INFLATION WAGE GOODS CONSTRAINT AND GROWTH

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Introduction

The purpose of this paper is to identify policy measures which maximize investment keeping inflation at the maximum tolerable level in the context of a developing country like India with an important food sector and a strong complementarity between private and public investment.

The attempt appears worthwhile on following grounds. First, in countries like India there exists a strong middle class resentment against inflation, which in turn exerts substantial political pressure on the government to keep inflation under control. Second, direct tax systems in LDCs are largely ineffective and the government has to look for alternative means for containing inflationary forces. Third, in LDCs government invests in infrastructure, and public infrastructural investment induces private investment by generating demand for private sector goods and services on the demand side and by increasing the availability of crucial infrstructural inputs on the supply side. Finally, the government also finds it politically infeasible to cut down its consumption (comprising mainly expenditure on defence and wages and salaries of government employees), transfers and subsidies. Therefore, when inflationary forces build up and the inflation rate threatens to rise above the maximum tolerable level, the government reduces its investment. The objective of this paper is to identify for policy measures which will enable the government to step up its own investment and thereby the aggregate investment keeping inflation at the maximum tolerable level.

The analysis is carried out within the framework of a dual economy model which has been developed by development economists in the Keynesian or structuralist tradition (see, for e.g., Rakshit (1982), Taylor (1983), Bose (1985, 1989) *et al.*) to emphasize the demand side factors in LDCs, and to capture the duality that exists between industry and agriculture in the organization of production and the price adjustment mechanisms. However, the difference between the model mentioned above, and the present one is that, here the rate of public investment and thereby that of aggregate investment are endogenized. These are such that in equlibrium the rate of inflation settles down to the maximum tolerable level.

The model we have developed here consists of two broad sectors, industry and agriculture. There is price rigidity in the former as captured by the mark-up pricing rule, while in the latter prices are determined by market forces of demand and supply. The economy that is considered in the present paper is taken to be a mixed one where the government invest in infrastructure in both the sectors and supplies private enterprises with infrastructural inputs. The results that have been derived here apply in the short run. The study, however, has one limitation. It focuses exclusively on the real sector and ignores the monetary sector altogether. The presumption is that, the government follows an accommodating monetary policy so that the relevant monetary aggregates are driven by demand side factors.

The paper is arranged as follows. Section I develops the model. Section 2 examines how a change in the industry-agriculture capital structure affects the equilibrium rate of investment. In section 3 we study what pricing policy the government should adopt in respect of infrastructural inputs to promote growth without raising the rate of inflation. Section 4 considers the issue of trade policy. The final section contains the concluding comments.

I The Model

The economy consists of two sectors : industry and agriculture, each of which produces a single good. Actually, industry comprises two subsectors : one producing the final good and the other the infrastructural input. The final good and the infrastructural input are produced by private producers and the government respectively. Here for simplicity we have vertically intergrated the two subsectors. As one can easily deduce mark-ups charged by producers determine uniquely the industrial product wage. Denoting it by σ we have

$$\sigma\left(\equiv\frac{W}{P_y}\right)=\sigma(\underset{-}{\alpha},\underset{-}{\gamma}) \tag{1}$$

where α and γ are mark-ups charged by private producers in industry and the government respectively; and W and p_y stand respectively for the money wage rate and the nominal price level of the industrial good (denoted by Y).

Agriculture is also assumed to produce a single final good which is referred to as food. It is produced with land, labour, capital and an intermediate good. Capital and the intermediate good are supplied by industry. To handle the problems that arise out of the introduction of intermediate inputs in agricultural production, following assumptions are made. The amount of cultivable land is fixed; labour and intermediate inputs are used in a fixed proportion to one another; agricultural wage is fixed in units of food; workers consume only food; and finally, the process of capital accumulation that takes place is land augmenting so that the production function displays constant returns to scale in labour, the intermediate good, and the stock of capital inclusive of land. These are basically simplifying assumptions. However, we shall explain the implications of the more general case as and when necessary.[1]

