Financial Sector Liberalization and Profitability of Banks: A Macro View

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Abstract

There is more or less a consensus that financial repression or the program of directed credit leads to low levels of bank profit and thereby threatens solvency of banks in the long run. Rationale of directed credit lies in the divergence between the patterns of private and social profitability in LDCs like India. This paper shows that, if allocation of bank credit conforms to the pattern of social profitability, as happens under a program of directed credit, a part of the additional gain to the society accrues to the banks as well in the form of additional profit. More precisely, this paper seeks to prove that free market conditions do not maximize bank profit in the context of LDCs like India, but a suitably designed program of directed credit does. Therefore, this paper argues, aggregate bank profit is not necessarily less in a regime of financial repression.

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1. Introduction

Until the beginning of the 80s financial institutions in almost all the developing countries in the world operated in a financially repressed regime. Governments followed a policy of administered interest rates and directed credit. There were also stringent restrictions on movements of capital across national frontiers. Since the beginning of the 80s developing countries started removing restrictions on interest rates, allocation of credit and international movements of capital. One disastrous consequence of this strategy switch towards liberalization and globalization was the currency and the banking crises that engulfed the East and South East Asian, and Latin American countries in the 90s and also in the present decade. The literature on financial sector liberalization is vast and still growing at a phenomenal pace. Some of the major issues that it deals with are the rationale and the critique of the policy of removal of controls on interest rates and credit allocation, necessity for bank regulation in a free market or liberalized regime and interrelationship between currency and banking crises. The major studies on the policy of directed credit are McKinnon(1973), Shaw(1973), Winbergen(1983), Taylor(1981), Rakshit(1994), Dutt(1991), Davidson(1986) and others. Jaffe and Russel(1976), Stiglitz and Weiss(1981), and Krugman(1998), among others, are some of the influential woks that emphasize on the necessity for bank regulation in a financially liberalized regime to ensure efficient allocation of credit by banks. Diamond and Dybvig(1983), Chang and Valesco(1998) and Dooly(2000) are some of the important studies dealing with the interrelationship between currency crisis and banking crisis. This paper focuses on the policy of directed credit and administered interest rates. To put the problem handled here in the sharpest possible relief, it steers clear of the issues of the international capital mobility or currency and banking crises and considers exclusively the policy of directed credit.

There are two major arguments in favor of liberalization of controls over interest rates and allocation of credit: promotion of efficiency and viability of banks. Proponents of the first argument are McKinnon(1973) and Shaw(1973). In a financially repressed regime credit is allocated to projects of low productivity, while projects of high productivity cannot materialize because of lack of funds. This leads to inefficiency in the allocation of investible resources and thereby to low growth. The argument is quite well known and so are its critiques (see, for e.g.,Winbergen (1983), Taylor (1981), Dutt (1991), Davidson (1986), Thirlwall (1976), Rakshit (1994) et al). The second argument is that, if banks are forced to lend at low rates of interest to unprofitable sectors, they incur substantial losses. This policy, it is therefore inferred, is bound to lead to bankruptcy of banks in the long run and hence is unsustainable (Rangarajan and Jadav(1990)). This argument seems to be quite universally accepted. There does not exist any theoretical study that has seriously examined this line of argument. This paper is a humble attempt at filling up this gap. In the pre-liberalization era planners or policy makers perceived a divergence between the pattern of social profitability and that of private profitability and therefore recommended the policy of directed credit to maximize social welfare. This paper shows that the program of directed credit not only maximizes social welfare; it may maximize aggregate profit of banks as well. The source of this increased profit of banks is again the divergence between the patterns of private and social profitability. A part of the additional gain that accrues to the society as directed credit program allocates credit in line with the pattern of social profitability may flow into the banking sector as well as additional profit.

This paper borrows from two major traditions: the post and the new Keynesian. It develops a model of a small open economy that, it hopes, captures the salient features of a developing country like India. The model consists of two broad sectors: the real sector and the financial sector. The real sector is built on the Keynesian or the post Keynesian tradition that emphasizes on the demand side factors in the determination of output and employment. The financial sector on the other hand is developed on the tradition set forth, to name only the pioneering studies, by Blinder and Stiglitz(1983), Bernake(1981), Blinder(1987) and, in the context of the developing countries, Rakshit(1993). These studies bring the credit market to the fore in explaining the link between the real and the monetary sector. The only departure from this tradition is that this paper instead of emphasizing on rigidities in interest rates assumes a perfectly competitive financial or banking sector. The other difference is that it considers only one kind of financial asset, namely, commercial banks' deposits, which serve as both medium of exchange and instrument of saving or holding wealth. In fact, for reasons of simplicity of exposition this paper assumes that savers and investors are different; savers hold all their wealth in the form of bank deposits; investors finance their entire investment with bank credit and economic agents carry out all their transactions only with bank deposits. Under these assumptions economic agents' demand for money, i.e., demand for bank deposits is always equal to supply of money or supply of bank deposits. The point may be explained as follows. Since there is only one kind of financial asset, viz, bank deposits, aggregate financial wealth in the economy equals aggregate supply of bank deposits. Again, as there is no possibility of substitution between physical and financial assets in the short run, one can hold one's financial wealth in the form of bank deposits only. Hence aggregate supply of bank deposits equals aggregate demand for bank deposits. Under these conditions it is obviously unnecessary to explicitly consider economic agents' demand for money.

The real sector is decomposed into two sub sectors: a domestic sector and an export sector. The domestic sector caters exclusively to domestic demand; it is oligopolistic and it produces a single good using only two inputs, an imported intermediate input and labor. The price of the good is set on a cost-plus basis and its output is determined by demand. The importance of demand in the determination of output and employment in the short run is quite well recognized even in the mainstream macroeconomics. The export sector produces a single good with only labor. It exports the whole of its output at the world price, which it takes as given. The financial sector consists only of banks. It is assumed to be perfectly competitive[1].

In LDCs like India there are several sources of external benefits and costs. Obviously, it is not possible to capture all these sources within the scope of a single paper. Hence the paper focuses on just one source of externality to highlight the reasons why aggregate bank profit in the short run may be higher under a program of directed credit than under competitive market conditions. The source of externality in the present paper consists in the assumptions regarding the nature of the monetary policy. In less developed countries like India at the current juncture monetary policy is the most important instrument for stabilization. The direction of monetary policy in these countries depends on the states of certain macro variables, the most notable of which are the exchange rate and the rate of inflation. The reasons may be stated as follows. Two major constraints that operate on aggregate output in LDCs like India are availability of foreign exchange and that of food. In these economies food prices play a crucial role in determining the rate of inflation. Accordingly, policy makers in these countries regard exchange rate and the rate of inflation as important indicators of the supply positions of these two crucial commodities. When exchange rate and inflation rate are low, authorities feel reassured and undertake expansionary monetary policy to give a boost to economic activities. On the other hand, when inflation and exchange rate move beyond certain tolerable levels, authorities become worried about the internal and external stability of the economy or the availability of the two crucial commodities and seek to bring the two rates down through contractions in money supply. Previously, governments used both fiscal and monetary policy for purposes of stabilization. But at the current juncture the thrust is almost entirely on monetary policy. Obsessions over the size of the fiscal deficit have severely restricted the scope of using the fiscal policy in the post-liberalization period.

In fact, if we look, for example, at the history of India's economic development in the post-Independence period, we find that whenever there were no causes for worry regarding the availability of food and foreign exchange, government's policies turned expansionary and India experienced a period of high growth. In the opposite case the government adopted contractionary programs plunging the economy into a recessionary phase. The period of second and third five year plans (1955-1965) that witnessed rapid industrialization engendered by a program of ambitious public investment program was a period of abundant supplies of foreign food and non-food aid. Drying up of foreign aid following the Indo-Pakistan war coupled with droughts in the second half of sixties and threats of and actual hikes in oil prices in the seventies induced the government to keep a tight rein on economic activities during the entire period through contractionary programs. Consequently, the economy entered into a phase of quasi-stagnation during these fifteen years. At the beginning of the eighties again stocks of both food and foreign exchange were comfortable. India's external debt servicing charges as a proportion of export earning was quite low. Emboldened by this scenario, government's policies again turned expansionary ushering in a phase of relatively high growth. This time, however, the government put brakes on its expansionary programs only when the country plunged into a BOP crisis in 1990-91. In the nineties after a brief spurt in economic activities following large-scale liberalization of controls over economic activities, the economy again entered into a recession, which is continuing even now. At the present food stocks and reserves of foreign exchange are comfortable. BOP position is satisfactory. Accordingly, the government is pursuing an expansionary monetary program to rejuvenate the economy.

From this brief history it is clear that the nature of government's policies in countries like India depends on the availability of foreign exchange and food. As we have already pointed out, the key variables that indicate the availability of food and foreign exchange are the exchange rate and the rate of inflation. Even though direction of monetary policy in these countries depends upon the levels of both the exchange rate and the rate of inflation, here for simplicity the paper focuses only on the former and ignores the latter as a determinant of the nature of monetary policy. This omission is, however, not of much importance in the present context as the purpose of this paper is just to construct a plausible example to point to the reasons why aggregate bank profit may be higher under the directed credit program than in competitive market conditions in the short run. In fact, if we had not made this omission, the results of the paper would have been stronger.

