Open Economy Macroeconomics of Balance Sheets, Sectoral Inter-linkage and the Stabilization Policies: Short Period Equilibrium in a Developing Country*

Moumita Basu•
Ranjanendra Narayan Nag•

This paper describes a simple framework of industry agriculture inter-linkage for analysis of different aspects of stabilization programme in an open economy. The paper focuses specifically on balance sheet effects of exchange rate depreciation on investment and output. At the heart of the model is the link between exchange rate, food price and industrial employment. The model is used to examine the effects of interest rate policy, fiscal policy, exogenous increase in food production and agricultural exports as well. This paper shows that the policy of lowering interest rate by the central bank may be counterproductive in a developing country while agricultural trade liberalization may work well for employment generation in an emerging market economy.

JEL Classification: E24, E50, F32.

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1. Introduction

The balance sheet effect of exchange rate depreciation and interest rate targeting in an open economy are topics that dominate discussion on different policy specific issues. That capital flow, exchange rate movement and employment are inter-connected is well recognized in the literature, but the usual accounts miss some essential aspects of an emerging market economy namely determination of

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• Assistant Professor, Bidhannagar college, EB-2, Sector-1, Salt Lake, Kolkata-700064. E-mail: 3.moumita@gmail.com

• Associate Professor, St. Xavier's College (Autonomous), 30, Mother Teresa Sarani, Kolkata 700016. E-mail: rnnag12@gmail.com

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employment in presence of wage indexation and dualistic structure of production. The motivation for writing this paper is to fill this gap in the literature.

In its orientation, the paper is closer to Rakshit (1983), Bose (1989) and Rattso and Torvik (1998, 2003) and also draws on the works of Krugman (1999, 2003). We specify the investment function to allow for the balance sheet effect of exchange rate depreciation. This is central to Krugman’s (1999, 2003) works on “third generation” approach to currency crisis. In particular, the balance sheet effect of exchange rate depreciation arises due to currency mismatches. A substantial part of investment demand is financed by external commercial borrowing in emerging market economies. This in turn may lead to currency mismatch. A currency mismatch arises when firms borrow in foreign currency but earns revenue in domestic currency. If a significant portion of debts is denominated in foreign currencies, as is often the case in emerging market economies, exchange rate depreciation leads to an increase in real debt burdens without a commensurate increase in the ability to pay and hence, produces adverse balance sheet effect on investment demand. In this paper, however, we choose a dual economy framework in terms of which we can address implications of balance sheet effects of exchange rate adjustment. The dual economy, characterized by industry agriculture inter-linkage, is open to both trade in commodities and capital flows. This dimension of openness is missing in most of structuralist models of sectoral inter-linkage\(^1\). In this model, both agricultural exports and capital flows are necessary to finance imports of intermediate goods for industry. A key feature of our model is the explicit recognition of an important dimension of monetary policy namely interest rate targeting by the Central Bank\(^2\). In addition, we account for the fact that external commercial borrowing generates a financial accelerator effect, to the extent that any change in the exchange rate amplifies changes in the balance sheets of firms which produce a major effect on investment and output level. The model also shows that agricultural trade liberalization may be beneficial for the economy from point of view of the employment generation.

The remainder of the paper is organized as follows. Section 2 describes the model. The comparative static exercises are examined in section 3. Section 4 summarizes the main results and offers some concluding remarks.


\(^2\) It is to be noted that money supply becomes endogenous when the Central Bank fixes the interest rate [see Romar (2000)].
2. The Model

The model extends the economic structure proposed by Rakshit (1983, 1989) and Bose (1989) by considering export of agricultural goods and import of intermediate inputs used in the industrial production. Agriculture produces a single output, say, food which is sold in both home and foreign markets. The industrial sector produces investment goods and consumption goods for the industrial firm owners, the agricultural farm owners and the government. However, the industrial workers consume only food. The industrial output is demand determined. In contrast to this, agricultural production, with its clear-cut crop cycles, is fixed in the short run. The wage is partially indexed to the food price and the industrial price follows the Kaleckian mark up pricing formula. The investment demand is negatively related to the domestic interest rate and real exchange rate. In this model we consider flexible exchange rate regime.

2.1 The agricultural sector

The market supply of food ($F_s$) is fixed

$$F_s = \bar{F} \quad (1)$$

The market demand for food ($F_d$), measured in units of food, emanates exclusively from industrial workers and exports

$$F_d = \frac{w \alpha_1 Y}{p_F} + \bar{X} + X\left(\frac{e P_{IF}}{p_F}\right) \quad (2)$$

Workers spend their entire wage bill ($w \alpha_1 Y$) to purchase food\(^3\). Here, $w$ is the wage rate, $\alpha_1$ is fixed labour coefficient in the industrial sector ($Y$) and hence, $\alpha_1 Y$ measures the industrial employment level. Exports are positively related to the world price (measured in units of domestic currency) relative to the domestic price of food.

