Subsidy Fiscal Deficit and Inflation in Developing Countries

Ambar Ghosh
Presidency College, Calcutta

Chandana Ghosh
Indian Statistical Institute, Calcutta, India

Abstract

Proponents of the New Economic Policy are of the view that, if subsidies are reduced and funds released therefrom are used to step up public investment to give a boost to aggregate investment, then fiscal deficit will stay unchanged and there will be no disturbance to the macroeconomic stability of the economy. This paper shows that the relationship between investment, fiscal deficit and macroeconomic stability is a complex one. More precisely the paper uses a structuralist dual economy model to show that there exists conditions under which if subsidies are reduced and public investment is stepped up to keep unchanged or raise aggregate investment, then both fiscal deficit and inflation will rise. Moreover, the conditions under which this happens are precisely those which have been presumed to be true by the proponents of the New Economic Policy.

Introduction

Some of the major macroeconomic problems faced by a developing country like India are, the threat of internal and external debt trap, inflation, BOP deficit and low levels of investment leading to low rates of growth. The major cause of the first three problems in the context of countries like India has been traced by the proponents of the New Economic Policy (NEP) to large fiscal deficits. They prescribe stringent restrictions on the latter to contain the former[1]. Regarding the fourth problem the proponents of NEP are of the view that, it is not possible to rely solely on the private sector to meet all the investment requirements of a country. It is necessary to step up public investment mainly in infrasturcture to sustain a high rate of growth[2].

Obviously, the recommendations presented above involve a policy conflict. How can the government step up public investment keeping fiscal deficit under tight control? One way out suggested in Indian context by the proponents of NEP consists in reducing subsidies and using the funds released to raise public investment. In fact, in a study NIPFP estimated that in 1994 explicit and implicit subdidies given by the Government of India constituted more than 14 per cent of GDP and 90 per cent of these subsidies were on nonmerit goods. Clearly, in the light of this study the suggestion made by the proponents of NEP makes eminent sense.

From the above it follows that, the policy makers in India subscribe to the view that by reducing subsidies it is possible to step up investment without raising fiscal deficit or the rate of inflation. The objective of this paper is to subject this proposition to close scrutiny. The paper shows that the relationship between subsidy, fiscal deficit and inflation is much more complex than what is conceived by the proponents of NEP. In fact, to anticipate a conclusion of the paper, it is found that, there exists conditions under which if the government seeks to reduce subsidies and raise public investment to keep aggregate investment unchanged, then it will lead to an increase in both inflation and fiscal decicit. If, following a reduction in subsidy, public investment is raised not just to keep aggregate investment unchanged, but to raise it, then under the same conditions inflation and fiscal deficit will increase even more.

The analysis is carried out in the structuralist dual economy framework for a closed economy as developed by Cardoso (1981), Rakshit (1982), Taylor (1983, 1991), Bose (1985, 1989), et. al. In this kind of a framework there is mark-up pricing and excess capacity in industry. In agriculture prices are market clearing and supply is not perfectly elastic. The models were constructed to emphasize on the importance of the demand side factors in the determination of output and prices in LDCs. We hope that, the demand side factors and the duality in the price adjustment processes and in the organization of production in industry and agriculture play a key role in understanding the behaviour of the macroeconomy in countries like India.

Relevance of the closed economy assumption in this era of globalisation may seriously be questioned. The assumption, however, may be justified on following grounds. First, the objective of this paper is to highlight the complexity of the relationship between subsidy, fiscal deficit and inflation. In the first attempt it is standard to study the relationship in the simplest possible framework. This is one reason why this paper does not bring in the complications of foreign trade. The other point is that, despite WTO agreements and dismantling of quantitative restrictions on agricultural imports in many developing countries like India, stringent restrictions on foreign trade in agricultural goods are likely to remain in future on grounds of food security and economic vulnerability of the weaker sections of population. In these countries agriculture not only supplies the masses with the most vital item of consumption, but also supports the bulk of the population. Any shrinkage in agricultural activities or instability in agricultural prices is likely to have disastrous consequences. Hence for quite some time to come in countries like India agricultural prices will continue to be determined by domestic demand-supply factors. For these reasons closed economy assumption is still valid for agriculture. However, extension of our model to the case of an open economy is eminently sensible and figures high on our future research agenda.

The paper is arranged as follows. Section 1 develops the model. Section 2 identifies the optimum mix of subsidy, fiscal deficit, and public investment which minimize inflation keeping investment at a target level. It also examines how fiscal deficit and inflation behave when subsidies are reduced and public investment is stepped up to raise or keep unchanged aggregate investment. Section 3 summarizes the major results and contains the concluding comments.

1 Model

The economy consists of two broad sectors, industry and agriculture; and is closed to the outside world. Industry produces a single good - the output of which is denoted by Y - using a fixed coefficient production function as shown below :

$$Y = \min\left(\frac{L_Y}{a}, \frac{K_Y}{b}\right) \tag{1}$$

where L_Y and K_Y denote respectively quantites of labour and capital available to industry, while a and b stand respectively for fixed quantities of labour and capital required per unit of Y. Henceforth for simplicity we shall assume 'a' to be equal to unity. Price of Y is set on a mark-up basis. Thus

$$\bar{P}_Y = (1+\alpha)\,.\,W \tag{2}$$

where W and $\bar{P}_Y$ denote respectively the money wage rate in industry and the price of Y received by the producers, while α denotes the fixed mark-up which is applied to the average variable cost of production, W. (Here our focus is only on the short run where capital stocks in both the sectors are fixed). However, there is a subsidy applied on an ad valorem basis on Y at the rate s. Hence the buyers do not face $\bar{P}_Y$, but P_Y

$$P_Y = \bar{P}_Y.(1-s) = (1-s).(1+\alpha)\,.\,W \quad \text{(using (2))} \tag{3}$$