Under the assumptions made above marketable surplus of food (X), defined as total food output net of agricultural wage bill in terms of food, is given by

$$X = X(K_x, M_x);\ \frac{\partial X}{\partial M_x} > 0 \text{ and } \frac{\partial^2 X}{\partial M_x^2} < 0 \quad \text{(by assumption)} \tag{2}$$

where X(.) is liner homogeneous and K_x and M_x denote respectively quantities of capital and intermediate input used in food production.[2] As the analysis applies to the short-run, K_x is given. It is assumed that food market is perfectly competitive; individual farmers maximise profit; and Y is used both as K_x and M_x.

From the first order condition for profit maximisation it follows that

$$\frac{\partial X}{\partial M_x} = \frac{1}{p};\ p \equiv \frac{p_x}{p_y} \tag{3}$$

where p_x denotes the money price of X.

From (2) and (3) we get

$$X^S = X^S(p);\ X^{S'} > 0 \tag{4}$$

or $$p^S = X^{S^{-1}}(X) = p^S(X);\ p^{S'} > 0 (\text{from } (4)) \tag{5}$$

where X^s denotes the planned supply of X and p^s may be called the supply price of X.

Equilibrium Condition in Agriculture

In order to carry out our analysis in the simplest possible framework we assume that workers consume only food and they do not save. This assumption does not affect our results in any substantial measure. However, we shall discuss the implications of the more general case as and when necessary. We also ignore food consumption of landlords and capitalists for standard reasons. It is also postulated that industrial workers get a subsidy at the proportional rate, ψ, per unit of food purchased. Accordingly, the relative price of food faced by industrial workers is p. (1-ψ) while the producers face p. Under these conditions food market is cleared when

$$\sigma \cdot Y = p \cdot (1 - \psi) \cdot (X + F_x) \tag{6}$$

where F_x denotes the amount of food import, while Y stands for in industrial output.

The economy considered here is an open one, and the country for the present is assumed to export only the industrial good and import food. This assumption is made for following reasons. We shall show later that in the present paper we focus only on situations where economic activities become subject · food constraint. Naturally, therefore, we shall want to know whether allowing exports of only industrial goods and using the export earning for purpc of food imports, the rate of growth of capital can be stepped up. We examinisin the simplest possible framework and hence postulate that the governmenclusively handles the food imports. More precisely, we assume that, the gnment regulates the exchange rate, secures the export earning of the exposat the officially fixed exchange rate and uses it for purposes of importingol. The imported food is simply sold in the domestic market.

Exports of industrial goods, denoted by E_y, is regarded as aceasing function of the ratio of the domestic price of the industrial good to: oreign price of the foreign industrial good in domestic currency. In the preseaer, (as we shall show later), a unique domestic rate of inflation obtains in equiim. We also assume the foreign rate of inflation to be given and postultlat the government regulates the exchange rate, ξ, in such a manner thae above mentioned relative price denoted by $\bar{p}$ becomes a policy variable.

$$E_y = E_y(\bar{p}); \quad \bar{p} \equiv \frac{p_y}{p_y^* \xi} \tag{7}$$

where p_y^* denotes the foreign price of the foreign industrial goo foreign currency. It is assumed further that, the government uses the ee foreign exchange earning to import food, which is sold in the domestic mat

Accordingly,

$$F_x = E_y(\bar{p}).\frac{p_y^*}{p_x^*} \equiv E_y(\bar{p}).\frac{1}{p^*} \tag{8}$$

where $p_x^* \equiv$ foreign price of food in foreign currency. Using (1), (6c (8) we can derive the food market clearing value of p denoted by p^D as g below

$$p^D = \frac{\sigma(\cdot).Y}{(1-\psi)[X + E_y(\bar{p}).\frac{1}{p^*}]}$$

$$\equiv p^D(\underset{+}{Y}, \underset{-}{X}; q, \bar{p}, \upsilon, \underset{-}{\alpha}, \underset{+}{\psi}) \tag{9}$$

The domestic price of food, p_x, is assumed to clear the food ma it every instant. Hence p and p^D are always equal. Agriculture is in equilibriwnen (see (5) and (9))

$$p^s X = p^D(\cdot) \qquad (10)$$

The good produced by industry (denoted by Y) is used for purposes of consumption and investment by the producers of X and Y as well as by the government. It also enters as an intermediate input in food production, and is exported.

