is obvious that barring two years of very spectacular progress, the estimates

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6/ Although it was earlier thought that imports affect consumption rather than the other way round, "the main explanation behind the past trends in fertilizer consumption lies in areas other than those related to aggregate availability of fertilizers." /Desai (1979), p. 398/. A recent report on fertilizer consumption (Business India, March 28 - April 10, 1983, pp. 50-55) also confirms this.

by the Planning Commission will turn out to be a little too optimistic. However, since the current shortfall is only partly due to low capacity utilization (the other reason being delayed installation of the capacity itself) which is likely to improve by 1984-85, the plan target may be met. Hence, we use these figures in our calculations. Production estimates for the next four years are not available, though capacity figures are. We assume a 70 per cent capacity utilisation (which can be compared to the approximately 68.5 per cent capacity utilisation during the last two years on an average) and arrive at production estimates for the years 1985-86 to 1988-89. The estimates for nitrogenous fertilizers would then be 54,60,62 and 67 lakh tonnes respectively. Similar estimates for phosphatic fertilizers would work out at 19 lakh tonnes in 1985-86 and 21 lakh every year (no addition to capacity anticipated) for the next three years. It should be noted that the assumed capacity utilisation figure is expected to take into account the capacity short-fall also.

Similarly, the consumption estimates made by the Planning Commission also seem to be too high to be reached by 1984-85, given the latest available data. Actually, estimating consumption is much more difficult than doing the same for production. This is because the capacities likely to be operational in the next few years are more or less known and assuming a certain rate of capacity utilization, production can be estimated. Consumption, on the other hand, is affected by a variety of factors as discussed above. A few pertinent facts in this respect should therefore be taken into consideration.

On the price front, the domestic pricing policy and import substitution is likely to result, in most cases, in increases in costs getting reflected in the price. As for the costs themselves, a substantial part of the raw materials costs are not likely to go up very much. This is because, petroleum and petroleum product prices have started falling after a period of sharp rise. Even if the fall is arrested, any rise in these prices is likely to be small in the near future. Since petroleum products constitute the major feedscock for indigenous fertilizers, the costs will rise less to this extent. However, on balance, costs are probably goint to rise slowly, implying slow price rise of fertilizers. That price rise affects fertilizer consumption has been amply demonstrated in 1980-81 when prices rose steeply and growth in consumption fell sharply. It had fallen in 1979-80 too, but that was probably due to the drought conditions, which was not so severe in the following year. Thus, the price rise is likely to affect growth in consumption. However, the recent price cut of about 17.5 per cent ought to encourage consumption. The effect in quantitative terms, however, depends on the relative importance of price in the fertilizer demand function, which is not known. Moreover, as has been recently announced, these reduced prices will be fully applicable only until present stocks last. This may cause a long-term shift in the domand function through a shift in agricultural practices, but it seems unlikely. The increase in consumption, in all probability, would be purely temporary. Also, the increase in the use of high-yielding variety seeds and the gains therefrom seem to be falling off. Between 1970-71 and 1975-76 it rose by about 107 per cent. The annual increase in 1981-82 works out to only 3 per cent. Similar is the case with spread of irrigation.

The rate of growth in irrigated area seems to be falling slowly over time. Between 1965-66 and 1970-71 the irrigated area increased by 31 per cent. Between 1970-71 and 1975-76 the rate of increase was only 21 per cent and it is a little lower between 1975-76 and 1980-81. Gross cropped area is also not chaning much. Prevailing state of technology in fertilizer use would therefore restrict the scope of increasing consumption through price cuts alone [Datta (1983)].

All this points to a smaller rate of growth in fertilizer consumption than envisaged by the Planning Commission. It estimated 1984-85 consumption to be 96 lakh tonnes in all (60 for N, 23 for P and 13 for K) as against the now-available figure of 64 lakh tonnes in 1982-83, which shows a less than 5 per cent increase over the figure for the previous year. Again, it is obvious that the estimates for 1984-85 have to be scaled down despite the price cut, to make them more realistic. We arbitrarily put the expected total consumption at 78 lakh tonnes. The expected break-up is as follows: 50 lakh tonnes of nitrogenous fertilizers, 18 lakh tonnes of phosphatic ones and 10 lakh tonnes of potassic fertilizers. This takes into account the special subsidy on phosphatic fertilizers. The Planning Commission's estimate of total fertilizer consumption in 1994-95 is 181 lakh tonnes. This implies, given an estimate of 96 lakh tonnes for 1984-85, an increase of 9.5 lakh tonnes every year on an average. We adopt the expected annual increase in consumption, and super-impose this on total consumption estimate (as modified by us) for the year 1984-85. This procedure yields total consumption estimates for the years 1985-86 to 1988-89 as 87.5, 97, 106.5 and 116 lakh tonnes, respectively. We do not estimate the breakup into the three types of fertilizers, but that can also be

estimated, given the Planning Commission estimates of consumption of nitrogenous and phosphatic fertilizers in 1989-90 as 86 and 33 lakh tonnes, respectively.