From (3) we can compute shares of profit, wage and subsidy in industrial output, Y, as shown below :

$$\text{Share of Wages} \equiv \frac{W}{P_Y} = \frac{1}{(1+\alpha).(1-s)} \tag{4}$$

$$\text{Share of Profit} \equiv \frac{W.\alpha}{P_Y} = \frac{\alpha}{(1+\alpha).(1-s)} \tag{5}$$

$$\text{Share of Subsidy} \equiv \frac{s(1+\alpha).W}{P_Y} = \frac{s}{(1-s)} \tag{6}$$

Agriculture is assumed to produce a single good which is referred to as food. It is produced with land, labour, capital and an intermediate good. The last two inputs are supplied by industry. To keep our analysis tractable we shall make a few simplifying assumptions regarding the production function in agriculture. We shall take the amount of land under cultivation as given, and will not show it explicitly in the production function. Moreover, we shall rule out any substitution between labour and intermediate good (for such substitutions are of little importance in the present context); and assume that they are used in a fixed ratio to one another. The production function of food, the output of which is denoted by $\widetilde{X}$, is assumed to display constant returns to scale in capital, intermediate good and labour. The presumption is that capital accumulation is land augmenting. To make matters still simpler we assume that real wage in agriculture is given in units of food. Under the conditions stated above, the marketable surplus of food available to industry (X) is given by

$$\begin{aligned} X &= \widetilde{X} - W_a.L_x = \widetilde{X} - W_a.\delta.M_x = \widetilde{X}(K_x, M_x, L_x) - W_a.\delta.M_x \\ &= \widetilde{X}(K_x, M_x, \delta.M_x) - W_a.\delta.M_x \equiv X(K_x, M_x); \frac{\partial X}{\partial M_x} > 0 \text{ and } \frac{\partial^2 X}{\partial M_x^2} < 0 \qquad (7) \\ &\quad \text{(by assumption)} \end{aligned}$$

where K_x, M_x and L_x denote respectively the quantities of capital, intermediate good and labour available to agriculture; $\widetilde{X}(.)$ gives the production function of food; δ stands for the fixed ratio of labour to intermediate inputs in food production and W_a is the given real wage rate in agriculture in units of food. It can easily be checked that since $\widetilde{X}(.)$ is linear homogeneous, so must be $X(.)$.

Food market is assumed to be perfectly competitive and producers maximize profit. From the first order condition of profit maximization we get

$$\frac{\partial X}{\partial M_x} = \frac{1}{P} \qquad (8)$$

where $P \equiv \frac{P_x}{P_Y}$, and P_x and P_Y denote money prices of X and Y respectively. From (7) and (8) we get

$$X^s = X^s(P)\ ;\ X^{s'} > 0 \qquad (9)$$

or

$$P^s = X^{s^{-1}}(X) = P^s(X);\ P^{s'} > 0 \qquad (10)$$

where X^s denotes the planned supply of X and P^s is the supply price of X.

Assuming that workers spend their entire income on food and ignoring producers' food consumption for standard reasons, food market clearing condition may be written as (using (4)).

$$P.X = \frac{1}{(1+\alpha).(1-s)}.Y = \frac{1}{1+\alpha}\left[\left\{1+\frac{s}{1-s}\right\} Y\right] = \frac{1}{1+\alpha}.(Y+S) \tag{11}$$

where

$$S \equiv \frac{s}{1-s}\, Y \quad \equiv \quad \text{Total amount of subsidy given by the government in terms of } Y \text{ (see (6)).}$$

The above equation yields the market clearing value of P, which is denoted by P^d.

$$P^d = \frac{\frac{1}{1+\alpha}\,(Y+S)}{X} \tag{12}$$

Agriculture is in equilibrium when

$$\frac{\frac{1}{1+\alpha}\,(Y+S)}{X} = P^S(X) \text{ (using (10) and (12))} \tag{13}$$

It is assumed that there exists excess capacity in industry, and accordingly, its output is demand determined. Industrial good is demanded for purposes of consumption by the producers of both X and Y; it is also used for purposes of investment, and as an intermediate input in agriculture. Thus industry equilibrium condition is given by

$$\begin{aligned} Y &= C_1.\left[\frac{\alpha}{(1-s).(1+\alpha)}\right].Y + C_2.(P.X - M_x) + M_x + I_p + I_g \\ &= C_1.\left[\frac{\alpha}{1+\alpha}\ \{Y+S\}\right] + C_2.PX + (1-C_2)\ M_x + I_p + I_g \\ &\quad \text{(since } \left(\frac{1}{1-s}\right) Y = Y + S, \text{ see (11))} \end{aligned} \tag{14}$$

where C_1 and C_2 stand for average and marginal consumption propensities of capitalists and landlords respectively; and I_p and I_g denote respectively private and public investment[3].

We assume that P_x clears food market at every instant so that (11) is always satisfied, and accordingly the value of P at every instant will equal that of P^d as yielded by (12). Since adjustments in X and Y are time consuming, it is only appropriate that demand for Y is reckoned at the market clearing P, P^d (see Rakshit (1982)). Substituting for P the value of P^d as given by (12) in (14) we get :

$$Y = C_1 \frac{\alpha}{1+\alpha} (Y+S) + C_2 \frac{1}{1+\alpha} (Y+S) + (1-C_2)\, M_x(X) + I_p + I_g$$

(using (7) and ignoring K_x, as K_x is exogenously given here) (15)

Government's budget constraint is given by

$$I_g + S = D \tag{16}$$

where D denotes the amount of fiscal deficit.

Now we introduce the inflation mechanism as developed by Cardoso (1981), and Taylor (1983, 1991). Accordingly, we assume here that industrial workers bargain for a higher money wage if wage rate in units of food falls below a minimum level (h^*). This may be formally expressed as follows :

$$\hat{W} = Q.\left(h^* - \frac{w}{P}\right) \ ; \ 0 < Q < 1 \ ; \ \hat{W} = \frac{1}{W}.\frac{dW}{d\tau} \ , \ \text{for } h^* > \frac{w}{P} \tag{17}$$

where $w \equiv \frac{W}{P_Y}$ and $\tau \equiv$ time. We shall presently explain that in our model $\hat{W}$ also equals the rate of inflation in equilibrium. Therefore (as follows from (17))

$$r = r\left(\frac{w}{P}\right) \ ; \ r' < 0 \tag{18}$$

where r denotes the rate of inflation. As P_Y is given by the mark-up pricing rule and s should be stable in equilibrium, $\hat{P}_Y = \hat{W}$ in equilibrium (see (2) and (3)). In equilibrium p is also stable. Hence in equilibrium $\hat{P}_x = \hat{W}$. Therefore $r = \hat{W}$ in equilibrium. Substituting for P the value of P^d as given by (12), and for w its value that we get from (4) in (18) and manipulating terms we have

$$r = r\left(\frac{X}{Y}\right) \ ; \ r' < 0 \tag{19}$$

In what follows we assume that $\left(\frac{X}{Y}\right) < h^*$.