This paper shows that, if the monetary authority regulates money supply to maximize aggregate output subject to an exchange rate constraint, neither aggregate bank profit nor GDP of the domestic economy is maximized in a competitive free market scenario in the short run. When exchange rate or availability of foreign exchange acts as the constraint, additional loans to the export sector eases up supplies of foreign exchange and lowers exchange rate. This induces or enables the monetary authority to undertake expansionary monetary policy, which in turn brings about an expansion in GDP, bank business and thereby in bank profit. In a competitive set up in a free market scenario, a single bank by giving more loans to the export sector cannot produce this macro impact. Hence a single bank while deciding on its credit allocation takes the policy parameters that determine the supply of money as given. This in the short run gives rise to a sub optimal allocation of credit in free market equilibrium, which maximizes neither bank profit nor GDP. However, when a central authority seeking to maximize aggregate bank profit, takes the credit allocation decision, it takes into account the aggregate external effect of lending to the export sector and accordingly designs the interest rate and credit allocation program. Therefore aggregate bank profit will be higher under a suitably designed program of directed credit. Hence one cannot say a priori that aggregate bank profit will necessarily be less under a program of directed credit. In fact, the paper shows that a suitably designed directed credit program maximizes bank profit and also raises GDP above its competitive equilibrium level.

The paper is arranged as follows. Section 2 develops the model and derives the amount of profit the banking sector as a whole earns in free market situations in the short run. Section 3 compares the free market outcome to that under the program of directed credit. The final section contains the concluding remarks.

2. The Model

Financial Sector

The model consists of a real and a financial sector. The paper focuses on the financial sector first. It consists only of banks: the central bank and the commercial banks and is perfectly competitive. There is only one kind of financial asset, bank deposits. Individuals do not hold any currency and carry out all their transactions with bank deposits only. Under these assumptions aggregate money supply equals aggregate bank deposits, which in turn equals aggregate bank credit. There are a large number of commercial banks. Each bank is a price taker in all markets. Each bank takes deposits and gives loans to both the domestic and the export sector in such a way that its profit is maximized. However, the market is segmented on the borrowers' side. Borrowers cannot transfer loans from one sector to another. For simplicity this paper further assumes that that the owner of each bank operates it only with her own labor and all banks are identical. Hence the paper carries out its analysis in terms of a single representative bank. In any period profit from old or already existing loans is given. Hence profit maximization on the part of a bank amounts to maximization of profit from new loans extended in the period under consideration. The representative bank's profit from new loans is given by

$$\Pi = [i^u - c^u(l_u)]l_u + (i^e - c^e(l_e))l_e - i^d(l_u + l_e); c^{u'} > 0, c^{u''} \geq 0, c^{e'} > 0, c^{e''} \geq 0 \quad (1)$$

where $\Pi \equiv$ bank profit, $i^u \equiv$ interest rate on new loans given to the domestic sector, $c^u(.) \equiv$ average cost of monitoring and recovering domestic sector loans, $l_u \equiv$ amount of new loans given to the domestic sector, $i^e \equiv$ interest on new loans given to the export sector, $c^e(.) \equiv$ average cost of monitoring and recovering export sector loans, $l_e \equiv$ amount of new loans given to the export sector, $i^d \equiv$ interest rate on new deposits. The bank takes the interest rates as given and chooses l_e and l_u in such a manner that its profit is maximized. As we have already mentioned, under the assumptions of this paper aggregate bank credit equals aggregate bank deposits. First order conditions for profit maximization is given by

$$mr_u \equiv [i^u - c^u(l_u)] - c^{u'}(l_u)l_u = i^d \quad (2)$$

and

$$mr_e \equiv [i^e - c^e(l_e)] - c^{e'}(l_e)l_e = i^d \quad (3)$$

where mr_u and mr_e denote respectively marginal revenues from lending to the domestic and to the export sector. From (2) and (3) we get the profit maximizing supplies of new loans to the domestic and the export sector as functions of the interest rates. Denoting them by l_u^s and l_e^s respectively, we have

$$l_e^s = \overline{l_e^s}(i^u, i^e, i^d) \quad (4)$$

$$l_u^s = \overline{l_u^s}(i^u, i^e, i^d) \quad (5)$$

We have already pointed out that under the assumptions of the paper total amount of supply of new bank loans is equal to the total amount of new bank deposits. In fact $(l_e^s + l_u^s)$ not only gives us aggregate planned supply of new loans to the export and the domestic sector but also aggregate planned demand for new bank deposits. In this paper there is no currency holding. The assumption of perfect competition implies fully flexible interest rates. This ensures that in equilibrium banks are fully loaned up. In this scenario the supply of new bank deposits in equilibrium is determined only by the supply of new high-powered money and the cash reserve ratio of the banks. Therefore in equilibrium the following equation must hold.

$$\overline{l_e^s}(i^u, i^e, i^d) + \overline{l_u^s}(i^u, i^e, i^d) = \frac{1}{\rho} dH \qquad (6)$$

where $\rho \equiv$ cash reserve ratio and dH denotes the increase in high-powered money, which is denoted by H. Thus the RHS of eq. (4) gives the total supply of new bank deposits or the total amount of new credit that the bank can supply. The LHS gives the total amount of new credit that the bank plans to supply or alternatively bank's planned demand for new deposits. From eq. (6) we get the equilibrium value of i^d as a function of the other interest rates and $(1/\rho)dH$.

$$i^d = i^d(i^e, i^u, \frac{1}{\rho} dH) \qquad (7)$$

Derivation of eq. (7) is shown in Figure 1 where mr_u and mr_e schedules represent left hand sides of eqs.(2) and (3) respectively. $\sum mr$ schedule is obtained through the horizontal summation of the two marginal revenue schedules. The vertical line, DD,

Derivation of the Equilibrium Credit Allocation and the Deposit Rate

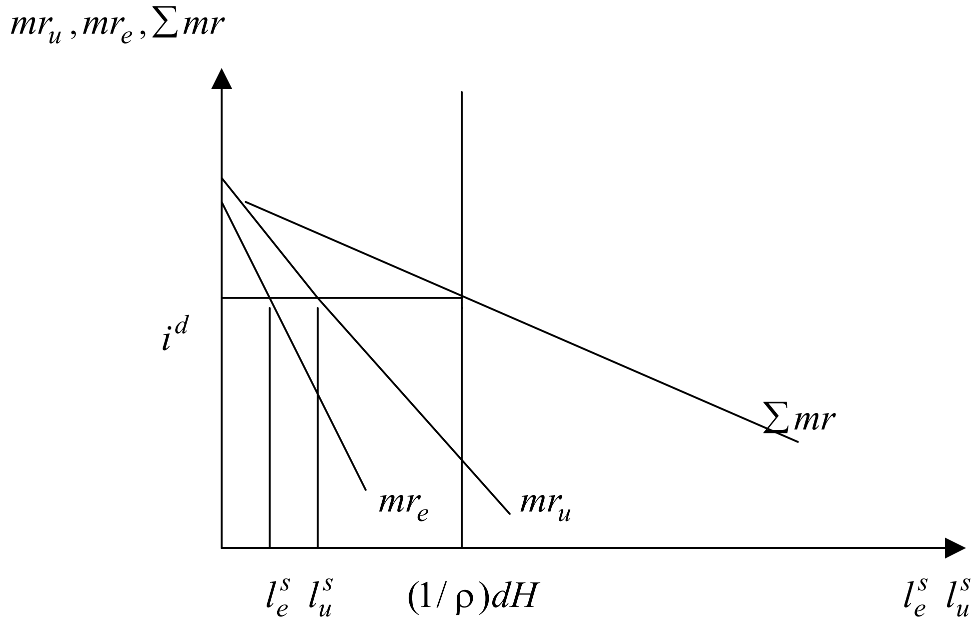

Figure 1

gives corresponding to every value of i^d the total supply of new bank deposits or the total amount of new credit that the bank can extend, given the cash reserve ratio, ρ. $\sum mr$ schedule may be regarded as demand for new deposits schedule or planned supply of new credit schedule. It gives corresponding to every i^d the total amount of new credit that the bank wants to supply or alternatively the total amount of new deposits that the bank wants to have. Thus equilibrium will occur at the point of intersection of the $\sum mr$ schedule and DD. The total amount of new credit is allocated between the domestic and the export sector in such a way that marginal revenues in both the markets are the same.