Under the conditions mentioned above demand supply balance equation in industry may be written as

$$Y = C_1.(\frac{\alpha}{1+\alpha}).Y + C_2.\bar{\lambda}(px - M_x) + M_x + I_r + I_g + E_y \qquad (11)$$

where $C_1 \equiv$ average and marginal consumption propensity of the industrial producers, $C_2 \equiv$ average and marginal consumption propensity of the landlords, $\bar{\lambda} \equiv$ share of the landlords in agricultural profit, $I_r \equiv$ aggregate private investment and $I_g \equiv$ aggregate public investment. We have ignored public consumption for simplicity.

Though not explicitly considered, agriculture in our model consists of two subsectors : One produces the final good, X, while the other produces an infrastructural input which is used in some fixed quantity per unit of X. The final good is produced by the landlords but the infrastructural input is produced by the government. Assuming prices of both industrial and agricultural infrastructural input to be the same, one can easily deduce that the share of the landlords in agricultural profit $(\bar{\lambda})$ is given by

$$\tilde{\lambda} = \tilde{\lambda}(\underset{+}{\alpha}, \underset{-}{\upsilon}, \underset{+}{p}) \qquad (11a)$$

Again, for simplicity we assume

$$I_r = I_r(\underset{+}{I} g) \qquad (11b)$$

Agricultural price is assumed to clear the market always. Therefore $p = p^D$ at every instant, and industrial demand is reckoned at this market clearing price. Using (11a), (11b) and (9), we one write (11) as

$$Y = C_1 \frac{\alpha}{1+\alpha} Y + C_2 \tilde{\lambda}(\underset{+}{\alpha}, \underset{-}{\upsilon}, p^D(\cdot)) \left[\frac{\sigma(\cdot)}{(1-\psi)} Y - p^D(\cdot)\, E_y(\bar{p}) \cdot \frac{1}{p^*} \right]$$

$$+(1 - C_2\, \tilde{\lambda}(\cdot))\, M_x(X) + I_r(I_g) + I_g + E_y \qquad (12)$$

The inflationary dynamics of the present study is borrowed from the works of structuralist writers (see, for example, *Cardoso* (1981) and *Taylor* (1983), (1991)). It is postulated that, industrial workers bargain for a higher money wage rate whenever wage rate in units of food is below a desired level (h^*). Thus, using (1), we have

$$\hat{W} = \phi.(h^* - \frac{\sigma}{p(1-\psi)}); \; 0<\phi<1; \; \hat{W} \equiv (\frac{(dW/d\tau)}{W}(\tau \equiv \text{time}) \qquad (13)$$

Since α and γ are fixed by assumption (see (1))

$$\hat{W} = \hat{p}_y; \; (\hat{p}_y \equiv \frac{1}{p_y}.\frac{dp_y}{d\tau}) \qquad (14)$$

In equilibrium, as we shall show later, p is fixed. So in equilibrium $\hat{W} = \hat{p}_y = \hat{p}_x (\equiv \frac{dp_x}{d\tau}.\frac{1}{p_x})$. Equations (13) and (14) imply that

$$\hat{W} = \hat{W}(h); \; \hat{W}' < 0 \qquad (15)$$

Where $\hat{W}$ gives the rate of wage inflation, and

$$h = \frac{\sigma}{p.(1-\psi)} \qquad (16)$$

The maximum tolerable rate of inflation and the value of h that equates $\hat{W}$ to this tolerable level are denoted by $\hat{W}^T$ and h^T respectively. Hence the value of p that corresponds to $\hat{W}^T$, and which is denoted by p^T is given by

$$p^T = \frac{\sigma(\cdot)}{h^T.(1-\psi)} \equiv p^T(\underset{-}{\alpha}, \underset{-}{\upsilon}, \underset{+}{\psi}) \qquad (17)$$