The specification of our model is now complete. It consists of the following key equations, (13), (15) and (19). We are for the present concerned with the short run where capital stocks are given. There are three endogenous variables in the model : Y, X and r. Exogenous variables of the model are I_p, C_1, C_2 and production functions in industry and agriculture, while D, S and I_g are policy parameters. The government by assumption can directly control D, S and I_g. We regard I_p (aggregate private investment)as given here. This will suffice for the present. Later we shall relax this assumption and make I_p an increasing function of the rates of profit in industry and agriculture and I_g (public investment). Equations (13), (15) and (19) can be solved for the equilibrium values of the endogenous variables. These equations may be solved as follows. From (13) and (15) we can solve for equilibrium values of X and Y, given I_g, I_p etc. Substituting these equilibrium values of X and Y in (19) we get the equilibrium value of r. The solution is shown diagramatically in Figures 1 and 2. Since S is given, $(\frac{dP_Y}{d\tau}).\frac{1}{P_Y} = \hat{W}$, (see (3)). Again, in equilibrium X and therefore P are fixed - vide (10). Therefore $(\frac{dP_X}{d\tau}).\frac{1}{P_X} = \hat{W}$, also in equilibrium.

The combination of X and Y which satisfy (13) and (15) are shown by $\overline{XX}$ and $\overline{YY}$ respectively in Figure 1. The signs of the slopes of $\overline{XX}$ and $\overline{YY}$ are quite selfevident. However, as we have shown in appendix A.1, $\overline{YY}$ has to be steeper than $\overline{XX}$ for the equilibrium to be stable. The curve rr in Figure 2 gives the locus of $(r, X/Y)$ satisfying (19). The equilibrium values of X and Y correspond to the point of intersection of $\overline{XX}$ and $\overline{YY}$. The equilibrium value of r is given by the point on rr correponding to the equilibrium value of (X/Y).

1.1 Trade off Between Inflation and Growth

We now show that there exists a trade-off between inflation and investment, i.e., if investment goes up, then there takes place an increase in the equilibrium rate of inflation. Note first that the ratio, (X/Y) gives the wage rate in food units in our model. It follows from (13) that this ratio falls along $\overline{XX}$ (Figure 1) with an increase in Y. Now consider an exogenous decline in the aggregate investment brought about by an autonomous fall either in I_p or in I_g on in both. This will lead to in Figure 1 a leftward shift in $\overline{YY}$, but leave $\overline{XX}$ unchanged (vide (13) and (15). Therefore equilibrium values of X and Y will fall, but that of (X/Y) will rise. Hence from (19) it is clear that, the rate of inflation will fall. This establishes our proposition, namely, a fall in aggregate investment reduces the rate of inflation, and coversely. This happens when the amount of subsidy is given and change in I_g - when such changes occur - are accmmmodated through adjustments in the amount of fiscal deficit.

The working of the model, or the mechanism that brings about these changes may be described as follows. It is assumed that prices of industrial goods are fixed on a cost-plus basis, while industrial output adjusts to demand. Prices of agricultural goods however clear food market at every instant and agricultural output goes up if market clearing price of food in units of Y is greater than the supply price of food in units of Y. If I_g falls, there will emerge excess supply in industry, and industrial output (Y) will shrink. The decline in Y will reduce employment and food demand creating a situation of excess supply in the food market at the initial level of marketable surplus of food (X) and food price. The excess supply in food market will reduce P^d. So $P^d < P^s$ at the initial X (see (12) and (13)). Therefore food output, and marketable surplus of food, X, will fall. The fall in X will reduce demand for Y even further. This contractionary process will continue until the system comes to the new equilibrium with lower values of Y and X. As $\overline{XX}$ is unchanged (Figure 1), with the fall in Y, $\left(\frac{X}{Y}\right)$ rises. So inflation, vide (19), falls.

1.2 Subsidy, Fiscal Deficit and Inflation

In the previous section we found that, if the government keeps the amount of subsidy unchanged and accommodates changes in the budget by adjusting the amount of fiscal deficit, the rate of inflation will go up with an increase in aggregate investment and conversely. Here we shall examine whether the rate of inflation can be reduced by effecting an increase in the amount of subsidy financed by an increase in fiscal deficit, given the level of aggregate investment. We shall work it out with the help of Figure 1.

An increase in S will lead to a rise in workers', capitalists' and landlords' income at the initial equilibrium (X, Y), which in turn will bring about an expansion in demand for both X and Y. There will thus take place, vide (13) and (15), an upward shift in $\overline{XX}$ and a rightward shift in $\overline{YY}$ in Figure 1. Hence equilibrium values of X and Y will rise. What happens to the rate of inflation depends upon how (X/Y) changes from one equilibrium to the other, (see (19)).