Substituting (7) into (4) and using eq. (6), we get

$$l_e^s = l_e^s(i^e, i^u, \frac{1}{\rho}dH); \frac{\partial l_e^s}{\partial i^e} > 0, \frac{\partial l_e^s}{\partial i^u} < 0, \frac{\partial l_e^s}{\partial(\frac{1}{\rho}dH)} > 0 \tag{8}$$

$$l_u^s = \frac{1}{\rho}dH - l_e^s(i^e, i^u, dH) \tag{9}$$

The signs of the partial derivatives of (8) may be explained with the help of Figure 1. An increase in i^u will shift the mr_u schedule and therefore the $\sum mr$ schedule rightward, but leave mr_e schedule unaffected. Therefore i^d will rise and so will l_u^s, but l_e^s will fall. Similarly, following an increase in i^e, i^d and l_e^s will rise, but l_u^s will decline. Again, an increase in $(1/\rho)dH$ will shift the DD schedule in Figure 1 rightward lowering i^d and raising both l_e^s and l_u^s. This explains the signs of the partial derivatives. Signs of the partial derivatives of (8) can be derived algebraically also using eqs. (2). (3) and (6). At this stage, for reasons that will be clear later, we generalize our discussion by allowing for the possibility that the monetary authority may force the bank to deviate from the profit maximizing behavior and to allocate more new loans to the export sector than what the bank otherwise would have done. As a result its allocation of the new deposits as loans to the export sector may differ from that given by (8) by a fixed factor θ . Denoting planned supplies of new loans to the export and the domestic sector in this generalized set up by $\overline{l_e^s}$ and $\overline{l_u^s}$ respectively, we get

$$\overline{l_e^s} = l_e^s(i^e, i^u, dH) + \theta \tag{10}$$

and

$$\overline{l_e^u} = \frac{1}{\rho} dH - \overline{l_e^s} = \frac{1}{\rho} dH - l_e^s(i^e, i^u, dH) - \theta \tag{11}$$

Real Sector

The real sector consists of a domestic sector and an export sector. Let us first focus on the export sector, which, by assumption, produces a single good exclusively for export. It is produced with only one input, labor. The good is exported at a given world price in foreign currency, P_e. Thus the domestic price of the good in domestic currency is $P_e\varepsilon$, where ε denotes the exchange rate. Production function of the good is given by

$$X = X(L_e); X' > 0, X'' < 0 \tag{12}$$

where $X \equiv$ output of the export sector, $L_e \equiv$ amount of labor employed in the production of the export good. Producers by assumption require credit to finance partially or fully the purchase of labor services. Thus demand for new credit of the exporters, denoted by l_e^d , is given by

$$l_e^d = \delta(L_e W - L_e^0 W^0); 0 < \delta \leq 1 \tag{13}$$

where $W \equiv$ money wage rate prevailing in the current period, $L_e^0 \equiv$ amount of labor employed in the export sector in the previous period and $W^0 \equiv$ wage rate in the previous period. Following Keynesian tradition the paper regards W as fixed in the short run. In the present context this is just a simplifying assumption. Exporters maximize profit. Their maximization exercise is given by

$$\max_{L_e} \Pi_e = P_e \varepsilon X(L_e) - WL_e - i^e \delta\left(WL_e - L_e^0 W^0\right) - i_0^e \delta L_0^e W_0$$

where $\Pi_e \equiv$ profit of the exporters and $i_0^e \equiv$ given interest rate on loans taken in the past. First order condition for profit maximization is given by

$$P_e \varepsilon X'(L_e) = (1 + i^e \delta) W \tag{14}$$

From eq.(14) we find that

$$L^d = L^d\left(\frac{W(1 + i^e \delta)}{P_e \varepsilon}\right); L^{d'} < 0 \tag{15}$$

where $L^d \equiv$ labor demand of the exporters. Sign of the derivative of (15) is quite self-explanatory. It follows from our assumption that $X'' < 0$.

Output of the export sector is given by

$$X = X\left(L^d\left(\frac{W(1 + i^e \delta)}{P_e \varepsilon}\right)\right) \equiv \overline{X}(\varepsilon, i_e); \overline{X_1} > 0, \overline{X_2} < 0 \tag{16}$$

Let us now focus on the domestic sector. Keeping in view developing countries like India, we make the following assumptions regarding its salient features. It is oligopolistic. It produces a single good, with capital, labor and an imported intermediate input. The good is used for purposes of consumption and investment. We denote the output of the good by Y. The price of the good, denoted by P_Y, is set by applying a fixed mark-up, α , to the average variable cost of production. Production function of the good is fixed coefficient. To produce one unit of Y one unit of capital, one unit of labor and one unit of the imported intermediate input are needed. The paper considers the short run only and accordingly capital stock in the domestic sector is given. There is excess capacity and unemployed labor at the given money wage rate, W and hence output is determined by demand[3]. The paper assumes for simplicity that the producers in the export sector do not need credit for purposes of production, i.e., to finance working capital requirements. Thus

$$P_Y = (1+\alpha)(W + P_m \varepsilon) \tag{17}$$

where $P_m \equiv$ price of the intermediate input in foreign currency. GDP of this economy is given by

$$\text{GDP} = [(P_Y - P_m \varepsilon)Y + P_e \varepsilon X] \tag{18}$$

Value of the financial services generated by the financial sector is included in GDP as given by (18). We assume that all individuals in the domestic economy have the same fixed average and marginal consumption propensity, c . We also assume for simplicity that the domestic sector needs loans only to finance investment, which is a decreasing function of i^u and which it finances entirely with new loans. Domestic sector's investment, which we denote by I^u, must also be a decreasing function of P_Y. However, in this paper all the determinants of P_Y, namely, α, W, P_m and ε are taken as given except ε . However, for simplicity we assume that the cost of imported intermediate inputs constitute a small proportion of P_Y. Hence variations in ε bring about only small changes in P_Y and thereby produce only a mild effect on I^u. Hence just to simplify our analysis, we drop P_Y as a determinant of I^u. Therefore, denoting domestic sector's demand for new credit by l_u^d, we have

$$l_u^d = P_Y I^u(i^u); I^{u'} < 0 \tag{19}$$

We have already said that output in the domestic sector is determined by demand. Hence equilibrium condition in the domestic sector is given by (using (17))

$$\begin{aligned} &P_Y Y = c.[(P_Y - P_m \varepsilon)Y + P_e \varepsilon X] + I^u(i^u)P_Y \Rightarrow \\ &[(1-c)Y - I^u(i^u)](1+\alpha)(W + P_m \varepsilon) = c.(P_e \varepsilon X - P_m \varepsilon Y) \end{aligned} \tag{20}$$

where $0 < c < 1$ and $c \equiv$ fixed average and marginal propensity to consume.

Let us now turn to the foreign exchange market. Demand for foreign exchange comes from the domestic sector. Supply of foreign exchange originates in the export sector. We assume a flexible exchange rate regime. Hence foreign exchange market is in equilibrium when following two equations are satisfied:

$$YP_m = XP_e \Rightarrow X = pY; p \equiv P_m / P_e \tag{21}$$

and using (16) and (21)

$$pY = \overline{X}(\varepsilon, i^e) \tag{21a}$$

Financial sector is in equilibrium when (from (10), (11), (12), and (13))

$$\overline{l_e^s} = l_e^s(i^e, i^u, \frac{1}{\rho}dH) + \theta = \delta(WL_e - W^0 L_e^0) = \delta(WX^{-1}(X) - W^0 X^{-1}(X_0)) \tag{22}$$

and (from (11), (17) and (19))

$$\overline{l_e^u} = \frac{1}{\rho}dH - l_e^s(i^e, i^u, \frac{1}{\rho}dH) - \theta = I^u(i^u)(1+\alpha)(W + P_m \varepsilon) \tag{23}$$

where $X_0 \equiv$ output of the export sector in the previous period. Adding (22) and (23), we get

$$\frac{1}{\rho} dH = \delta \left(W X^{-1}(X) - A \right) + I^u \left(i^u \right)(1+\alpha)(W + P_m \varepsilon); A \equiv W^0 X^{-1}(X_0) \qquad (24)$$

In less developed countries like India in the post-liberalization era, as we have already explained in detail, one of the overriding objectives of monetary policy consists in maximizing GDP subject to a target level of exchange rate. Hence we assume in this model that the monetary authority controls money supply in such a manner that ε remains at a target level. Therefore in equilibrium

$$\varepsilon = \bar{\varepsilon} \qquad (25)$$

where $\bar{\varepsilon} \equiv$ the target level of the exchange rate.

The specification of our model is now complete. It consists of 6 key equations, (20), (21), (21a), (22), (24) and (25) in 6 endogenous variables, $X, Y, \varepsilon, i^u, i^e$ and dH. We solve these 6 equations as follows. First we consider the subsystem given by (20), (21), (21a), (22) and (24). We solve these equations for the equilibrium values of the first five endogenous variables mentioned above as a function of dH, given the exogenous variables. Then we substitute the equilibrium value of ε into eq. (25) to obtain the equilibrium value of dH. Now we focus on the subsystem. We solve this subsystem as follows. We first solve (20), (21) and (22) for equilibrium values of X, i^e and i^u as functions of Y, ε and dH, given the exogenous variables. Then we put the equilibrium

Derivation of the Equilibrium Value of i^e

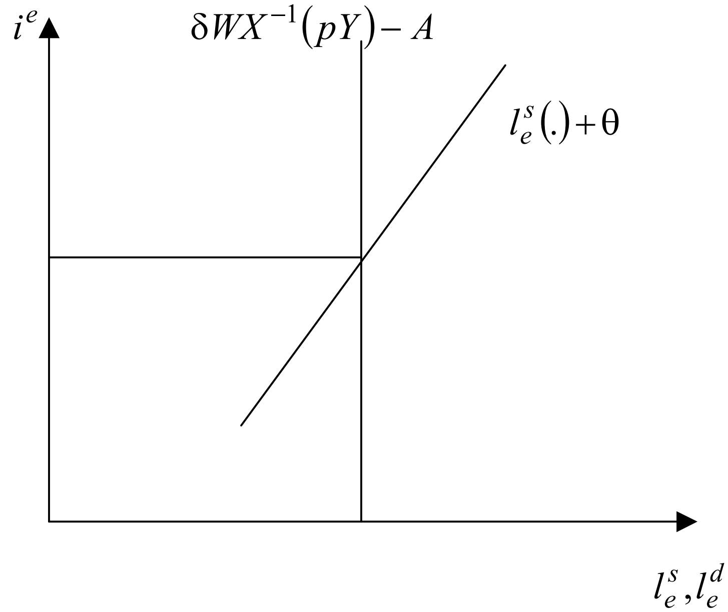

Figure 2

values of X and i^u in (24) to get ε as a function of Y and dH. Again, we put equilibrium value of i^e in (21a) to get ε as a function of Y and dH. Obviously, in equilibrium these two values of ε are equal. Thus we get the final equation that gives the equilibrium value of Y as a function of dH. Let us now get into the details of the solution.