As we have noted already, I_g is regulated to keep the rate of inflation at the target level. Therefore, in equilibrium we have

$$p = p^T = \frac{\sigma(\cdot)}{h^T.(1-\psi)} = p^T(\underset{+}{\sigma(\cdot)}, \underset{+}{\psi}) \text{ (see 1)} \qquad (18)$$

The specification of our model is now complete. The equilibrium of our system is given by (5), (10), (12) and (18). They can be solved for the equilibrium values of the four endogeneous variables, Y, X, p and I_g, given the exogenous variables, viz, C_1, C_2, h^T and industrial and agricultural production functions, and the policy parameters, namely, α, γ, $\bar{p}$, and ψ.

The equations describing the equilibrium may be sequentially solved as follows. Equations (10) and (12) can be solved for values of X and Y that equilibrate industry and agriculture as functions of I_g. Putting this value of X in (5) we get the value of p that corresponds to equilibrium in industry and agriculture as a function of I_g, given the policy parameters and exogenous variables. The equilibrium value of I_g is the one which corresponds to $p = p^T$ (see (18)). A diagramatic solution of the equations mentioned above is shown in Figures 1 and 2. In Figure 1, XX and YY give all combinations of X and Y satisfying (10) and (12) respectively, given I_g. Both the curves are upward sloping. However, for stability XX is to be flatter than YY.

An increase in I_g *ceteris paribus*, will, vide (12), create an excess demand for Y and bring about a rightward shift in YY. Hence values of Y and X which equilibrate industry and agriculture will rise. Accordingly, as one can read off from pp in the second quadrant of Figure 1, (which shows the value of p corresponding to every X as given by (5)), the value of p that corresponds to industry agriculture equilibrium rises following an increase in I_g. Hence WW in Figure 2 which gives this value of p corresponding to every I_g is upward sloping. The equilibrium value of I_g is obviously the one which corresponds to $p = p^T$ (see (18)) on WW.

We can, however, derive the equilibrium values of X, Y and the aggregate investment directly. Denoting the equilibrium values of X, Y and I by X^E, Y^E and I^E respectively, we have

$$X^E = X^s\left(\frac{\underset{-\ -}{\sigma(\alpha, \upsilon)}}{h^T(1-\psi)}\right) = X^E\underset{-\ \ -\ \ +}{(\alpha, \upsilon, \psi)} \quad \text{(using (18) and (4))} \tag{19}$$

$$Y^E = \left(\frac{X^E(\cdot)+F_X}{h^T}\right) = \left(\frac{X^E(\cdot)+E_y(\bar{p})\cdot\frac{1}{p^*}}{h^T}\right) \tag{20}$$

and (from (12), (20) and (17))

$$I^E = Y^E - C_1.\frac{\alpha}{1+\alpha}Y^E - C_2\tilde{\lambda}(\cdot)\left[\frac{\sigma(\cdot)}{1-\psi}Y^E - p^T(\cdot)E_y(\bar{p}).\frac{1}{p^*}\right] - (1-C_2)M_x(X^E(\cdot)) \tag{21}$$

2. Industry - Agriculture Capital Structure and Growth

Here we examine how an increase in agricultural capital stock (K_x), given capital stock in industry (K_y), affects I^E. We first rewrite the expression for I^E as given by (21) as follows

$$I^E = \left[\left\{1 - C_1 \frac{\alpha}{1+\alpha} - C_2\tilde{\lambda}(\alpha, \upsilon, p^T(\cdot)\frac{\sigma(\cdot)}{1-\psi}\right\} - (1 - C_2\tilde{\lambda}(\cdot)) \right.$$

$$\left. \frac{M_X(X^E(p^T(\cdot))}{X^E(p^T(\cdot))}\frac{X^E}{Y^E} - (1 - C_2\tilde{\lambda}(\cdot)\frac{p^T(\cdot)}{p^*})\frac{E_y(\bar{p})}{Y^E}\right] Y^E \qquad (22)$$