We now derive the conditions under which the rate of inflation rises following an increase in S financed by a rise in fiscal deficit, given the level of aggregate investment. We find from (19) that the rate of inflation is an increasing function of (Y/X). An increase in (Y/X) implies a decline in wage rate in units of food and therefore a rise in the rate of inflation. Thus the effect on inflation of a rise in S can be traced through its impact on (Y/X). We rewrite agricultural equilibrium condition (13) as

$$\frac{1}{1+\alpha}(Y+S) = p^S(X)X \tag{20}$$

Taking total differential of (20), with α treated as a constant, we get

$$p^{S'}XdX + p^S dX = \frac{1}{1+\alpha}(dY+dS) = \frac{1}{1+\alpha}[1+1/(dY/dS)]dY \tag{21}$$

Following a ceteris paribus increase in S equilibrium values of Y and X change. In fact, other exogenous variables remaining unchanged, we can derive the change in the equilibrium value of Y as a function of dS from the industry and agriculture equilibrium conditions. This is given by

$$dY = \bar{\theta}(\underset{+1}{C}, \underset{+2}{C}).dS \tag{22}$$

The value of $\bar{\theta}(.)$ is derived in appendix in section A.2. From (22) we get

$$\frac{dY}{dS} = \bar{\theta}(\underset{+1}{C}, \underset{+2}{C}) \tag{23}$$

If we substitute for (dY/dS) its value as given by (23) in (21), we get the relationship between changes in equilibrium values of Y and X following a ceteris paribus increase in S. After making this substitution we get

$$\left(\frac{1}{1+\alpha}\right).\left[1+\frac{1}{\bar{\theta}(.)}\right]dY = \left[p^{S'}.X + p^S\right].dX \tag{24}$$

Dividing the lhs of (24) by $\frac{1}{1+\alpha}(Y+S)$ and the rhs by $p^S.X$ (as $\frac{1}{1+\alpha}(Y+S) = p^S.X$ in the initial equilibrium — see (13)), we get

$$\left[1+\frac{1}{\bar{\theta}}\right]\frac{dY}{Y}.\frac{Y}{Y+S} = \left[p^{S'}.\frac{X}{p^S}+1\right]\frac{dX}{X}$$

$$\text{or, } \left[1+\frac{1}{\bar{\theta}}\right](1-s)\hat{Y} = \left(1+\frac{1}{\eta}\right)\hat{X}\ ; \left(\text{since } \frac{S}{Y} = \frac{s}{1-s} \text{ see (6)}\right) \tag{25}$$

where $\hat{Y} \equiv \frac{dY}{Y}, \hat{X} \equiv \frac{dX}{X}$ and $\eta \equiv$ price elasticity of supply of X.

Therefore, following a ceteris paribus increase in S,

$$\left(\frac{\hat{X}}{\hat{Y}}\right) > 1, \quad \text{if}$$

$$\left[1 + \frac{1}{\bar{\theta}(.)}\right].(1 - s) > \left(\frac{1}{\eta}\right) \tag{26}$$

As both X and Y rise following an increase in S, the rate of inflation falls when (26) is satisfied following an increase in S.

Now we explain the meaning of the terms on the lhs and rhs of (26). First note that, here the economy moves from one equilibrium to another because of a ceteris baribus increase in S financed by an increase in D. The lhs of (26) gives the percentage increase in the equilibrium value of industrial workers' expenditure on food in units of Y per one per cent increase in the equilibrium value of Y. The rhs gives the percentage increase in the equilibrium value of food supply to industry in units of Y per one per cent increase in the equilibrium value of X. Therefore lhs (26) $.\hat{Y} =$ rhs (26). $\hat{X}$. Accordingly, if lhs (26) ¿ rhs (26), then $\hat{X} > \hat{Y}$ following a ceteris baribus increase in S.

From (26) and (23) it follows that if C_1, C_2 and s are sufficiently small, and price elasticity of food supply to industry sufficiently large, the inflation rate falls following an increase in S. The intuition behind the result may be explained as follows.

An increase in subsidy financed by an increase in fiscal deficit produces two opposite effects on the rate of inflation.

(i) On the one hand, there takes place an increase in disposable income by the amount of the increase in S. Since this leads to an increase in demand for both X and Y, the effect is inflationary. The larger are C_1, C_2 and s, the greater is this demand expansion. (The higher is s, the greater is the increase in capitalists' and industrial workers' income per unit increase in Y). The smaller is the price elasticity of food supply, the larger is the increase in food prices following a given excpansion in food demand. Therefore, the larger are C_1, C_2 and s and the smaller is η, the stronger is the inflationary effect.

(ii) On the other hand, an increase in S is also associated with a rise in the rate of subsidy, s. This rise in s lowers P_Y since industrial prices are set on the basis of mark-up pricing rule — see (3). The fall in P_Y, given P_x, gives a boost to food supply tending to lower food prices and the rate of inflation thereby. Obviously, this disinflationary effect is stronger, the greater is the price elasticity of food supply to industry and the larger is the increase in s following a given increase in S.

Now the smaller is the intial Y, and the less is the expansion in Y following a given increase in S, the larger is the rise in s. We have already explained in (i) that, the smaller are C_1, C_2, the less is the expansion in Y following an increase in S.

Again, it is not very difficult to see that, the lower is the initial s and the smaller are C_1, C_2, the less is the initial Y. Let us explain. Given the level of aggregate investment, the less is the initial s, the smaller is the private sector's income in units of Y per unit of Y. Hence the smaller is the initial Y. Moreover, the less are C_1, C_2, the lower is the level of the initial Y corresponding to a given initial s.

Summing up the above observations we find that, the smaller are C_1, C_2, and the initial s and the larger is the price elasticity of food supply to industry, the greater is the likelihood that the inflation rate will fall following an increase in S. Hence the result. From the above we get the following proposition : -

Proposition 1 : If consumption propensities and the initial rate of subsidy are sufficiently small, and the price elasticity of food supply sufficiently large, then, with the aggregate investment remaining unchanged, an increase in subsidy financed by an increase in fiscal deficit will lower inflation instead of raising it.