Equilibrium in the food market requires that

$$\bar{F} = \frac{w \alpha_1 Y}{p_F} + \bar{X} + X\left(\frac{e P_{IF}}{p_F}\right) \quad (3)$$

\(^{3}\) In this paper we assume that the workers consume only food. If we assume that workers spend on both food and industrial output the qualitative results of this paper remain unaltered, only the algebra will be complicated.
From equation (3) we can obtain the equilibrium food price ($P^*_F$)

$$P^*_F = \rho(Y, e, w, \bar{X}, F)$$ (4)

Let us explain partial effect of each variable on food price. An increase in industrial output ($Y$) raises workers’ consumption leading to increase in the food price at given other variables and hence, $\rho_1 = \frac{\partial \rho}{\partial Y} > 0$. The exchange rate depreciation raises exports leading to increase in demand for food and hence, $\rho_2 = \frac{\partial \rho}{\partial e} > 0$. An increase in the wage rate ($w$) leads to increase in wage bill as well as workers’ demand for food. Therefore, food price rises and hence, $\rho_3 = \frac{\partial \rho}{\partial w} > 0$. An exogenous increase in exports also raises food price, that is, $\rho_4 = \frac{\partial \rho}{\partial X} > 0$. An increase in food production generates excess supply in the food market leading to fall in food price. Therefore, we get $\rho_5 = \frac{\partial \rho}{\partial F} < 0$.

2.2 Wage rate

The wage rate is assumed to be partially indexed to the food price and it is given by

$$w = w_1 P^*_F$$ [where, $0 < \alpha < 1$] (5)

where, $w_1 = \frac{\partial w}{\partial P} = \alpha w_0 P^*_{F-1} > 0$.

An increase in food price raises the wage rate less than proportionately and hence, real wage in terms of agricultural output falls. Workers’ demand for food is price inelastic since the absolute value of elasticity of workers’ food demand is $(1-\alpha)$.

2.3 Industrial Sector

The industrial sector uses two variable factors of production namely labour (L) and imported intermediate input, that is, oil (O). We assume that labour
coefficients ($a_i$) and intermediate input coefficients ($a_{i_o}$) are fixed. Capital is a fixed factor of production.

The price equation for the industrial goods follows the Kaleckian mark up pricing

$$P_y = k[w a_1 + e P_o (1 - s_u) a_{i_o}] \text{ [where, } k > 1 \] (6)$$

where, $k$ is the constant profit mark-up which indicates an oligopolistic structure of the industrial sector; $e$ is the nominal exchange rate; $P_o$ is the international price of oil which is given in the world market. We assume that the government gives an oil subsidy ($s_u$) to the industrial sector. Hence, domestic price of oil is $e P_o (1 - s_u)$. An increase in food price reduces exports leading to exchange rate depreciation which in turn raises domestic price of imported intermediate inputs. The wage rate also increases as it is partially indexed to the food price. Hence, the simultaneous increase in the exchange rate and the wage rate consequent on increase in food price leads to an increase in the industrial price which follows from the equation (6).

Now, percentage change in the industrial price can be expressed as a weighted average of percentage change in the wage rate and percentage change in the exchange rate, as shown in equation (7).

$$\hat{P}_y = \theta_1 \hat{w} + \theta_2 \hat{e} \quad (7)$$

where, $\theta_1 = \frac{w a_1}{w a_1 + e P_o (1 - s_u) a_{i_o}}$, $\theta_2 = \frac{e P_o (1 - s_u) a_{i_o}}{w a_1 + e P_o (1 - s_u) a_{i_o}}$ and $\theta_1 + \theta_2 = 1$

Note, $\theta_1$ is the cost share of labour and $\theta_2$ is the cost share of imported intermediate inputs in the industrial sector. Thus we get that percentage change in the industrial price is trapped between percentage change in the wage rate and percentage change in the exchange rate.

The industrial profit less taxes is given by

$$\pi_y = y \left(1 - \frac{w a_1}{P_y} - \frac{e P_o (1 - s_u) a_{i_o}}{P_y}\right) - \frac{T}{P_y} \quad (8)$$
Here, $T$ denotes business taxes levied on industrial producers.

The aggregate demand for industrial output (in real term) is given by

$$AD_y = cT_y + \frac{P_y P_F}{P_y} + I \left( i_0 \frac{P_y}{P_F} \right) + \frac{C}{P_y} \tag{9}$$

The industrial output is allocated to consumption, investment, and government use. Industrial producers use ‘c’ fraction of their profit to consume industrial goods. In contrast, agricultural farmers spend their entire earnings* $\left( \frac{P_y P_F}{P_y} \right)$ to purchase industrial goods. The investment demand is an inverse function of interest rate and real exchange rate $[I_1 = \frac{\partial I}{\partial i} < 0$ and $I_2 = \frac{\partial I}{\partial \left( \frac{P_y P_F}{P_y} \right)} < 0]$. In nominal term, the government expenditure is exogenously given. However, we consider the real government expenditure, measured in units of industrial output, as a component of aggregate demand for industrial output.