Coupled with the expected production figures, this allows us to compute total import of fertilizers which works out to 27 lakh tonnes (10 lakh tonnes of N, 7 lakh tonnes of P, and all the 10 lakh tonnes of K) in 1984-85. It may look too big in the face of only 11.62 lakh tonnes of imports in 1982-83. But the fact is that due to over-estimation of consumption, the fertilizer stock at the end of 1981-82 was very big. Hence, though the gap between consumption and production was about 20 lakh tonnes, a little less than half of the excess demand was met from the stocks and the rest by imports. This is unlikely to be repeated, since the consumption estimates have been revised. Similarly, imports for the next four years work out to be 14.5, 16, 23.5 and 28 lakh tonnes, respectively.

3. The Forecasts

What remains to be done to forecast fertilizer subsidies is mere calculation. The 1982-83 rates of subsidy work at Rs 1,250 per tonne of domestic production and Rs 843 per tonne of imported fertilizers. Ideally, we should have computed the rates for each type of fertilizer within these two groups also, to take into account the fact that rates of subsidies on different types of fertilizers differ and of the changing composition of fertilizer consumption. However, the details given in the budget are not adequate for this exercise. Recognising this limitation, we proceed with our calculations.

Given those rates and the assumption that they are going to be the same in 1984-85, the expected subsidies on the two groups of fertilizers are:

Domestic: Rs (1,250 x 51=) 63,750 lakh, and
Imported: Rs (843 x 27=) 22,761 lakh.

Thus, the total fertilizer subsidies for the year 1984-85 work out to be Rs 86,511 lakh or about Rs 865 crore. This can be compared to the total subsidies of Rs 648 crore and Rs 798 crore in 1982-83 (revised estimates) and 1983-84 (budget estimates). In fact, we expect the fertilizer subsidies to cost the exchequer most amont the three major types of subsidies - food, export and fertilizer.

On the same assumption, the subsidies on fertilizers for the years 1985-89 work out to be Rs 1035 crore (912.5 + 122.2), Rs 1147 crore (1012.5+134.9), Rs 1236 crore (1037.5+198.1), and Rs 1336 (1100 + 236) crore. The rates of subsidies are likely to change in the current year, it should be noted, but pending full information on the recent price cut, it cannot be taken into account.

TABLE A.I

Data Related to the Forecast of Food Subsidies

	Food subsidies (Rs crore)	Population (crore)	GNP (current prices) (Rs crore)	Production of foodgrains (wheat and rice) (million tonnes)	Consumer price index (urban manual worker)	Stock of foodgrains (wheat and rice) ('000 tonnes)	Unit value index of imports (rice & wheat)	Agricultural prices/ manufacturing prices (index)	Cost of cultivation index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1959-60	-	-	-	-	-	2439	77.06	-	-
1960-61	18.08	44.24	13999	45.64	57.47	2463	60.42	129.4	66.4
1961-62	19.25	45.22	14799	47.73	59.77	2386	62.52	132.3	70.0
1962-63	32.57	46.20	15727	44.00	62.07	1987	59.94	169.7	69.4
1963-64	33.87	47.21	17978	46.85	64.94	1986	60.58	128.6	68.7
1964-65	33.94	48.25	21113	51.32	71.26	674	64.62	112.9	67.8
1965-66	-56.00[a]	49.32	21866	40.98	75.86	1898	63.00	112.1	69.0
1966-67	93.28	50.42	25250	41.83	83.91	1815	89.34	102.0	88.1
1967-68	95.00	51.54	29512	54.15	91.38	1695	103.23	93.1	95.7
1968-69	12.10	52.70	30293	58.41	92.53	3893	106.14	100.4	96.4
1969-70	30.69	53.89	33521	60.52	95.98	4387	105.82	97.3	115.7
1970-71	17.98	55.13	36452	66.06	100.00	5334	100.00	100.0	100.0
1971-72	49.69	56.38	38972	69.21	103.45	7879	97.90	109.1	100.3
1972-73	117.00	57.67	42939	63.99	110.34	3410	168.82	110.5	119.5
1973-74	251.00	58.98	53447	65.83	127.01	2945	183.36	100.2	127.8
1974-75	295.00	60.32	52972	63.68	155.17	2538	226.98	99.4	176.5
1975-76	250.00	61.69	66115	77.59	159.20	7983	276.09	108.8	190.7