2 Profitability and Private Investment

Here we seek to find out whether there exists an optimum mix of I_g, S and D which minimizes the rate of inflation corresponding to any given level of aggregate investment, when I_P is sensitive to profit rate and I_g. We continue to treat I_g as a policy parameter, but

$$I_P = I_P\left(\underset{+}{\frac{\alpha}{1+\alpha}\ (Y+S)},\ \underset{+}{\Pi(X)},\ \underset{+}{I_g}\right) \tag{27}$$

where

$$\frac{\alpha}{1+\alpha}\,(Y+S)\ \left(\equiv \frac{\alpha}{1+\alpha}\left(1+\frac{s}{1-s}\right)\,Y = \frac{\alpha}{1+\alpha}(Y+S)\ (\text{— see (5) and (6)})\right)$$

$$= \text{profit in industry in terms of } Y.$$

and

$$\Pi(X) \left(\equiv p^S(X)X - M_x(X) \; (\text{— see (7) and (10)} \right)$$

$$= \text{profit in agriculture in terms of } Y$$

$$I = I_P + I_g = I_P \left(\frac{\alpha}{1+\alpha} (Y+S),\ \Pi(X), I_g\right) + I_g \quad \text{using (27))} \tag{28}$$

Our extended model, with aggregate investment treated as an endogenous variable is now given by the following key equations : (13), (15), (16), (19) and (28). The key equations of this new model are the same as those of the previous model except for the fact that it contains only one additional equation, (28). The endogenous variables of the model are Y, X, D, r and I. The exogenous variables of the model lare C_1, C_2, α and production functions, while I_g and S are policy parameters. The equations may be solved as follows. We can solve (13) and (15) for the industry-agriculture equilibrium values of X and Y in terms of I, given S and other exogenous variables. Putting these values of X and Y in (28), we can rewrite it as

$$I = I_P \left(\frac{\alpha}{1+\alpha} .(Y(I,S)+S),\ \ \Pi(X(I,S)), I_g\right) + I_g \tag{29}$$

where $Y(.)$ and $X(.)$ give respectively the industry-agriculture equilibrium values of Y and X as functions of I and S, given other exogenous variables, as yielded by (13) and (15). We can solve (29) for the equilibrium value of I. The solution is shown in Figure 3 where II gives corresponding to any I the value of I as yielded by the rhs of (29), given I_g, S and the exogenous variables. Obviously, the equilibrium value of I corresponds to the point of intersection of the 45^o line and the II schedule. II is upward sloping because an increase in I brings about an expansion in both X and Y which in turn raises profit rates in both industry and agriculture giving a boost to I_P and therefore I (see (27)).

Denoting the equilibrium value of I by I^*, we get

$$I^* = I^*(I_g, S) \ ; \quad I^*_{I_g}, I^*_s > 0 \tag{30}$$

Signs of partial derivaties of (30) may also be derived diagramatically as follows. One can easily check that, an increase in I_g or S, given I, raises the planned value of I as yielded by (28). Therefore II in Figure 3 shifts upward and the equilibrium value of I rises.

2.1 Derivation of the Inflation Minimizing Pair (I_g, S) Corresponding to a Given I^*

Here we derive the inflation minimizing pair (I_g, S) corresponding to a given I^*. First, note that, we can solve the key equations of our model, (13), (15), (16), (19) and (28) to obtain

$$r^* = r^*(I_g, S) \tag{31}$$

where $r^* \equiv$ the equilibrium rate of inflation. The pair (I_g, S) which minimize r^* corresponding to a given I^* is derived by carrying out the following exercise

$$\underset{I_g.S}{Min}\ r^*(I_g, S)$$

subject to

$$I^*(I_g, S) = \bar{I} \tag{32}$$

The exercise has been carried out diagramatically in Figure 4. In both Figures 4a and 4b, the line I_gI_g in the second quadrant gives all the combinations of I_g and S which keep the equilibrium level of aggregate investment, I^* at a given level, $\bar{I}$, i.e., which satisfy (32). The slope of I_gI_g may be explained as follows. Since, as follows from (30), I^* goes up following an increase in either I_g or S, one has to be lowered following an increase in the other if I^* is to be kept at a given level. In the first quadrant $rr(\bar{I})$ gives the value of r^* corresponding to different combinations of I_g and S lying on I_gI_g. The shape of $rr(\bar{I})$ may be explained as follows. With $I^* = \bar{I}$, as S goes up and I_g falls comensurately along I_gI_g, both X and Y expand. This happens because, as we have explained earlier, an increase in S, with $I = \bar{I}$, leads to an upward shift in $\overline{XX}$ and a rightward shift in $\overline{YY}$ in Figure 1. Hence, when $S = 0$ and $I_g = I_g^0$ (see Figs. 4a and 4b), Y and X are at their minimum possible levels, with $I = \bar{I}$. Therefore price elasticity of supply of X, η is likely to be at the highest possible level and s at the minimum possible level.

Propositions 1 states that, with I remaining at a given level, an increase is S lowers inflation, if C_1, C_2 and s are sufficiently small and η sufficiently large. Thus, with $I = \bar{I}, r^*$ has the highest chance of falling following an increase in S from zero (and a comensurate decline in I_g from I_g^o along I_gI_g). Let us first consider the case where r^* does fall. As S rises and I_g falls along I_gI_g so that $I = \bar{I}$, both X and Y expand. Hence η is likely to fall and s is likely to rise. (s may of course fall if Y rises more than proportionately following the increase in S. But we ignore this case for the time being). Thus, as S rises, with

$I = \bar{I}$, the chance of r^* falling following a further increase in S diminishes. Therefore, as S increases, we are likely to eventually get a value of S, say $\bar{S}$, such that, if S is raised from $\bar{S}$, then r^* will rise instread of falling. Thus $rr(\bar{I})$ may be U-shaped as shown in Figures 4a and 4b. In that case the inflation minimizing value of S, with $I = \bar{I}$, will correspond to the minimum point of $rr(\bar{I})$. The value of I_g which corresponds to the inflation minimizing S on I_g, I_g is the inflation minimizing value of I_g.

These values of I_g and S are shown as $\bar{I}_g$ and $\bar{S}$ in Figures 4a and 4b. Of course $rr(\bar{I})$ can slope downward or upward all through. In these cases we have corner solutions to our constrained minimization problem. From the above and proposition 1 we get the following proposition :-

Proposition 2 : If S is reduced and I_g is raised to keep I unchanged, then the rate of inflation will rise if C_1, C_2 and s are sufficiently small and η sufficiently large.