Since the industrial output is demand determined, equilibrium condition in the industrial sector is given by

$$y = AD_y \tag{10}$$

From equation (10) we can obtain the equilibrium value of industrial output as

$$y^* = \frac{A_1}{A_2}$$

where,

$$A_1 = P_y P_F + P_y I \left( i_0 \frac{P_F}{P_y} \right) + G - cT, \quad A_2 = P_y (1 - c) + c \left[ w \alpha_i + \epsilon P_y \left( 1 - s_u \right) \alpha_y \right]$$

Now, the equilibrium industrial output can be expressed as

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*No qualitative change occurs if we assume that part of the farmers’ income is saved.*
Let us interpret the partial effect of each variable on the industrial output. An increase in food price raises earning of agricultural farm owners leading to increase in demand for industrial output and therefore, 
\[ y_1 = \frac{\partial y}{\partial P_F} = \frac{F}{A_2} > 0. \] An increase in industrial price causes lower consumption expenditure of agricultural farmers, lower real government expenditure, higher investment expenditure and higher consumption expenditure of industrial producers. However, the restoration of a stable equilibrium requires that an increase in industrial price should reduce demand for industrial output, and hence, 
\[ y_2 = \frac{\partial y}{\partial P_Y} = \left( \frac{I e P_o}{P_Y} \right)^{-\epsilon(1-\epsilon)} \frac{A_2}{A_2} < 0. \] An increase in the wage rate reduces profit of industrial firm owners leading to decrease in producers’ consumption. Hence, the demand for industrial output decreases due to increase in the wage rate, that is, 
\[ y_3 = \frac{\partial y}{\partial w} = -\epsilon \frac{A_2}{A_2} < 0. \] The exchange rate depreciation raises oil cost of the industrial sector leading to decrease in profit of industrial producers. Investment demand also decreases due to balance sheet effect of real exchange rate depreciation. Hence, 
\[ y_4 = \frac{\partial y}{\partial e} = \frac{I e P_o}{A_2} - \frac{A_2}{A_2} c e P_o (1 - \sigma) A_o < 0. \] An increase in interest rate reduces investment demand. Therefore, demand for industrial output falls, that is, 
\[ y_5 = \frac{\partial y}{\partial i} = -\epsilon \frac{A_2}{A_2} < 0. \] An increase in subsidy reduces input cost leading to increase in the profit of industrial producers. Consequently, demand for industrial output rises and hence, 
\[ y_6 = \frac{\partial y}{\partial s} = \frac{A_2}{A_2} c e P_o A_o > 0. \] An increase in \( G \) leads to increase in demand for industrial output, that is, 
\[ y_7 = \frac{\partial y}{\partial G} = \frac{1}{A_2} > 0. \] However, an increase in tax reduces profit of producers leading to decrease in demand for industrial output, that is, 
\[ y_8 = \frac{\partial y}{\partial T} = -\epsilon \frac{A_2}{A_2} < 0. \] At initial equilibrium food price an increase in food production raises earning of agricultural farm owners leading to increase in demand for industrial output.

\[ y^* = y(P_F, P_Y, w, e, i, s, G, T, F, P_o) \]
owners. This gives the primary boost to demand for industrial output and hence,

\[ y_9 = \frac{\partial y}{\partial P} = \frac{\partial P}{\partial y} > 0. \]

An increase in oil price in the world market leads to increase in the input cost and fall in the demand for industrial output. Therefore,

\[ y_{10} = \frac{\partial y}{\partial P_o} = -\frac{\partial P_o}{\partial y} c\sigma(1 - \sigma_o)\alpha_o < 0. \]

2.4 Balance of Payment Equilibrium

The balance of payment (BOP) equilibrium is given by,

\[ P_o[X(t_o, P_o) + \bar{X}] + k\left[t_o - i^* - \left(\frac{e^f}{e} - 1\right)\right] = P_o\alpha_o y \quad (12) \]

The left-hand side of the equation (12) represents the supply of foreign exchange which consists of exports and an endogenous capital flow. In this model, capital flow is a positive function of the uncovered interest differential\(^5\). The right-hand side of the equation (12) shows the demand for foreign exchange which includes imports of oil.