As we have said above, we first solve (20), (21) and (22) for equilibrium values of X, i^e and i^u as functions of Y, ε and dH, given the exogenous variables. Eq. (21) gives the equilibrium value of X as a function of only Y, given p. Substituting (21) into (20), we have

$$Y = \frac{I^u(i^u)}{(1-c)} \Rightarrow$$

$$i^u = I^{u^{-1}}([1-c]Y) \tag{26}$$

Again, substituting (21) and (26) into (22), we have

$$l_e^s\left(i^e, I^{u^{-1}}(\{1-c\}Y), \frac{1}{\rho}dH\right) + \theta = \delta W X^{-1}(pY) - A \tag{27}$$

We can solve the above equation for the equilibrium value of i^e as a function of Y, dH and θ, given other exogenous variables. It is given by

$$i^e = i^e(Y, dH, \theta); i_1^e > 0, i_2^e < 0, i_3^e < 0 \tag{28}$$

Corresponding to every (Y, dH), given the exogenous variables, (28) gives the value of i^e that equilibrates the credit market of the export sector when X and i^u are such that foreign exchange market is cleared and the domestic sector is in equilibrium. Derivation

Derivation of Eq. (30)

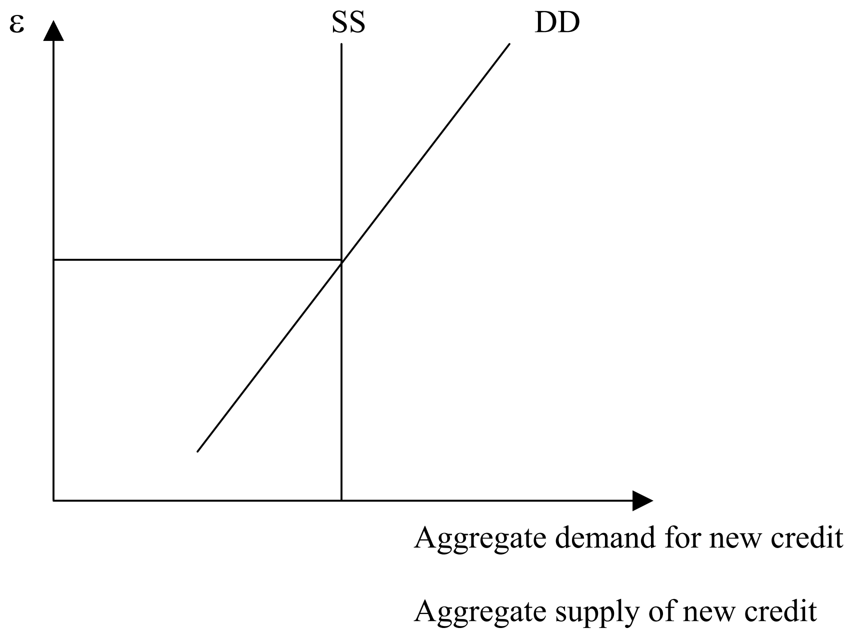

Figure 3

of (28) is shown in Figure 2 where the vertical line represents the RHS of (27). It gives demand for new credit of the export sector corresponding to every i^e for a given value of Y, when X is such that the foreign exchange market is cleared. The upward sloping schedule representing the LHS of (27) gives corresponding to every i^e the supply of new credit to the export sector for given values of Y, dH and θ, when i^u corresponding to the given Y is such that the domestic sector is in equilibrium. Let us now explain the signs of the partial derivatives of (28). An increase in Y implies a rise in the equilibrium value of X - see (21)- and hence an expansion in the demand for new credit of the export sector at every i^e. This will lead to a rightward displacement of the vertical line. Again, an increase in Y, vide (26), implies a fall in the equilibrium value of i^u. This in turn implies a rise in the supply of credit to the export sector at every i^e - see (8). Hence the supply of new credit schedule, i.e., the upward sloping schedule also shifts to the right. As a result the direction of change in i^e is ambiguous. We assume that $(-l_2^e)$ is sufficiently small. Under this assumption the rightward displacement of the supply schedule will be less than that in the demand schedule raising i^e. Again, an increase in dH or θ will bring about a rightward displacement of only the supply schedule lowering the value of i^e. This explains the signs of the partial derivatives of (28). The signs of these partial derivatives can also be derived algebraically.

Substituting (21) and (26) into (24), we get

$$\frac{1}{\rho}dH = \delta\left[WX^{-1}(pY) - A\right] + (1-c)Y(1+\alpha)(W + P_m\varepsilon) \tag{29}$$

We can solve eq. (29) for ε as a function of Y and dH.

Derivation of Eq. (32)

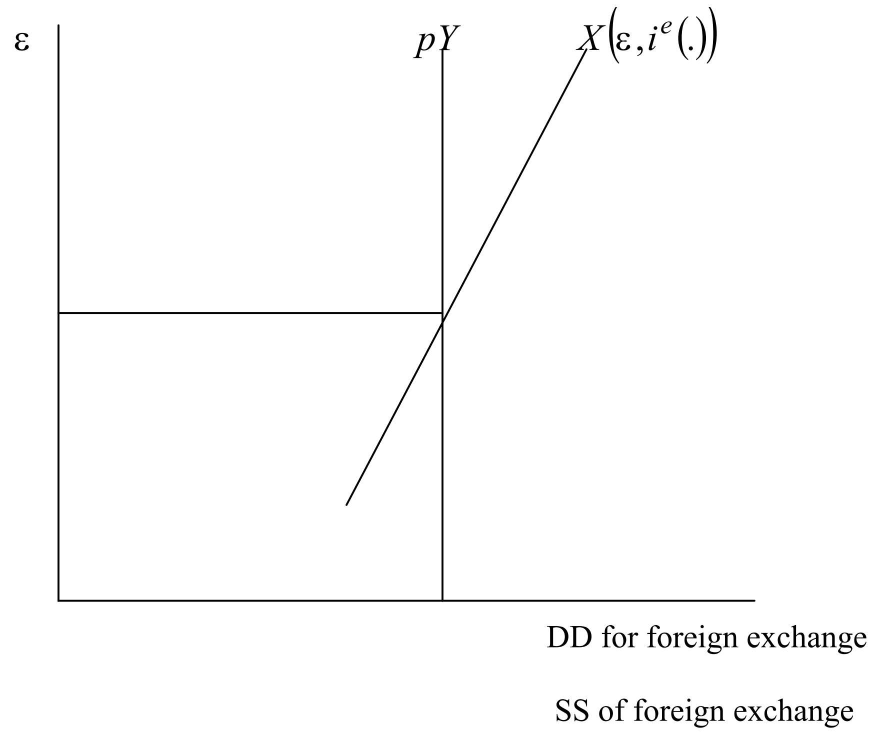

Figure 4

Derivation of Equilibrium Values of ε and Y as functions of dH

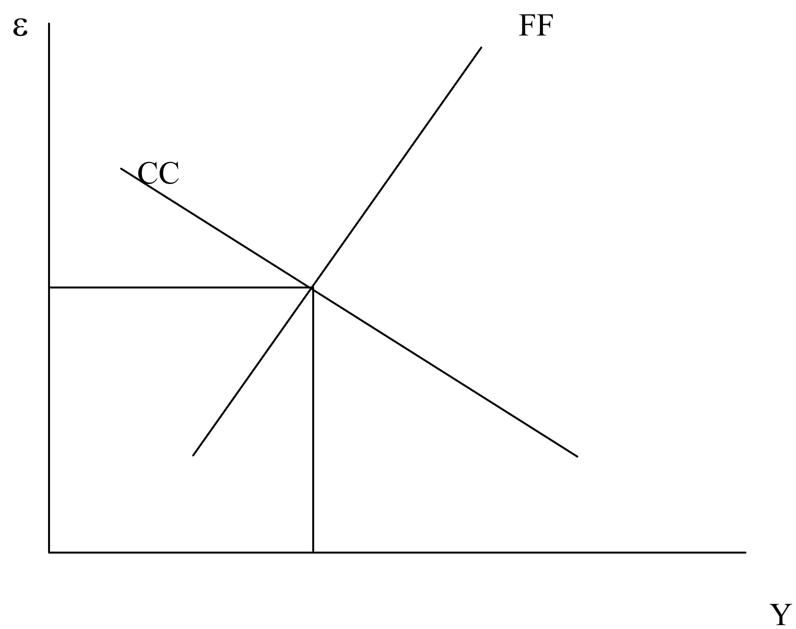

Figure 5

$$\varepsilon = \varepsilon^{c}(Y, dH); \varepsilon_1^c < 0, \varepsilon_2^c > 0 \tag{30}$$