Now we shall examine how fiscal deficit, D behaves when S is lowered and I_g is raised along $I_g I_g$. When S is lowered, as we have already explained, X, Y and profit rates in both industry and agriculture go down. This brings about a decline in I_P. Hence, to keep I unchanged, I_g has to be raised. If I_P is very highly sensitive to profit rate and not much to I_g, then the amount of required increase in I_g may be larger than the amount of decline in S — see (27) and (28). In this case D will rise. Thus we get the following proposition :-

Proposition 3 : If sensitivity of I_P to profit rate is suficiently high, but to I_g sufficiently low, then if S is reduced and I_g is raised along with it to keep I unchanged, fiscal deficit, D, will rise.

From Proposition 2 and Proposition 3 we get the following result :-

Proposition 4 : If S is reduced and I_g is raised along with it to keep I unchanged, then both the rate of inflation and fiscal deficit will increase if C_1, C_2 and s are sufficiently small, η sufficiently large and sensitivity of I_P to profit rate is sufficiently high, but to I_g sufficiently low.

3 Conclusion

The proponents of the New Economic Policy (NEP) recommend stringent restrictions on fiscal deficit to avoid macroeconomic imbalance and internal and external debt traps. They also recognize the necessity of large scale public investment particularly in infrastructure to sustain a high rate of growth. To reconeile the apparently incompatible objectives of having public investment on a substantial scale and keeping fiscal deficit at a low level, they prescribe in Indian context a drastic reduction in subsidies. They point out that, if subsidies are reduced to finance a step-up in public investment, then there will be no upward pressure on fiscal deficit and hence macroeconomic stability of the economy will not be jeopardized.

Our paper shows that in a structuralist dual economy model where effective demand plays a key role in determining aggregate output, the policy prescription described above does not always work. More importantly and ironically, it shows that the policy prescription is unlikely to work under conditions which constitute a part of the basic premise of the New Economic Policy. It is found that, if public investment is stepped up following a reduction in subsidy to raise or just to keep unchanged aggregate investment, then fiscal deficit will rise if private investment is not much sensitive to public investment, but highly responsive to profit rates. This condition is perhaps a basic assumption of the New Economic Policy which relies on market forces to ensure efficiency and drive growth.

Price elasticity of supply of agricultural goods is a bone of cotention between the proponents and critics of the New Economic Policy. While the former consider it to be fairly high, the letter regard it to be very low. Our paper shows that, if, following a reduction in subsidy public investment is increased to raise or just to keep aggregate investment unchanged, then inflation will go up isntead of falling, when, given the consumption propensities of different classes, and the initial rate of subsidy, the price elasticity of food supply is sufficiently high. This paper, of course, has some obvious limitations. It does not explicitly consider either the monetary sector or the external sector. Extension of our model to incorporate these sectors is eminently sensible.

Appendix

A.1 The Stability of Equilibrium : 1.

The agriculture and industry equilibrium conditions given respectively by (13) and (15) in the text are rewritten as follows :

$$p^D - p^S = \frac{\frac{1}{1+\alpha}(Y+S)}{X} - p^S(X) \equiv P(Y, X; S) = 0 \tag{a.1}$$

$$C_1.(\frac{1}{1+\alpha}(Y+S)) + C_2.(\frac{1}{1+\alpha}(Y+S)) + (1-C_2)M_x(X) + I_P + I_g - Y \equiv U(Y, X; S) = 0 \tag{a.2}$$

Equations (a.1) and (a.2) can be solved for the equilibrium values of Y and X, given I_P, I_g, S etc. Now we consider the stability of the equilibrium defined above. The adjustment rules of Y and X are given by

$$\frac{dY}{dt} = a_1.U(.) \; ; \; a_1 > 0 \tag{a.3}$$

$$\frac{dY}{dt} = a_2.P(.) \; ; \; a_2 > 0 \tag{a.4}$$

Given the adjustment rules stated above, the equilibrium is stable if

$$\frac{\partial U}{\partial Y} + \frac{\partial P}{\partial X} < 0 \tag{a.5}$$

$$\begin{vmatrix} \frac{\partial U}{\partial Y} & \frac{\partial U}{\partial X} \\ \frac{\partial P}{\partial Y} & \frac{\partial P}{\partial X} \end{vmatrix} \; > \; 0 \tag{a.6}$$

From (a.6) it follows that the equilibrium is stable if

$$\left[-\left(\frac{\partial U}{\partial Y}\right) / \left(\frac{\partial U}{\partial X}\right)\right] - \left[-\left(\frac{\partial P}{\partial Y}\right) / \left(\frac{\partial P}{\partial X}\right)\right] > 0 \tag{a.7}$$

This implies that the slope of $\overline{YY}$ > The slope of $\overline{XX}$ (see Figure 1).

A.2 Derivation of $\bar{\theta}$

From equations (13) and (16) we find that

$$\begin{aligned} \frac{dY}{dS} &= \frac{\left(C_1.\frac{\alpha}{1+\alpha} + C_2.\frac{1}{1+\alpha}\right) + \frac{(1-C_2).M_x}{(1+\eta)p^S}(1+\tilde{q})}{1 - \left(C_1.\frac{\alpha}{1+\alpha} + C_2.\frac{1}{1+\alpha}\right) - (1-C_2).\frac{M_x}{(1+\alpha).(1+\eta)}p^S} > 0 \\ &= \bar{\theta}\left(\underset{+}{C_1}, \underset{+}{C_2}\right) \end{aligned} \tag{a.8}$$

Notes

1. See Joshi and Little (1994).

2. See Ahluwalia (1998).

3. Since there is public investment, government should have a share in profit in both the sectors. It is assumed in this paper that the government invests only in infrastructure and sets the prices of infrastructural inputs on a mark-up basis. Hence share of the government in industrial profit will be determined by the mark-ups charged by the government and the private producers. In case of agriculture, the share will be determined by the government's mark-up and agricultural prices. However, we have assumed for simplicity that the government's mark-up and therefore its profit share are zero.

Bibliography

Ahluwalia, M.S. (1998) : 'Infrasturcture Development in India's Reforms' in Ahluwalia, I.J., & Little, I.M.D. (eds.)*India's Economic Reforms and Development*; Oxford University Press, Delhi.