As $X(.)$ is linear homogenous (see (21)), $\dfrac{M_x(X^E(\cdot))}{X^E(\cdot)}$ is fixed, given p. Thus from (22) we get using (19) and (20) and assuming $E_y = 0$

$$\frac{dI^E}{dK_x} = \left[\left\{1 - C_1\frac{\alpha}{1+\alpha} - C_2\tilde{\lambda}(\cdot)\frac{\sigma(\cdot)}{1-\psi}\right\} - (1 - C_2\tilde{\lambda}(\cdot))\frac{M_x(X^E(\cdot))}{X^E(\cdot)} h^T\right]$$

$$\frac{X^E}{K_x}(p^T).\frac{1}{h^T} > 0 \qquad (23)$$

As $X(.)$ is linear homogeneous in K_x and M_x, one can easily check that the profit maximizing $\frac{x}{K_x}$ is fixed, given p. Thus if K_x goes up by unity X^E goes up by $[\frac{X^E(\cdot)}{K_x}]$ and Y^E rises by $\frac{X^E(\cdot)}{K_x}.\frac{1}{h^T}$. From the above we get the followng proposition.

Proposition 1 : In a situation of wage goods constraint the larger is K_x relative to industrial capital stock, the higher is I^E, provided industrial exports constitute a negligible proportion of industrial output. If, however, share of industrial exports in industrial output is significantly large, the result noted above may be reversed.

3. Government's Mark-up on Infrastructural Inputs, Foods Supsidy and Growth

We shall establish the following proposition here.

Proposition 2 : If υ is raised, and ψ is stepped up along with it so that p^T remains unaffected then I^E will rise unambiguously.

This follows straightway from (21) which is rewritten as follows :

$$I^E = Y^E - C_1 \frac{\alpha}{1+\alpha} Y^E - C_2 \underset{+\ -\ +}{\tilde{\lambda}(\alpha, \upsilon, p^T(\cdot))}$$

$$\left[\frac{\sigma}{1-\psi} Y^E - M_x(X^E) - p^T E_y(\bar{p}) \frac{i}{p^*}\right] - M_x(X^E) - E_y(\cdot) \quad (24)$$

If δ and ψ are raised in such a manner that $\frac{\sigma(\upsilon, \alpha)}{(1-\psi)}$ and therefore p^T do not change (see (18)), X^E and Y^E will remain unaltered. Under these conditions only $\tilde{\lambda}$ in (24) will fall raising I^E. (The point to note here is that, the government does not allow the rise in υ to affect $\bar{p}$ and therefore E_y).

4. Trade Policy and Growth

Here we examine whether by raising E_y and F_x and by lowering it is possible to raise I^E. We rewrite (21) as follows :

$$I^E = Y^E - C_1 \frac{\alpha}{1+\alpha} Y^E - C_2 . \tilde{\lambda}(\alpha, \upsilon, p^T(\cdot))$$

$$\left[\frac{\sigma(\alpha, \upsilon)}{1-\psi} Y^E - p^T(\cdot) E_y(\bar{p}) \frac{\bar{p}}{p^*}\right] - (1 - C_2) M_x(X^E) - E_y(\bar{p}) \quad (25)$$

$$(-1).\frac{dI^E}{d\bar{p}} = \left[(1 - C_1 \frac{\alpha}{1+\alpha}) \frac{1}{p^T} \frac{p_x}{p_x^* \xi} . \frac{1}{h^T} - 1\right](-E_y')$$

$$= \left[\left(1 - C_1 \frac{\alpha}{1+\alpha}\right) \frac{1}{\frac{\sigma}{1-\psi}} . \frac{p_x}{p_x^* \xi} - 1\right](-E_y') \quad (26)$$

$(\frac{\alpha}{1+\alpha})$ is the share of capitalists in industrial production. Since government is also an industrial producer, $1 - \frac{\alpha}{1+\alpha} > \sigma$. Thereofe, if $C_1 \simeq 1$ and $\psi \simeq 0$, $-\frac{dI^E}{d\bar{p}} > 0$, if $\frac{p_x}{p_x^* \xi} > 1$. From the above one can deduce the following generalized proposition.