Contd../-

TABLE A.I (Contd.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1976-77	506.00	63.08	71231	70.93	159.20	18771	266.24	110.5	176.6
1977-78	480.00	64.50	80493	84.42	170.11	17274	301.78	102.5	172.0
1978-79	570.00	65.94	86816	89.28	175.85	17137	358.66	104.4	170.9
1979-80	600.00	67.41	95023	74.16	189.66	17358	404.58	114.4	166.9
1980-81	650.00	68.90	114601	89.94	212.07	11669	409.69	122.2	213.2
1981-82	700.00	70.43	130795	91.42	237.36	11130	370.01	114.4	228.7

a. The negative figure resulted due to some accounting adjustments. It has not been used in our estimations.

Sources:
1. Economic Survey, various issues.
2. Monthly Statistics of Foreign Trade in India, various issues.
3. Bulletin on Food Statistics, various issues.
4. Agricultural Situation in India, various issues.
5. Indian Economic Statistics, Vol. II (Public Finance), various issues.

TABLE A.II

Data Related to the Forecast of Export Subsidies

	Export subsidies (Rs crore)	Unit value index of exports	Wholesale price index (all commodities	Value of exports (Rs crore)	Trade deficit (Rs crore)	India's share in world export (per cent)
1959-60	-	-	-	627.4	304.9	1.15
1960-61	-	66	55.1	630.5	451.0	1.04
1961-62	5.50	66	55.2	668.3	328.0	1.07
1962-63	14.20	64	57.3	680.9	398.0	1.00
1963-64	7.22	63	60.9	801.6	415.2	1.05
1964-65	2.10	64	67.5	800.9	586.9	.99
1965-66	19.89	68	72.7	784.5	583.4	.90
1966-67	42.55	102	82.8	1086.5	904.6	.90
1967-68	22.68	102	92.4	1257.9	797.8	.75
1968-69	35.49	100	91.3	1367.4	373.1	.73
1969-70	44.95	104	94.8	1403.9	178.4	.67
1970-71	50.31	106	100.0	1402.7	317.7	.65
1971-72	63.86	108	105.6	1555.4	438.2	.58
1972-73	77.97	120	116.2	1895.5	251.0	.58
1973-74	77.55	146	139.7	2350.7	378.6	.51
1974-75	88.38	183	174.9	3179.7	977.2	.47
1975-76	160.69	197	173.0	4177.6	566.5	.50
1976-77	288.61	210	176.6	5133.1	-316.2	.56
1977-78	346.87	236	185.8	5433.5	107.5	.57
1978-79	419.80	234	185.8	5554.9	1842.6	.51
1979-80	378.89	236	217.6	6201.4	3374.3	.47
1980-81	426.42	254	257.3	6576.4	5967.2	.34
1981-82	509.44	259	281.3	7358.1	-	-

Sources:
1. Economic Survey, various issues.
2. Indian Economic Statistics, Vol.II, (Public Finance), various issues.
3. United Nations, Yearbook of International Trade Statistics.
4. Monthly Wholesale Price Index, various issues.

TABLE A.III

Data Related to the Forecast of Fertilizer Subsidies

	Fertilizer subsidies (Rs crore)	Area under high-yielding variety seeds (million hectares)	Total import of fertilizers ('000 tonnes)	Production of fertilizers-total ('000 tonnes)	Value of total imported fertilizers (Rs crore)	Gross cropped area (million hectares)	Irrigated area (million hectares)	Wholesale price index of fertilizers
1970-71	-	15.38	629	1059	99.9	165.79	38.01	100.0
1971-72	-	18.17	997	1230	111.3	165.19	39.37	100.6
1972-73	-	22.32	1194	1386	145.7	162.15	40.82	105.7
1973-74	-	26.04	1244	1383	226.8	169.87	42.18	113.9
1974-75	-	27.33	1602	1512	532.5	164.19	43.65	203.0
1975-76	-	31.89	1556	1855	533.8	170.99	45.30	214.7
1976-77	59.79	33.56	1051	2380	261.2	167.28	46.91	186.5
1977-78	61.42	38.93	1521	2670	337.9	172.31	48.49	177.2
1978-79	293.26	40.13	1987	2940	448.2	175.18	50.65	175.0
1979-80	602.53	38.38	2005	2983	515.5	167.20	52.60	167.0
1980-81	505.26	45.26	2759	3005	817.8	173.00	54.60	243.0
1981-82	386.22	46.68	2041	4093	548.0	175.00	57.45	274.0

Sources: 1. Economic Survey, various issues.

2. Indian Economic Statistics, Vol.II (Public Finance), various issues.

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