Bose, A. (1985) : 'On the Macroeconomics of Development Models', mimeo, *Indian Institute of Management*, Calcutta.

———— (1989) : 'Short Period Equilibrium in a Less Developed Economy' in M. Rakshit (ed.) *Studies in the Macroeconomics of Developing Countries*; Oxford University Press; Calcutta.

Cardoso, E.A. (1981) : 'Food Supply and Inflation', *Journal of Development Economics*, Vol. 8, No. 3.

Joshi, V. and Little, I.M.D. (1994) : 'India - Macroeconomics and Political Economy, 1964-1991', World Bank, Washington DC, and *Oxford University Press*, New Delhi.

Rakshit, M. (1992) : Labour Surplus Economy : Macmillan, *Delhi and Humanities Press*, New Jersey.

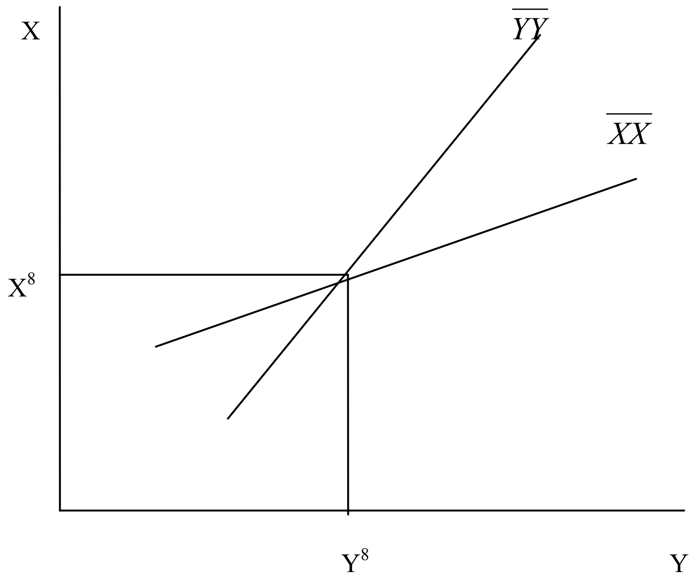

Figure 1

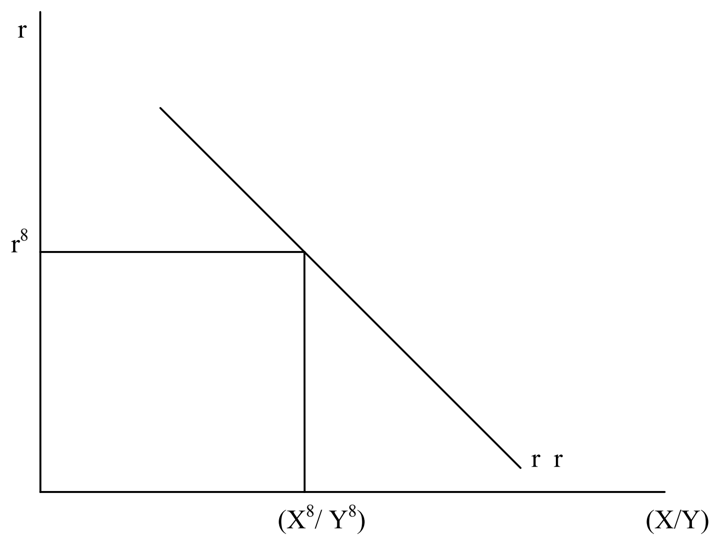

Figure 2

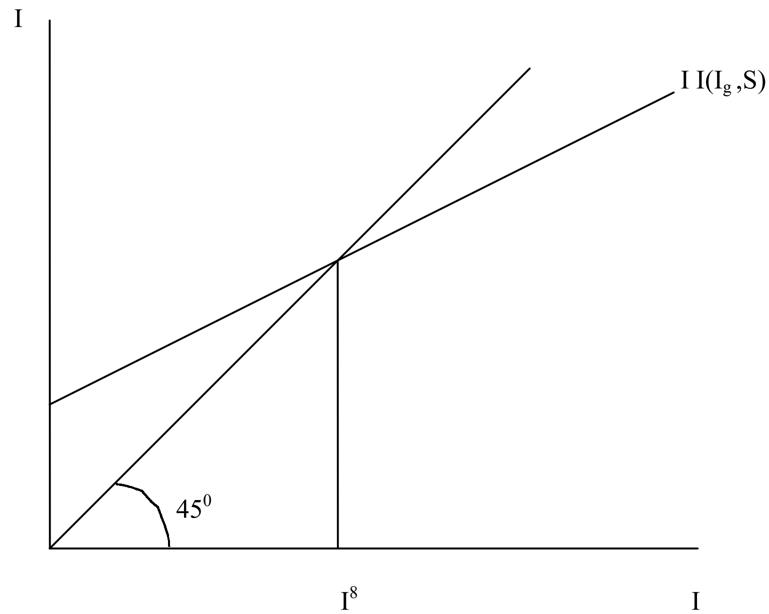

Figure 3

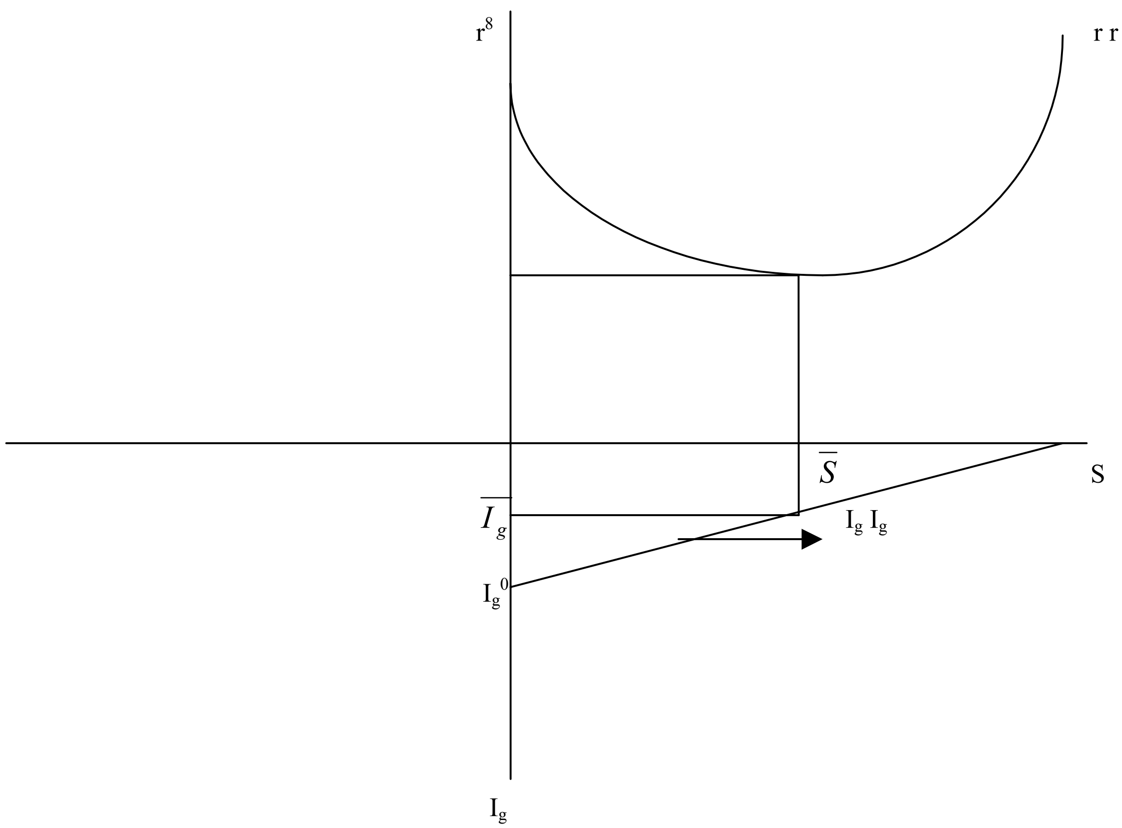

Figure 4b

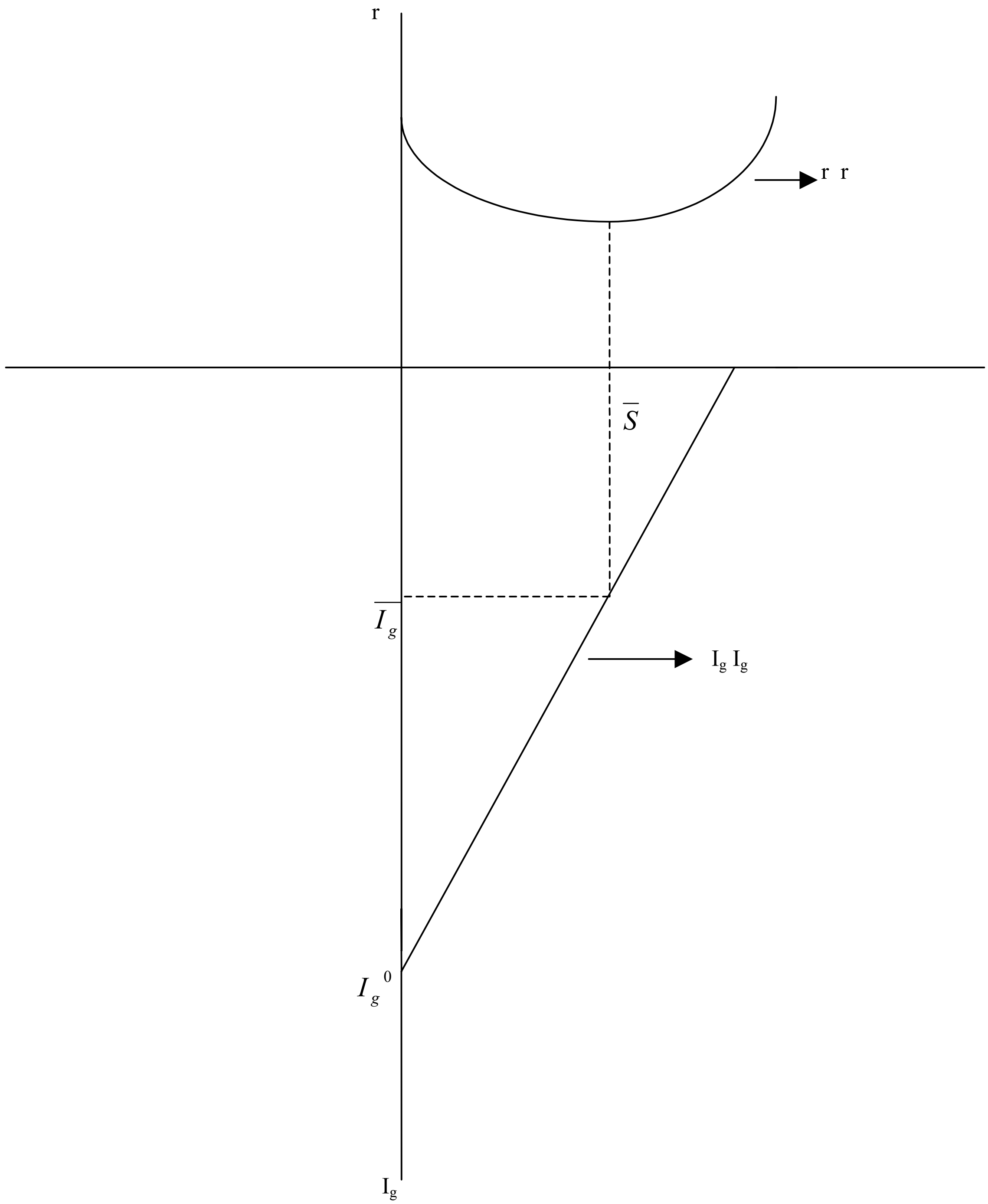

Figure 4b