Proposition 3 : The policy of reducing $\overline{p}$ to raise industrial exports to raise food imports will lead to an increase in investment level under the following conditions. Consumption propensities of industrial producers are close to unity, and food subsidy on workers' consumption is close to zero, then domestic agricultural price has to be higher than foreign agricultural price in domestic currency. The lower are consumption propensities of industrial producers and the greater is the consumption subsidy on food, the higher the domestic agricultural price has to be relative to foreign agricultural price in domestic currency.

5. Conclusion

This paper seeks to suggest policy measures which will maximise investment keeping inflation at the maximum tolerable level in the context of a developing country like India. It focuses only on situations where agriculture is too small relative to industry so that industrial capacity can not be fully utilized keeping inflation at the maximum tolerable level. In other words in our model availability of agricultural goods acts as a binding constraint on industrial activities.

Even though in the present study public expenditure is financed with money creation, monetary sector has been ignored on the basis of the assumption that the government follows an accommodating monetary policy. This omission, however, becomes significant if movement of funds across the national frontier is allowed for. Extension of our work in the situation where there is full capital account convertibility will be eminently fruitful.

Government produces infrastructural inputs in our paper, but the infrastructural seetor has not been explicitly considered. At the present juncture availability of infrastructural inputs is holding down economic activities in India. Extension of our model to explicitly consider the infrastructural sector to focus on situations of infrastructural bott bnecks will be extremely useful.

Notes

1. The assumption of a fixed agricultural wage rate in units of food is a simplifying one. In our model in equilibrium there will prevail a uniqe wage rate in units of food in both sectors. Therefore, this assumption does not affect the generality of the comparative static results.

2. We shall show below that, if agricultural production function is homogeneous of degree one in capital inclusive of land, intermediate good and labour, then the marketable surplus function as given by (2) in the text, will also be homogeneous of degree one in capital inclusive of land and intermediate good, if labour and intermediate good are used in a fixed ratio to one another and wage is fixed in units of food. Agricultural production function is given by

$$\begin{aligned}\widetilde{X} &= \widetilde{X}(K_x, L_x, M_x) \\ &= \widetilde{X}(K_x, \delta M_x, M_x)\end{aligned} \tag{N.1}$$

where $\widetilde{X}$ stands for output of food, K_x, M_x and L_x denote the quantities of capital inclusive of land, intermediate good and labour used in food production respectively and δ denotes the fixed ratio of L_x to M_x.

The amount of marketable surplus of food (X) is given by

$$X = \widetilde{X}(.) - \omega.\delta.M_x = X(K_x, M_x) \tag{N. 2}$$

where ω gives the fixed agricultural wage rate in units of food. It is quite obvious that if $\widetilde{X}(.)$ is homogeneous of degree one in K_x, L_x and M_x then X (.) will also be so in K_x and M_x given ω.

One point must be noted this regard. In agricultural production function capital stock consists of private capital and public infrastructural capital stock in agriculture. The relationship between X and any given combination of the inputs will depend upon the ratio between these two types of capital stock. In the short run this ratio will be given, but in the medium run it will vary. However, we ignore this problem here. The same will be true for industry as well. In other words we assume that private and public infrastructural capital always bear a fixed ratio to one another in both agriculture and industry.

Another point is that, in the present study we have vertically integrated the private sector producing the final agricultural product and the public sector supplying the former with agricultural infrastructural inputs. This we have done under the assumption that a fixed amount of these infrastructural inputs is required per unit of food output.