Corresponding to every given (Y, dH), (30) gives the value of ε that equates aggregate supply of new credit to its demand when X and i^u are such that foreign exchange market is cleared and domestic sector is in equilibrium. Derivation of (30) is shown in Figure 3 where the vertical line, SS, representing the LHS of (29), gives the aggregate supply of new credit corresponding to every different ε, given dH. The upward sloping line, DD, representing the RHS of (29) gives the aggregate demand for new credit corresponding to every different ε for a given value of Y, when X and i^u corresponding to the given Y are such that the foreign exchange market is cleared and domestic sector is in equilibrium. The value of ε given by (30) corresponds to the point of intersection of these two lines. An increase in Y shifts the demand schedule rightward lowering ε. Again an increase in dH leads to a rightward displacement of the supply schedule without affecting the demand schedule. Hence ε rises. This explains the signs of the partial derivatives of (30). We can derive these signs algebraically also.

Again, substituting (28) into (21a), we get

$$pY = \overline{X}\left(\varepsilon, i^{e}(Y, dH, \theta)\right) \tag{31}$$

We can solve eq. (31) for ε as a function of Y, dH and θ, given other exogenous variables. Thus

$$\varepsilon = \varepsilon^{f}(Y, dH, \theta); \varepsilon_1^f > 0, \varepsilon_2^f < 0, \varepsilon_3^f < 0 \tag{32}$$

Corresponding to any Y, given dH, θ and other exogenous variables, (32) gives the value of ε that equilibrates the foreign exchange market when i^e, i^u and X are such that the credit markets for the export sector and domestic sector are in equilibrium, and production plans of the exporters are fulfilled, i.e., $X = \overline{X}(.)$ as given by (16). Derivation of (32) is shown in Figure 4 where the vertical line, representing the LHS of (31), gives the demand for foreign exchange in terms of X corresponding to different values of ε, given Y. The upward sloping line, representing the RHS of (31), gives the supply schedule of X. An increase in Y shifts the vertical line rightward. It also raises i^e, vide (28), and thereby lowers X shifting the supply schedule leftward. Thus ε rises. Again, an increase in dH shifts the supply schedule rightward without affecting the demand schedule. Hence ε falls. Again an increase in θ, vide (28), lowers i^e and thereby raises X shifting the supply schedule rightward. Hence ε falls. This explains the signs of the partial derivatives of (32). Obviously, in equilibrium the following equation is satisfied.

$$\varepsilon^c(Y, dH) = \varepsilon^f(Y, dH, \theta) \tag{33}$$

We can solve (33) for the equilibrium value of Y as a function of dH and θ. Thus

$$Y = Y(dH, \theta); Y_1 > 0, Y_2 > 0 \tag{34}$$

Again, substituting (34) into (32), we get the equilibrium value of ε as a function of dH and θ.

$$\varepsilon = \varepsilon(dH, \theta); \varepsilon_1 > 0 \text{ (by assumption for stability)} \tag{35}$$

Derivation of (34) and (35) is shown in Figure 5 where CC and FF represent the LHS and RHS of eq. (33) respectively. We have examined the stability of equilibrium of the subsystem in the appendix in section A.1. Given the adjustment rules, the only additional assumption that we have to make for stability is that $\left(-\overline{X_2}\right)$ is sufficiently small. We shall explain the signs of the partial derivatives of (34) and (35) below.

Let us first examine the impact of an increase in dH on Y and ε. An increase in dH, vide (30), brings about an upward shift in CC, and, vide (32), a downward shift in FF. Hence Y goes up, but the direction of change in the equilibrium value of ε is ambiguous. However, for the present we consider the case where ε rises. As we shall show below, this happens when $\left(-\overline{X_2}\right)$ is sufficiently small. The two major factors on which $\left(-\overline{X_2}\right)$ depends are price sensitivity of X and δ, which measures the extent of dependence of exporters on production loans. The smaller the magnitudes of these two, the less is $\left(-\overline{X_2}\right)$.

Let us now derive these results algebraically. Taking total differential of (29) and (31) treating all exogenous variables as given, we have

$$\begin{bmatrix} \underset{(+)}{\delta w X^{-1'} p + (1-c) P_Y} & \underset{(+)}{(1-c)(1+\alpha) Y P_m} \\ \underset{(+)}{p + \left(-\overline{X_2}\right) i_1^e} & \underset{(-)}{-\overline{X_1}} \end{bmatrix} \begin{bmatrix} dY \\ d\varepsilon \end{bmatrix} = \begin{bmatrix} \underset{(+)}{\frac{1}{\rho} d(dH)} \\ \underset{(+)}{\left(-\overline{X_2}\right)\left(-i_2^e\right)\frac{1}{\rho} d(dH)} \end{bmatrix} \tag{36}$$

From the above system of equations it follows that

$$dY = \frac{\begin{vmatrix} \frac{1}{\rho} d(dH) & (1-c)(1+\alpha) Y P_m \\ \left(-\overline{X_2}\right)\left(-i_2^e\right)\frac{1}{\rho} d(dH) & -\overline{X_1} \end{vmatrix}}{\begin{vmatrix} \delta W X^{-1'} p + (1-c) P_Y & (1-c)(1+\alpha) Y P_m \\ p + \left(-\overline{X_2}\right) i_1^e & -\overline{X_1} \end{vmatrix}} \equiv \frac{\Delta_1}{\Delta} > 0; \Delta < 0, \Delta_1 < 0 \tag{37}$$

$$d\varepsilon = \frac{\begin{vmatrix} \delta W X^{-1'} + (1-c)P_Y & \frac{1}{\rho} d(dH) \\ p - \overline{X_2} i_1^e & \left(-\overline{X_2}\right)\left(-i_2^e\right)\frac{1}{\rho} d(dH) \end{vmatrix}}{\Delta}$$

$$= \frac{\left\{\delta W X^{-1'} + (1-c)P_Y\right\}\left\{p - \overline{X_2} i_1^e\right\}\left[\frac{\left(-\overline{X_2}\right)\left(-i_2^e\right)\frac{1}{\rho} d(dH)}{p - \overline{X_2} i_1^e} - \frac{\frac{1}{\rho} d(dH)}{\delta W X^{-1'}(1-c)P_Y}\right]}{\Delta}$$

(38)

The sign of $d\varepsilon$ depends upon the sign of the term within third brackets in the numerator. The first term within the third brackets gives the horizontal shift of FF, while the second term gives the horizontal shift in CC. If the latter is greater than the former, the numerator is negative and $d\varepsilon$ is positive. This happens, as it is quite clear from the terms within the third brackets, when $\left(-\overline{X_2}\right)$ is sufficiently small.

Again, from eq. (21) we get

$$dX = pdY = p\frac{\Delta_1}{\Delta} > 0 \qquad (39)$$

Results given by (37), (38) and (39) yield the following proposition:

Proposition 1: ***An increase in dH will unambiguously raise output levels in both the sectors. It will also raise (lower) the exchange rate if price sensitivity of exports and/or dependence of exporters on production loans are sufficiently small (large).***

In times of recession there is substantial excess capacity and it is easy to increase production. In such a situation therefore supply of exports may be sufficiently price sensitive. On the other hand in periods of boom there is little idle capacity and it is

Derivation of the Equilibrium Value of dH

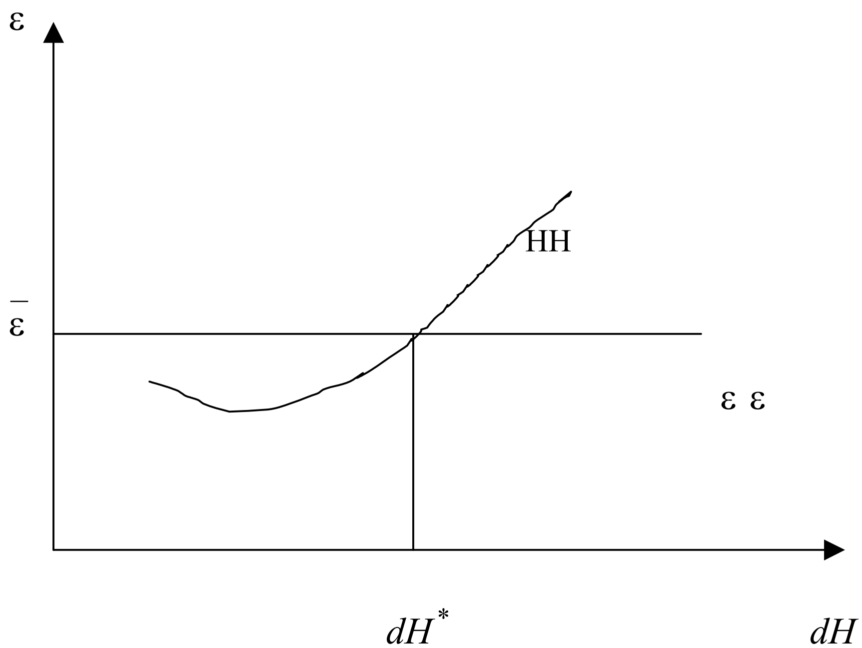

Figure 6

difficult to raise production. Marginal productivity of labor in such a situation is likely to fall sharply with a rise in production and as a result production of exportables is likely to be highly price inelastic. Thus from proposition 1 it follows that in recessionary situations monetary expansion is likely to lower exchange rate and thereby price level, while in times of boom it may do just the reverse. For stability here we are interested in the situation where the exchange rate rises with monetary expansion.