From equation (12) we can determine the equilibrium exchange rate as

\[ e = e(P_o, y, t_o, P_o, i^*) \quad (13) \]

Let us consider the partial effect of each variable on the exchange rate. An increase in food price reduces exports leading to excess demand in the foreign exchange market. Hence, exchange rate depreciates, that is, \( e_1 = \frac{\partial e}{\partial P_o} > 0. \) An increase in industrial output raises demand for foreign exchange leading to exchange rate depreciation and hence, we get \( e_2 = \frac{\partial e}{\partial y} > 0. \)

An increase in the uncovered interest differential is \( \left[i - i^* - \left(\frac{e^f}{e} - 1\right)\right], \) where, \( i \) and \( i^* \) are domestic and foreign interest rates respectively. Here, risk premium is represented by the expected change in exchange rate. In this model, the expected exchange rate is assumed to be fixed. Clearly, our model departs from the Mundell-Fleming framework in the sense that we allow for imperfect capital mobility and hence, we drop the assumption of interest rate parity.

\(^5\) The uncovered interest differential is \( \left[i - i^* - \left(\frac{e^f}{e} - 1\right)\right], \) where, \( i \) and \( i^* \) are domestic and foreign interest rates respectively. Here, risk premium is represented by the expected change in exchange rate. In this model, the expected exchange rate is assumed to be fixed. Clearly, our model departs from the Mundell-Fleming framework in the sense that we allow for imperfect capital mobility and hence, we drop the assumption of interest rate parity.
domestic interest rate raises capital inflow leading to increase in supply of foreign exchange. Hence, exchange rate appreciates, that is, \( e_3 = \frac{\partial e}{\partial i_o} < 0 \). An autonomous increase in exports leads to exchange rate appreciation, that is, \( e_4 = \frac{\partial e}{\partial x} < 0 \).

2.5 Macroeconomic Equilibrium and Graphical Representation

The model can be solved for five endogenous variables namely food price, the wage rate, the industrial price, the industrial output and the exchange rate from the equations or conditions specified in (3), (5), (6), (10) and (12) respectively.

The diagrammatic representation can be used to depict the relationship between the food price and the industrial output with simultaneous determination of other endogenous variables. For this purpose we substitute equation (13) into equation (4) and equation (11) and we get,

\[
P_F^* = \rho[y, e(P_F, y, i_o, \bar{X}, \bar{P}_o, i^*), \bar{X}, \bar{P}]
\]

\[
y^* = y[P_F, P_y, w, e(P_F, y, i_o, \bar{X}, \bar{P}_o, i^*), i_o, s, G, T, \bar{P}, P_o]
\]

The equation (4') can be solved for food price for each arbitrary chosen industrial output to generate the FF curve which represents the food market equilibrium. For instance, an expansion of the industrial sector requires more labour and imported intermediate inputs. This increase in level of employment raises workers’ demand for food. Moreover, the increase in import demand leads to exchange rate depreciation which in turn causes an increase in agricultural exports. The resulting excess demand for food is eliminated by an increase in food price and hence, FF curve is upward sloping, as shown in Figure (1a) or in Figure (1b).

Similarly, from equation (11’), for each food price we solve for the industrial output and generate the YY curve to represent equilibrium in the industrial sector. Let us intuitively explain this. An increase in food price leads to less than proportionate increase in the wage rate, as shown in equation (5). In addition, the increase in food price reduces exports leading to exchange rate depreciation.
Now, this increase in both the wage rate and the exchange rate implies an increase in the industrial price, as represented by the price equation (6).

However, effect on real wage \( \left( \frac{W}{P_y} \right) \) and real exchange rate \( \left( \frac{e}{P_y} \right) \), measured in units of industrial goods, is ambiguous. For instance, if \( \hat{W} > \hat{e} \), from equation (7), we immediately get \( \frac{W}{P_y} > \frac{e}{P_y} \). In this case \( \frac{W}{P_y} \) rises and \( \frac{e}{P_y} \) falls. In contrast, if \( \hat{W} < \hat{e} \), \( \frac{W}{P_y} \) falls and \( \frac{e}{P_y} \) rises. Therefore, the increase in food price has an ambiguous effect on both investment expenditure and consumption expenditure of industrial firm owners, as represented in equation (10). However, the farmers’ real consumption expenditure rises due to increase in food price relative to the industrial price \( \left( \frac{P_F}{P_y} \right) \). On the other hand, increase in the industrial price causes a decrease in the real government expenditure \( \left( \frac{G}{P_y} \right) \). After considering all the effects, it is clear that any change in food price has ambiguous effect on the industrial output. Consequently, the YY schedule may be negatively sloped, as shown in figure (1a), or positively, as represented in Figure (1b).