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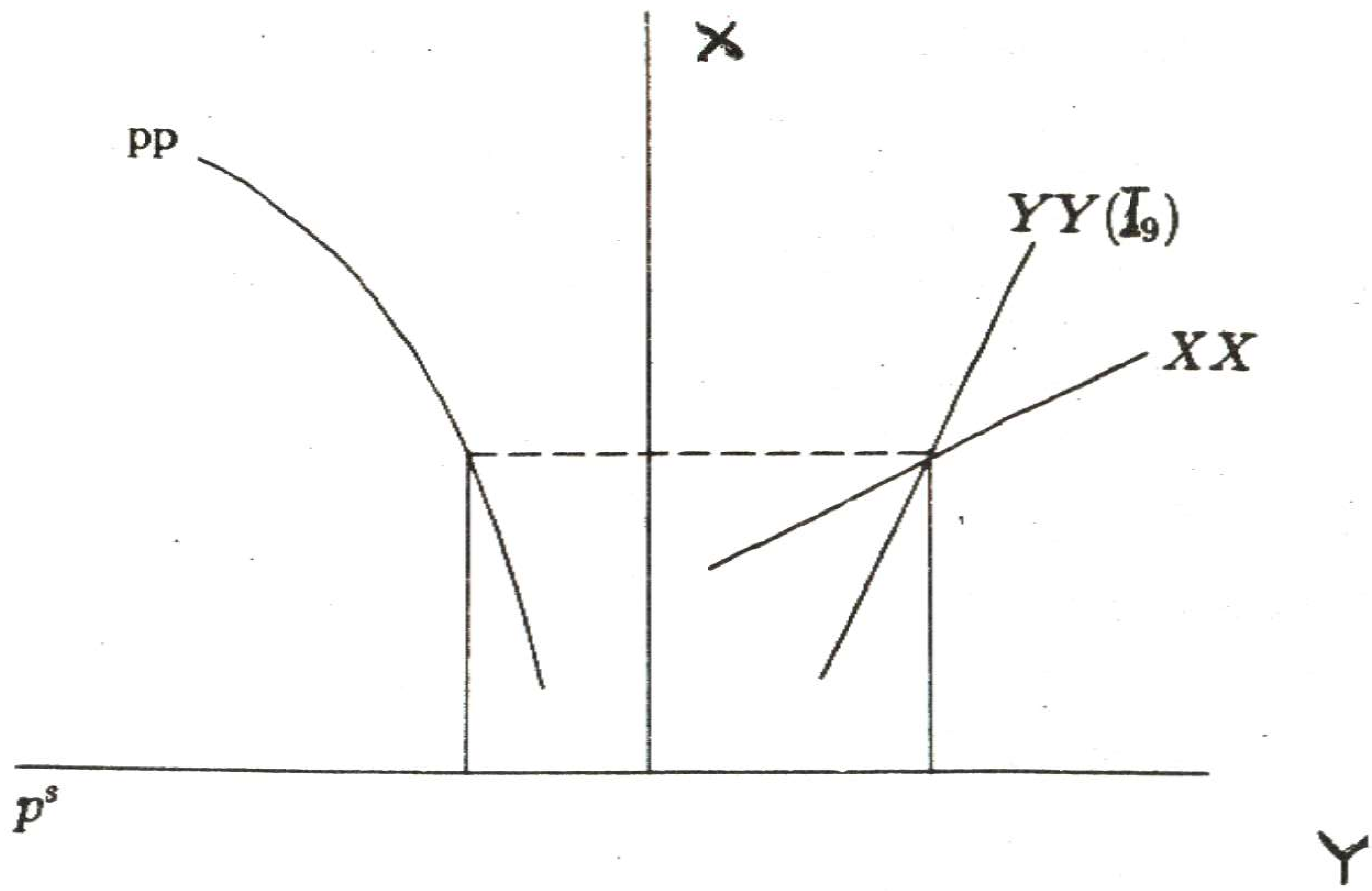