Let us now explain the intuition behind the result. An increase in dH raises supply of new credit to both the sectors lowering interest rates. This in turn induces producers to expand outputs in both the sectors. If supply of exports is not sufficiently interest elastic, increase in the supply of foreign exchange will fall short of the increase in demand for foreign exchange due to the expansion in the domestic sector's output at the initial exchange rate. Hence exchange rate will rise. This explains the result.

Let us now derive the equilibrium value of dH. Substituting (35) into eq. (25), we have

$$\varepsilon\left(dH;\theta\right)=\bar{\varepsilon} \tag{40}$$

We can solve (40) for the equilibrium value of dH, given θ and other exogenous variables. We assume the following adjustment rule for dH :

$$\frac{d\left(dH\right)}{dt}=\xi\left[\bar{\varepsilon}-\varepsilon\left(dH;\theta\right)\right];0<\xi<1 \tag{41}$$

Linearising the above equation around the equilibrium value of dH, we have

$$\frac{d\left(dh\right)}{dt}=\xi\left[-\varepsilon_1 dh\right];dh\equiv\left(dH-dH^*\right);dH^*\equiv \text{ equilibrium value of } dH. \tag{42}$$

From the above equation it is clear that the equilibrium value of dH is stable if $-\varepsilon_1<0$, i.e., if, as follows from (38), $\left(-\overline{X_2}\right)$ is sufficiently small. The latter condition is satisfied, as we have already mentioned, when price elasticity of supply of exports is sufficiently low or δ is sufficiently small or both. The situation is shown in Figure 6 where the HH line represents the LHS of eq. (40) for any given value of θ, while at every point on the horizontal line $\varepsilon = \bar{\varepsilon}$ for every value of dH. Obviously, the equilibrium value of dH corresponds to the point of intersection of the HH and the horizontal line.

We solve (40) for the full equilibrium value of dH denoted by dH^* as a function of θ, given other exogenous variables. It is given by

$$dH^* = H(\theta) \tag{43}$$

Substituting (43) into (34), we get the full equilibrium value of Y. Denoting it by Y^*, we get

$$Y^* = Y^*(\theta) \tag{44}$$

Substituting (43) and (44) into (28), we get the full equilibrium value of i^e, i^{e*}. Thus

$$i^{e*} = i^{e*}(\theta) \tag{45}$$

Substituting (44) into (26), we get

$$i^{u*} = i^{u*}(\theta) \tag{46}$$

where $i^{u*} \equiv$ full equilibrium value of i^u. Substituting (43), (45) and (46) into (7), we get the full equilibrium value of i^d. Denoting it by i^{d*}, we get

$$i^{d*} = i^{d*}(\theta) \tag{47}$$

Substituting (43), (45) and (46) into (10), we get the full equilibrium value of l_e. Denoting it by l_e^*, we get

$$l_e^* = l_e^*(\theta) \tag{48}$$

3. Comparison of Bank Profits under Free Market Conditions and Under Directed Credit Program

Here we shall show that bank profit under competitive conditions in the free market may be less than that under the program of directed credit. To do this we shall first examine how an increase in θ affects the macro variables in this model.

The Effect of an Increase in θ

We shall examine here the effect of an increase in θ with the help of Figures 5 and 6. An increase in θ in Figure 5, vide eq. (31), will lower FF, but leave, vide eq. (29) or (30), CC unaffected. Hence, given dH, there will take place a decline in the equilibrium value of ε and a rise in that of Y.

This result may be algebraically derived as follows.

Taking total differential of (29) and (31) treating dH as fixed, we have

$$\begin{bmatrix} \delta W X^{-1'} \underset{(+)}{p} + (1-c)P_Y & (1-c)Y(1+\alpha)\underset{(+)}{P_m} \\ p + \underset{(+)}{\left(-\overline{X_2}\right)} i_1^e & \underset{(-)}{-\overline{X_1}} \end{bmatrix} \begin{bmatrix} dY \\ d\varepsilon \end{bmatrix} = \begin{bmatrix} 0 \\ \left(-\overline{X_2}\right)\underset{(+)}{\left(-i_3^e\right)} d\theta \end{bmatrix}$$

The signs of the elements of the matrices above are derived from eqs. (12), (16), and (28).

Solving the two equations given above, we get

$$\frac{d\varepsilon}{d\theta} = \frac{\left[\{\delta W X^{-1'} p + (1-c)P_Y\}\left(-\overline{X_2}\right)\left(-i_3^e\right)\right]}{[\delta W X^{-1'} p + (1-c)P_Y]\left(-\overline{X_1}\right) - \left[p + \left(-\overline{X_2}\right)i_1^e\right](1-c)Y(1+\alpha)P_m} \le 0 \tag{49}$$

$$\frac{dY}{d\theta} = \frac{-(1-c)(1+\alpha)YP_m\left(-\overline{X_2}\right)(-i_3)}{\Delta} \ge 0 \tag{50}$$

Given the signs of the partial derivatives of (28), the assumption that $\delta \in (0,1]$-see (13), ε will fall and Y will increase following an increase in θ if and only if $\left(-\overline{X_2}\right) > 0$.

Let us now explain the intuition behind the result. An increase in θ leads to an increase in the supply of new credit to the export sector at the expense of that to the domestic sector lowering i^e and raising i^u - see eqs. (22) and (23). The former, vide (16), will give a boost to the supply of exports, while the latter, as follows from eq. (20), will lead to a contraction in the domestic sector's output. Both will lead to an excess supply of foreign exchange at the initial equilibrium exchange rate. Thus ε will begin to fall. The fall in ε, vide (16), will lead to a reduction in X. But the reduction in X will create excess supply of credit for the export sector, which in turn will reduce i^e and prevent X from falling. Thus both ε and i^e will decline together.

The exchange rate, ε, and therefore the price of the domestic sector's output will go on falling until there emerges excess supply of credit for the domestic sector and i^u begins to fall. This process of adjustment will come to a halt only when ε and therefore i^u decline sufficiently enough to raise Y and therefore demand for foreign exchange to such an extent that the initial excess supply of foreign exchange is removed. This explains our result. (One can easily deduce that that the interest rates will fall unambiguously following an increase in θ. From (49) and (50) we know that an increase in θ will lower ε and raise Y. Therefore, as follows from (21a), equilibrium value of i^e must be less. Otherwise foreign exchange market will not be in equilibrium. Again, it follows from eq. (26) that a higher equilibrium value of Y is consistent only with a lower equilibrium value of i^u).

Let us now examine how an increase in θ affects the equilibrium value of dH. As we find from (49), ε declines unambiguously following an increase in θ, given dH. This implies a downward shift in the HH schedule in Figure 6, which in turn means an expansion in the equilibrium value of dH.

This result may be algebraically derived as follows: Substituting (35) into eq. (25), taking total differential of the resulting equation treating $\bar{\varepsilon}$ as fixed and solving for $(dH / d\theta)$, we have

$$\frac{dH}{d\theta} = \left(\frac{-\varepsilon_2}{\varepsilon_1} \right) > 0 \tag{51}$$

$\varepsilon_2 < 0$ (from (49)) and $\varepsilon_1 > 0$ from our stability condition- see (35).

From (49) and (50) we find that, as long as there is slack in the export sector so that $\left(-\overline{X_2}\right) > 0$, an increase in θ, given dH and other factors, will raise output levels in both the sectors and reduce ε. The latter in turn will bring about an expansion in dH, which again will lead to further expansion in output levels in both the sectors.

Proposition 2: As long as there is slack in the export sector so that output of the export sector is price elastic, the monetary authority can expand outputs in all sectors keeping the exchange rate at the target level by forcing banks to lend more than they otherwise will to the export sector. Therefore by choosing a suitably large value of θ so that the slack in the export sector is fully exhausted, it will be possible for the monetary authority to maximize aggregate output, given the target level of the exchange rate.

The increase in dH will increase bank business too. Both aggregate credit and aggregate bank deposit will go up. Borrowing and lending rates will adjust so that banks find it profitable to take in the new deposits and use them to extend new loans. Therefore bank profit is likely to go up too. In a competitive scenario an individual bank cannot produce any impact on dH by changing only its own allocation of new credit. Hence, when an individual bank maximizes profit, it takes dH as given. In a competitive set-up, therefore, in the free market scenario the allocation of new credit that occurs does not maximize aggregate bank profit. We shall prove this proposition rigorously in the next section.