Figure (1a) or Figure (1b) shows the YY and FF schedule together. Any point to the left of the YY schedule represents excess demand in the market for industrial goods while excess demand in the food market is reflected by the points below or right of the FF schedule. There are four zones. Zone I indicates a combination of excess supply in the industrial sector and excess demand in the food market, Zone II an excess demand in both the markets, Zone III an excess demand in the industrial sector and excess supply in the food market, Zone IV an excess supply in both the markets. The equilibrium configuration of food price and industrial output is \( E^* \), the point of intersection of FF and YY curve as represented in Figure (1a) or Figure (1b). A stable equilibrium requires that the YY schedule must be steeper than the FF schedule.
Figure 1a: Food Price and Industrial Output with downward sloping YY schedule

Figure 1b: Food Price and Industrial Output with upward sloping YY schedule
3. Comparative Static

The comparative static exercises carried out in this section will emphasize on implications of interest rate policy, removal of oil subsidy, autonomous increase in exports, expansion of agricultural sector, and balanced budget fiscal expansion for the food price, the industrial output, employment, the exchange rate, the wage rate and the industrial price.

3.1 Interest Rate Policy

Consider a fall in the interest rate administered by Central Bank. This produces multiple cross effects. First, it entails a net capital outflow and hence, exchange rate depreciates which causes less than proportionate increase in industrial price. So real exchange rate \( \left( \frac{e}{P_y} \right) \), measured in units of industrial output, rises which induces a fall in capitalists’ consumption expenditure. However, real wage \( \left( \frac{w}{P_y} \right) \), measured in units of industrial goods, falls. This produces an ambiguous effect on industrial profit and hence, on capitalists’ consumption expenditure on industrial goods. The adverse balance sheet effect of exchange rate depreciation leads to fall in investment. Another source of contraction of the industrial sector is the fall in real government expenditure measured in units of industrial goods since government expenditure in nominal term is fixed. Next we consider the effect on agricultural price. Since the exchange rate depreciates, agricultural exports go up and food price rises. However, the final effect on terms of trade, that is, the ratio of food price to the industrial price is ambiguous. Accordingly, we cannot ascertain the effect on agricultural farm owners’ expenditure on industrial goods. The preceding analysis suggests different possible macroeconomic outcomes. A likely outcome is industrial contraction with an increase in price across the board. Geometrically, the YY schedule shifts leftward and the FF schedule shifts upward, as represented in figure (2a) or figure (2b).

\(^6\) At initial given wage rate, from equation (7), we get \( \dot{\theta} > \ddot{p} > \ddot{w} = 0. \)
There are several possible cases. However, Figure (2a) or (2b) illustrates the case in which the equilibrium industrial output decreases and equilibrium food price rises. In figure (2a), the increase in food price aggravates the initial industrial contraction as decrease in real government expenditure outweighs other...
components of demand. In contrast, in figure (2b), the increase in food price mitigates the recessionary effect on industrial output. It is pertinent to note that the working class is affected due to fall in employment as well as fall in the real wage measured in units of food.

3.2 Removal of oil subsidy

The removal of oil subsidy raises costs of imported intermediate inputs which in turn depresses profit and hence, consumption expenditure of industrial producers. Moreover, price of industrial goods goes up. This causes further reduction in demand. Thus industrial output falls. Diagrammatically, the YY schedule shifts leftward as shown in Figure (3a) or (3b). The resulting BOP surplus causes exchange rate appreciation and hence, export demand falls. Moreover, workers’ demand for food declines as a result of decrease in the level of employment in the industrial sector. Consequently, excess supply in food market arises and hence, food price falls.

A decrease in food price reduces the wage rate due to partial wage indexation. Moreover, export demand increases which in turn results in exchange rate appreciation. Hence, initial increase in industrial price is modified. Now two possibilities arise. Fall in food price may lessen or may aggravate the initial industrial contraction. When YY curve is negatively sloped, a fall in food price may have a mellowing effect on industrial output if increase in real government expenditure offsets other components of demand as shown in Figure (3a). In contrast, the reduction in food price exacerbates initial contraction due to fall in consumption expenditure of agricultural farmers. This is shown in Figure (3b).

However, effect on investment expenditure and consumption expenditure of industrial producers is ambiguous since real wage and real exchange rate, measured in units of industrial output, may move in either direction. The contraction of the industrial sector also reduces level of employment. The fall in food price reduces the wage rate less than proportionately. Hence, the real wage in terms of food increases which may raise workers’ demand for food to restore the food market equilibrium.
3.3 Autonomous Increase in Exports

An autonomous increase in exports leads to exchange rate appreciation. The fall in industrial price arises due to decrease in cost of importing oil. The real exchange rate appreciation produces a favourable balance sheet effect on
investment. The other favourable effects on demand for industrial goods include increase in consumption expenditure of agricultural workers and rise in real government expenditure due to fall in industrial price. The effect on industrial profit is ambiguous, since \( \frac{\theta}{P_y} \) falls and \( \frac{\omega}{P_y} \) rises\(^7\). Accordingly capitalists’ consumption expenditure goes either way. Therefore, the final effect on the industrial output is ambiguous.