Figure 1

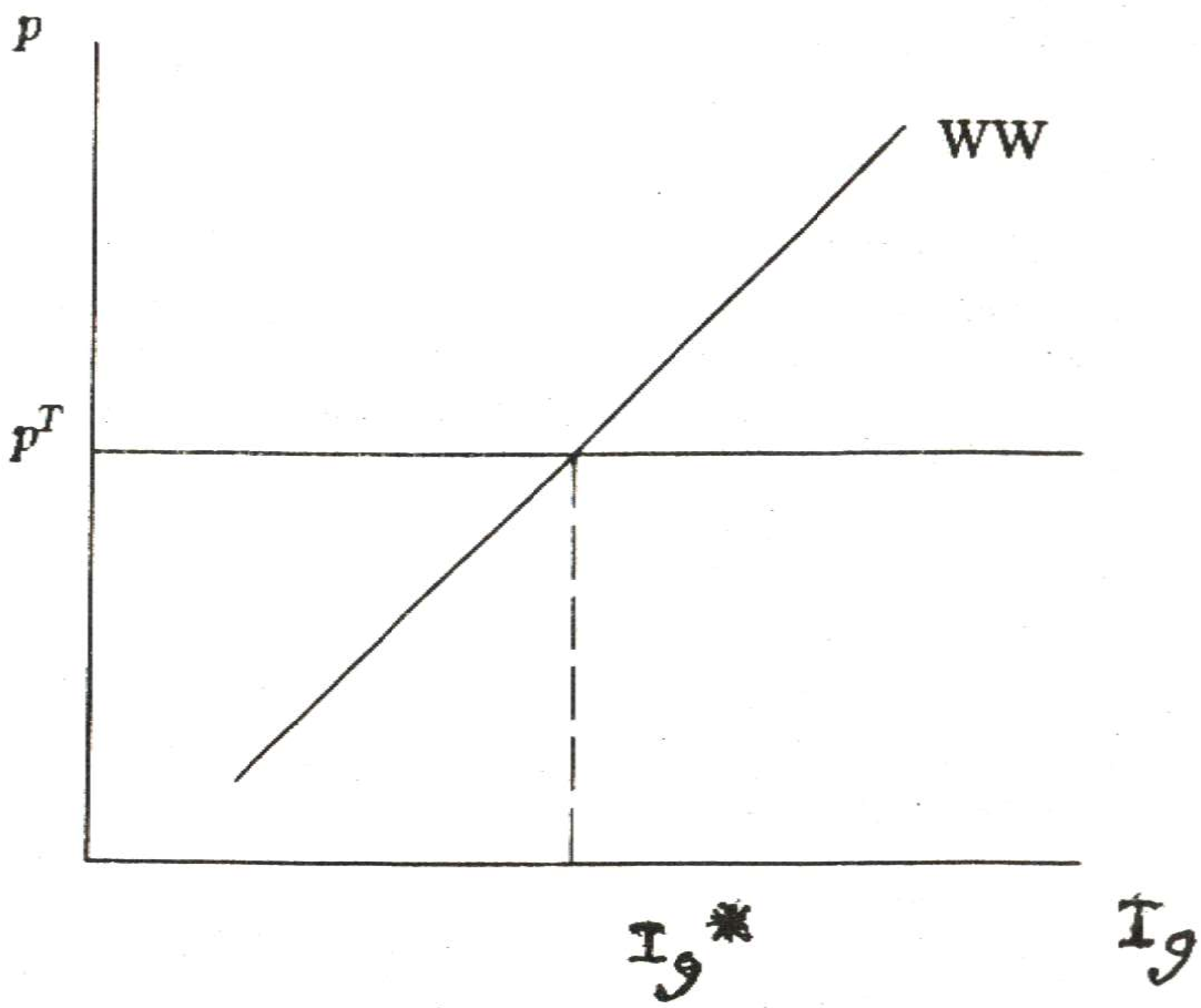

Figure 2