3.1 Decentralized profit maximizing allocation versus centralized profit maximizing allocation

The optimization exercise that a representative bank carries out in the free market or decentralized set-up is given by (1). The optimization exercise of the representative bank in the situation of full equilibrium with $\theta = 0$ is therefore given by

$$\max_{l_e} \Pi = [i^{e*}(0) - c(l_e)]l_e + [i^{u*}(0) - c(\frac{1}{\rho} dH^*(0) - l_e)][\frac{1}{\rho} dH^*(0) - l_e] -$$
$$i^d(i^{e*}(0), i^u(0), \frac{1}{\rho} dH^*(0)) \frac{1}{\rho} dH^*(0)$$

where $i^{e*}(0), i^{u*}(0)$, $i^d(i^{e*}(0), i^{u*}(0), (1/\rho)dH^*(0))$ and $dH^*(0)$ denote full equilibrium values of i^e, i^u, i^d and dH respectively, when $\theta = 0$. First order condition for profit maximization is given by

$$[\{i^{e*}(0) - c^e(l_e)\} - c^{e'}(l_e)l_e] - [\{i^{u*}(0) - c^u(\frac{1}{\rho} dH^* - l_e)\} -$$

$$c^{u'}(\frac{1}{\rho} dH^*(0) - l_e)(\frac{1}{\rho} dH^*(0) - l_e)] \equiv \overline{L}(l_e) = 0 \quad (52)$$

We can solve eq. (52) for the full equilibrium value of l_e that obtains under competitive conditions in the free market when $\theta = 0$. We denote this value of l_e by $\tilde{l}_e^* \equiv l_e^*(0)$, see (48). (Substituting for i^e, i^u and i^d their respective full equilibrium values corresponding to $\theta = 0$ and for l_u the expression $\left[(1/\rho)dH^* - l_e\right]$ in eqs. (2) and (3) and by subtracting (2) from (3), we get(52)).

Let us now describe the optimization exercise that a central planner seeking to maximize aggregate bank profit will carry out. Unlike the representative bank, the central planner takes into cognizance the effect of additional loans to the export sector on dH. Accordingly, substituting eqs. (43) – (46) and (48) into (1), his optimization exercise may be written as

$$\begin{aligned}\max_{\theta} \Pi = {} & [i^{e*}(\theta) - c^e(l_e^*(\theta))]l_e^*(\theta) + [i^{u*}(\theta) - c^u(\frac{1}{\rho}dH^*(\theta) - l_e^*(\theta))] \\ & [\frac{1}{\rho}dH^*(\theta) - l_e^*(\theta)] - i^d(i^{e*}(dH^*(\theta), i^u(dH^*(\theta)), \frac{1}{\rho}dH^*(\theta))[\frac{1}{\rho}dH^*(\theta)]\end{aligned} \tag{53}$$

Inverting eq.(48), we get

$$\theta = l_e^{*-1}(l_e^*) \equiv l(l_e^*) \tag{54}$$

Substituting (54) into (53), we can rewrite the planner's optimization exercise as follows:

$$\begin{aligned}\max_{l_e^*} \Pi = {} & [i^{e*}(l(l_e^*)) - c^e(l(l_e^*))]l_e^* + [i^{u*}(l(l_e^*)) - c^u(\frac{1}{\rho}dH^*(l(l_e^*)) - l_e^*)] \\ & [\frac{1}{\rho}dH^*(l(l_e^*)) - l_e^*] - i^d(i^{e*}(dH^*(l(l_e^*)), i^u(dH^*(l(l_e^*))), \frac{1}{\rho}dH^*(l(l_e^*)))[\frac{1}{\rho}dH^*(l(l_e^*))]\end{aligned}$$

The first order condition for profit maximization in this case is given by (see (52))

$$\overline{L}(l_e^*) + \left[l_e^* i^{e*'} + D.i^{u*'} + B.\frac{1}{\rho} - \left\{i_1^d\left(i^{e*'}\right) + i_2^d\left(i^{u*'}\right) + i_3^d\right\}\right]l'dH^{*'} = 0 \tag{55}$$

Derivation of the Optimum Value of θ

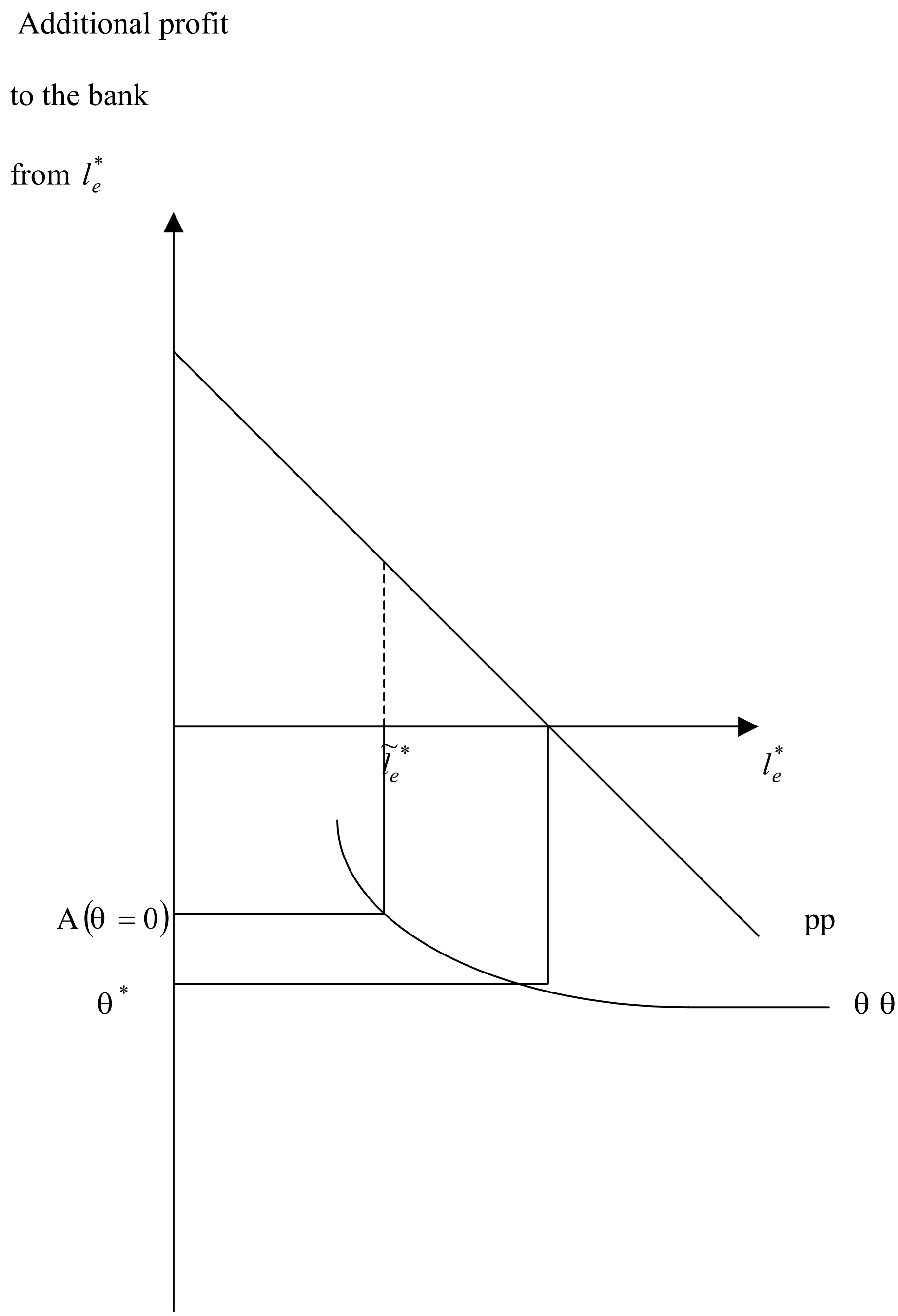

Figure 7

where

$$\overline{L}\left(l_e^*\right) \equiv \left[\left\{A - l_e^* c^{e'}\left(l_e^*\right)\right\} - \left\{B - c^{u'}(D)D\right\}\right], A \equiv \left[i^{e*}\left(l\left(l_e^*\right)\right) - c^e\left(l_e^*\right)\right], B \equiv$$

$$\left[i^{u*}\left(\frac{1}{\rho} dH^*\left(l\left(l_e^*\right)\right) - l_e^*\right) - c^u\left(\frac{1}{\rho} dH^*\left(l\left(l_e^*\right)\right) - l_e^*\right)\right], D \equiv \frac{1}{\rho} dH^*\left(l\left(l_e^*\right)\right) - l_e^*$$

The first term on the LHS of (55) gives the extra profit the bank earns from a unit increase in l_e, given dH. The second term on the other hand gives the extra profit of the bank from the increase in dH^* that takes place as the central planner increases θ by such an amount that l_e^* goes up by unity. The second term is positive as long as $dH^{*'}$ is so. The reason may be explained as follows. Following an increase in dH^* and the consequent increase in bank deposits, both lending and deposit rates adjust in such a way that the bank considers it worthwhile to take in the new deposits and lend them out. The additional gain that accrues to the bank as it receives the new deposits is given by the second term. It must be positive if $dH^{*'}$ is so; otherwise, the bank would not have accepted the new deposits. It should be clear from (49) and (51) that, given (28) and the assumption that $\delta \in (0,1]$, $dH^{*'} > 0$ if and only if $\left(-\overline{X_2}\right) > 0$.