The model shows that agricultural trade liberalization contributes to output and employment generation in the industrial sector. What drives the result is the exchange rate appreciation and consequent fall in the industrial price. The expansion of the industrial sector is represented by the rightward shift of the YY schedule in Figure (4a) or Figure (4b). In the food market, there is an increase in demand for food due to increase in autonomous exports. Hence, food price rises, which causes leftward shift of the FF schedule, as shown in Figure (4a) or Figure (4b).

Figure (4a) illustrates the case in which the increase in food price moderates the initial increase in industrial output due to decrease in real government expenditure. In contrast, Figure (4b) shows that the increase in food price reinforces initial expansion of the industrial sector since increase in consumption expenditure of agricultural farm owners offsets the other components of demand. The increase in food price raises the wage rate less than proportionately leading to decrease in the real wage.

3.4 Expansion of Agricultural Sector

An Expansion of the agricultural sector implies increase in the food production. This may arise due to an improvement in the productivity of factors used in the agricultural production. This comparative static exercise may not corroborate Rakshit’s paradox of plenty (Rakshit 1983). This is due to different kind of open

\(^7\) Initially, \( \tilde{\theta} = 0 \) \( > \frac{\theta}{P_y} \) \( > \tilde{\theta} \)
At initial equilibrium food price, an increase in food production results in higher real

\[ \text{In Rakshit’s closed economy model industrial wage is fully indexed to food price, that is, real wage measured in units of food is fixed. This is hardly realistic in a developing country like India since wage adjusts not only slowly but also weakly in response to change in price.} \]

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Figure 4a: Effect of increase in Exports on Food Price and Industrial Output with downward sloping YY schedule

Figure 4b: Effect of Increase in Exports on Food Price and Industrial Output with upward sloping YY schedule

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8 In Rakshit’s closed economy model industrial wage is fully indexed to food price, that is, real wage measured in units of food is fixed. This is hardly realistic in a developing country like India since wage adjusts not only slowly but also weakly in response to change in price.
earnings of the agricultural farm owners and hence, higher demand for industrial output. This initial expansion of the industrial sector causes rightward shift of the YY schedule, as shown in Figure (5a) or Figure (5b). On the other hand, the increased food production causes a decline in food price. Hence, the FF schedule shifts downward in Figure (5a) or (5b).

In Figure (5a), the new equilibrium point $E_2$ corresponds to lower food price and higher industrial output. The decrease in food price reduces the wage rate less than proportionately under partial wage indexation such that the real wage in terms of food will rise leading to increase in demand for food. Moreover, there is an increase in export due to fall in food price.

On the other hand, the industrial expansion induces higher level of employment which in turn stimulates the initial increase in demand for food. Naturally, food price will not decrease as much as it would for given industrial output. It is worth mentioning that effect on farmers’ income is ambiguous corresponding to the new equilibrium. Two possible cases may emerge. Farmers’ income may

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9 See appendix
increase if the YY schedule is negatively sloped as represented in Figure (5a). The increase in exports raises supply of foreign exchange while the industrial expansion leads to an increase in demand for imported intermediate inputs. Therefore, effect on both the exchange rate as well as the industrial price is ambiguous.

The Figure (5b) shows the possibility of industrial contraction as obtained by Rakshit (1983). In this case shift of the FF schedule dominates that of the YY schedule and new equilibrium corresponds to the lower industrial output. However, in this framework the paradox of plenty is much weaker due to exchange rate appreciation, fall in industrial price and consequence rise in real government expenditure. It is instructive to note that in this framework realization crisis does not occur in the agricultural sector. The simple logic is this. Any increase in food production causes food price to fall which in turn causes an increase in workers’ demand for food and export as well and thus the excess supply is eliminated. However, farmers’ income may fall in the second case.

3.5 Balanced Budget Fiscal Expansion

Consider the balanced budget fiscal expansion which leads to increase in both government spending on industrial output and taxes in such a way that the initial budgetary position remains unchanged. The increase in taxes reduces profit of
the industrial producers and hence, their consumption expenditure. However, the increase in government spending outweighs the fall in consumption expenditure of industrial producers since they spend a fraction of their profit to purchase industrial output. Therefore, there is an increase in industrial output due to the balanced budget fiscal expansion. Moreover, the increase in industrial output raises the amount of oil subsidy allowing further increase in taxes to maintain initial budgetary position. The YY schedule becomes steeper and shifts rightward, as shown in Figure (6a) or Figure (6b).

Figure (6a) or Figure (6b) shows that the equilibrium moves from point $E_1$ to $E_2$. The increase in industrial output leads to increase in demand for oil. Hence, exchange rate depreciates leading to increase in exports of food. Moreover, workers’ demand for food rises due to increase in industrial employment. So there generates excess demand in the food market. Consequently, food price increases to restore the food market equilibrium. Higher food price causes higher the wage rate, higher the exchange rate and higher the industrial price.
4. Conclusion

The paper discusses how macroeconomic outcomes of policy induced and other exogenous shocks are influenced by different types of sectoral inter-linkages in an open economy. The practitioners prefer to work with aggregative framework. However, it is desirable to address policy related issues in a dualistic framework which is a closed approximation of economic structure in a developing country. Though the Neoclassicists strongly argue in favour of microeconomic foundations for macroeconomic structure we have chosen a structuralist methodology to posit macroeconomic issues in terms of different social classes and technological relationships given by globalization. The model developed in the present paper is a static dual economy model of an open economy in which unemployment arises due to wage indexation and effective demand problem.

The major findings of this paper are the following. The interest rate policy of the Central Bank may reduce industrial output as well as level of employment. This result shows that the policy of lowering interest rate may not augur well for developing countries which are subject to supply side constraints namely wage goods constraint and may face problems arising due to capital outflow. The removal of oil subsidy reduces food price as well as industrial output leading to decrease in the level of employment. An exogenous increase in exports of agricultural goods may entail positive macroeconomic outcome in terms of

Figure 6b: Effect of Balanced Budget Fiscal Expansion on Food Price and Industrial Output with upward sloping YY schedule

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employment generation. An agricultural expansion may cause an industrial expansion. A balanced budget fiscal expansion raises both food price and industrial output. The broad message of this paper is that comparative static effects of different policies on employment and output critically depend on multitudes of cross effects generated by changes in the food price, the exchange rate, the wage rate and the industrial price. This paper shows that more attention is to be paid to development of agricultural sector along with appropriate policies to sustain growth of agricultural exports. The paper can be extended in several directions. We may introduce informal credit as a source of financing working capital in the agricultural sector. We can introduce one more sector for example, service sector and explore implications of service led growth. Moreover, long term adjustment may be introduced through capital formation.

References


Appendix

The equilibrium values of food price, industrial output, exchange rate, wage rate and industrial price are given by the following equations, reproduced from the text,

\[ P_F^* = \rho(Y, e, w, \bar{X}, \bar{F}) [\rho_1 > 0, \rho_2 > 0, \rho_3 > 0, \rho_4 > 0, \rho_5 < 0] \] (A1)

\[ y^* = y(P_F, P_Y, w, e, i_0, s_w, G, T, \bar{F}, \bar{P}_o) \] (A2)

\[ [y_1 > 0, y_2 < 0, y_3 < 0, y_4 < 0, y_5 < 0, y_6 > 0, y_7 > 0, y_8 < 0, y_9 > 0, y_{10} < 0] \]

\[ e = e(P_F, y, i_0, \bar{X}, P_o, \bar{F}) [e_1 > 0, e_2 > 0, e_3 < 0, e_4 < 0, e_5 < 0, e_6 < 0] \] (A3)

\[ w = w_0 P_F \left\{ \text{where, } 0 < \alpha < 1 \text{ and } w_1 = \frac{\partial w}{\partial P_F} > 0 \right\} \] (A4)

\[ P_y = k [w_0 a + e P_o (1 - s_u) a] \] (A5)

\[ [\text{where, } k > 1, P_1 = \frac{\partial P_y}{\partial w} > 0, P_2 = \frac{\partial P_y}{\partial e} > 0, P_3 = \frac{\partial P_y}{\partial e} < 0, P_4 = \frac{\partial P_y}{\partial P_o} > 0] \]

Now slope of the FF schedule is given by,

\[ \frac{dP_F}{dy} \bigg|_{FF} = \frac{\rho_1 + \rho_2 e_2}{1 - \rho_2 e_1 - \rho_3 w_1} > 0 \]
It is straightforward to check that the stability in the food market equilibrium requires that \((1 - \rho_2 e_1 - \rho_3 w_1) > 0\).

On the other hand, the slope of the YY schedule is given by,

\[
\frac{dP_F}{dy}\bigg|_{YY} = \frac{1 - y_4 e_2 - y_2 \rho_2 e_2}{y_1 + y_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1}
\]

Stability of the equilibrium in the industrial sector requires that \((1 - y_4 e_2 - y_2 \rho_2 e_2) > 0\).

If \([y_1 + y_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1] < 0\), the YY schedule is downward sloping. Otherwise, the YY schedule is positively sloped.

Finally, the stability condition for the macroeconomic equilibrium (Point E* in Figure 1) requires that

\[
\frac{dP_F}{dy}\bigg|_{FF} = \frac{\rho_1 + \rho_2 e_2}{1 - \rho_2 e_1 - \rho_3 w_1} < \frac{dP_F}{dy}\bigg|_{YY} = \frac{1 - y_4 e_2 - y_2 \rho_2 e_2}{y_1 + y_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1}
\]

That is, given the Jacobian matrix as,

\[
J = \begin{bmatrix}
1 - \rho_2 e_1 - \rho_3 w_1 & \rho_1 + \rho_2 e_2 \\
y_1 + y_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1 & 1 - y_4 e_2 - y_2 \rho_2 e_2
\end{bmatrix}
\]

the sign of its determinant is positive:

\[
\det J = (1 - \rho_2 e_1 - \rho_3 w_1)(1 - y_4 e_2 - y_2 \rho_2 e_2) - 
(\rho_1 + \rho_2 e_2)(y_1 + y_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1) > 0
\]

**Comparative Static Exercises**

1. **Interest rate Policy**

\[
\frac{dP_F}{dt_0} = \frac{(1 - y_4 e_2 - y_2 \rho_2 e_2) \rho_2 e_3 + (\rho_1 + \rho_2 e_2)[y_2 P_2 e_3 + y_4 e_3 + y_5]}{|J|}
\]
\[
\frac{dy}{di_o} = \frac{(1 - \rho_3e_1 - \rho_3w_1)[y_2P_2e_3 + y_4e_3 + y_5] + [y_1 + y_2(P_1w_1 + P_2e_1) + y_4e_1 + y_3w_1]\rho_3e_3}{|J|}
\]

If \( y_2P_2e_3 + y_4e_3 > |y_5| \), the YY curve shifts leftward due to fall in interest rate and most likely outcome is

\[
\frac{dy}{di_o} > 0
\]

2. Removal of Oil Subsidy

\[
\frac{dP_T}{ds_u} = \frac{(\rho_4 + \rho_3e_2)[y_2P_2 + y_6]}{|J|} > 0 [\text{since}, (\rho_4 + \rho_3e_2) > 0, y_2 < 0, P_3 < 0, y_6 > 0]
\]

\[
\frac{dy}{ds_u} = \frac{(1 - \rho_2e_1 - \rho_2w_1)[y_2P_2 + y_6]}{|J|} > 0 [\text{since}, (\rho_4 + \rho_3e_2) > 0, y_2 < 0, P_3 < 0, y_6 > 0]
\]

3. Autonomous Increase in Exports

\[
\frac{dP_T}{dX} = \frac{(1 - y_1e_2 - y_1\rho_2e_2)\rho_4 + (\rho_4 + \rho_2e_2)(y_2P_2e_4 + y_4e_4)}{|J|} > 0
\]

\[
\frac{dy}{dX} = \frac{(1 - \rho_2e_1 - \rho_2w_1)(y_3P_2e_4 + y_4e_4) + [y_1 + y_2(P_1w_1 + P_2e_1) + y_4e_1 + y_3w_1]\rho_4}{|J|} > 0
\]

Provided that,

\[
(1 - \rho_2e_1 - \rho_2w_1)(y_3P_2e_4 + y_4e_4) > |[y_1 + y_2(P_1w_1 + P_2e_1) + y_4e_1 + y_3w_1]\rho_4|
\]
4. Expansion of Agricultural Sector

\[ \frac{dP_F}{dF} \frac{1 - \gamma_1 e_2 - \gamma_2 \rho_2 e_2}{|J|} \rho_3 \frac{(\rho_1 + \rho_2 e_2) y_2}{|J|} < 0 \]

since, \(|1 - \gamma_2 e_2 - \gamma_2 \rho_2 e_2| \rho_3| > (\rho_1 + \rho_2 e_2) y_2| \rho_3|

However, \(\frac{dP_F}{dF} \frac{1 - \gamma_2 e_2 - \gamma_2 \rho_2 e_2}{|J|} \rho_3 \frac{(\rho_1 + \rho_2 e_2) y_2}{|J|} \rho_3 \)

On the other hand,

\[ \frac{dy}{dF} \frac{1 - \rho_2 e_1 - \rho_3 w_1}{|J|} y_3 + \left[ \gamma_1 + \gamma_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1 \right] \rho_3 > 0 \]

if \(1 - \rho_2 e_1 - \rho_3 w_1 \left| y_3 \right| \left[ \gamma_1 + \gamma_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1 \right] \rho_3 \left| y_3 \right| \rho_3 \)

5. Balanced Budget Fiscal Expansion

In this case the Jacobian becomes

\[ |J| = (1 - \rho_2 e_1 - \rho_3 w_1) (1 - \gamma_2 e_2 - \gamma_2 \rho_2 e_2 + c s_2 e P_0 a_0) \]

\[ - (\rho_1 + \rho_2 e_2) \left[ \gamma_1 + \gamma_2 (P_1 w_1 + P_2 e_1) + y_4 e_1 + y_3 w_1 \right] \]

\[ \frac{dP_F}{dG} \frac{1 - c (\rho_1 + \rho_2 e_2) y_2}{|J|} > 0 \]

\[ \frac{dy}{dG} \frac{1 - c (1 - \rho_2 e_1 - \rho_3 w_1) y_2}{|J|} > 0 \]