Now, as follows from eq.(52), at $l_e^* = l_e^*(0) \equiv \tilde{l}_e^*$, (see (48)), the first term on the LHS of (55) given by $\overline{L}\left(\tilde{l}_e^*\right) = 0$. If at this value of l_e^*, which corresponds to $\theta = 0$, there is slack in the export sector so that $\left(-\overline{X_2}\right) > 0$, then $dH^{*'} > 0$ and therefore the second term on the LHS of (55) is positive.

We assume that the second order condition for profit maximization is satisfied; otherwise the issue of profit maximization is not relevant. Under this assumption the LHS of (55) falls with an increase in l_e^* or θ . At $\tilde{l}_e^*$, as we have already seen, the first term on the LHS of (55) is zero, but the second term is positive if there is slack in the export sector. Therefore, when the second order condition for profit maximization is satisfied, aggregate bank profit will be maximized at a higher value of l_e^* , i.e., at a positive value of θ .

One can easily deduce from our model that in the free market full equilibrium where $\theta = 0$, there will be slack in the export sector if, given other factors, the target level of exchange rate, $\bar{\varepsilon}$, is not sufficiently high. This leads to the following proposition:

Proposition 3: If, given other factors, $\bar{\varepsilon}$ **is not sufficiently high, then in the free market full equilibrium situation, where** $\theta = 0$, **there is slack in the export sector and consequently** $dH^{*'} > 0$. **In this situation aggregate bank profit is not maximized in the free market set-up. It is maximized only when the central planner chooses a positive value of** θ **and thereby forces banks to lend more to the export sector than they otherwise will.**

The reason for the result is the following. As long as there is slack in the export sector, additional loans to that sector brings about an increase in dH^* and thereby leads to an expansion in output levels in all sectors. All this contributes to bank profit. In a competitive banking sector an individual bank by lending more to the export sector cannot produce this macro impact. Hence it takes dH^* as given while deciding on its sectoral credit allocation. This gives rise to a sub optimal allocation of credit in the free market equilibrium even from the point of view of bank profit.

The situation is shown in Figure 7 where the downward sloping line pp gives the value of the LHS of eq.(55) corresponding to different values of l_e^*. We measure the value of θ along the vertical axis in the downward direction taking point A as the origin. $\theta\ \theta$ represents eq.(54), which gives the value of θ corresponding to different values of l_e^*. If there is slack in the export sector at $\tilde{l}_e^*$, the value of LHS of (55) at $\tilde{l}_e^*$ is positive and pp intersects the horizontal axis at a higher value of l_e^* that corresponds to a higher value of θ.

3.2 Directed Credit Program and Bank Profit

Here we shall show that the directed credit program can achieve the allocation that occurs when a central planner seeking to maximize aggregate bank profit takes the credit allocation decision. Let us denote the value of θ that maximizes aggregate bank profit by θ^*. If the government pegs i^e, i^u and i^d at $i^{e*}(\theta^*) < i^{e*}(0)$, $i^{U*}(\theta^*) < i^{u*}(0)$ and $i^{d*}(\theta^*) < i^{d*}(0)$ respectively (see eqs.(45), (46) and (47)), fixes dH^* at $dH^*(\theta^*)$ (eq.(43)), and specifies $l_e^*(\theta^*)$ (eq.(48)) and $[(1/\rho)dH^* - l_e^*(\theta^*)]$ as sectoral credit targets, the economy will achieve the outcome that the central planner achieves in an otherwise free market set-up by fixing θ at θ^*. With the interest rates pegged at the above mentioned levels, domestic and export sector will be in equilibrium with output levels equal to $Y^*(\theta)$ (eq.(44)) and $X^*(\theta) = pY^*(\theta)$ (see eq.(21)) and the credit markets will be in equilibrium with the above mentioned outputs and interest rates.

Under the directed credit program specified above aggregate bank profit will be maximized and GDP will be higher than the level that occurs in the free market equilibrium with $\theta = 0$. From the above it follows that the directed credit program that pegs interest rates below free market equilibrium levels that prevail when $\theta = 0$ and specify sectoral credit targets so that the sectors that ease up crucial constraints on economic activities get more credit than they otherwise will is likely to raise bank profit by enabling the government to undertake expansionary programs. At least one cannot say a priori that such a program will necessarily reduce aggregate bank profit. This leads to the following proposition:

Proposition 4: A suitably designed directed credit program can maximize aggregate bank profit when a free market set-up fails to do so. Therefore aggregate bank profit is not necessarily less under a directed credit program than that in a competitive situation.

4. Conclusion

The two major constraints that operate on economic activities in countries like India are the availability of foreign exchange and that of food. Low values of the exchange rate and the rate of inflation indicate adequate supplies of these two crucial commodities and vice versa. Accordingly, when exchange rate and the rate of inflation are low, governments feel reassured and undertake expansionary programs. However, when they move beyond tolerable levels governments feel apprehensive of severe BOP crisis and food shortage and put brakes on economic expansion through contractionary policies. Since it is not possible to consider the whole gamut of policies that the government uses to stabilize the values of the crucial macro variables or all the variables that the government seeks to stabilize, we consider here only the monetary policy and focus only on the exchange rate as the crucial variable that the government seeks to stabilize. This omission, however, does not affect the generality of the results drawn. Had we not made these omissions, the results of the paper would have been stronger. Another point to be noted in this context is that monetary policy is steadily growing in importance as the instrument for stabilization in the post-liberalization period.

In this paper therefore the policy makers regulate only money supply to maximize aggregate output keeping the exchange rate at a target level. In such a scenario, as the paper shows, neither aggregate bank profit nor GDP of the domestic economy may be maximized in a free market set up. When the government wants to keep the exchange rate at a target level, additional loans to the export sector generate external benefits not only for the economy as a whole but also for the banking sector. It eases up supplies of foreign exchange and lowers exchange rate. This induces or enables the monetary authority to increase money supply, which in turn brings about an expansion in GDP, bank business and thereby bank profit. In a competitive banking sector in the free market scenario, a single bank by giving more loans to the export sector cannot produce this macro impact. Hence a single bank while deciding on its credit allocation takes the determinants of money supply as given. This gives rise to a sub optimal allocation of credit in free market equilibrium, which maximizes neither bank profit nor GDP. However, when a central planner seeking to maximize aggregate bank profit takes the credit allocation decision, it takes into account the aggregate external effect of lending to the export sector and succeeds in establishing the credit allocation that does the job. We refer to this outcome as the centralized outcome.

Our paper shows that the free market outcome and the centralized outcome differ if in the former there is some slack in the export sector so that the output of the export sector is price elastic. When this condition is satisfied, the central planner by forcing the banks to lend more to the export sector than they otherwise will by an appropriate amount can maximize bank profit and raise GDP. Interest rates in this centralized outcome will be less, while aggregate money supply, bank credit and bank deposit will be higher. The paper also shows that a suitably designed system of administered interest rates and directed credit can achieve the centralized outcome. From this it follows that a directed credit program, which pegs interest rates at less than free market equilibrium levels and allocates larger amount of credit to sectors that ease up crucial constraints on economic activities does not necessarily lead to smaller amount of bank profit.

Appendix

A.1. Stability of Equilibrium

To keep our large model tractable, we make certain assumptions regarding the speeds of adjustment of the endogenous variables. One should regard these assumptions simply as an expository device. As credit market is perfectly competitive, we assume that interest rates adjust instantaneously to clear the credit markets. We assume further that speeds of adjustments in ε and X are much slower than those of interest rates so that credit markets are cleared before any change in ε or X could take place. Actually, ε in this model equilibrates the foreign exchange market only through its impact on the planned supply of X. Since adjustment in X is likely to be sluggish, ε will also be slow in equilibrating the foreign exchange market. For simplicity we have assumed that adjustments in X and ε are in tune with one another and they adjust simultaneously to equilibrate the foreign exchange market. However, the speed of adjustment in Y is assumed to be much slower than those of X or ε . This is because, usually in LDCs like India X is produced in the informal sector in small-scale units, which enjoy a high degree of operational and managerial flexibility compared to the production units in the domestic sector dominated by organized large-scale firms. The former are also less fettered by government regulations. Output in the domestic sector is therefore assumed to adjust only after adjustments in X and ε are complete. Finally, we assume that the monetary authority is the slowest to respond to the changing economic scenario and adjusts dH only when adjustments in all other variables are complete.

We therefore first examine the stability of the equilibrium values of interest rates, given the values of all other endogenous variables. Using equations (22) and (23), we write the adjustment equations of the endogenous variables as follows:

$$\frac{di^e}{dt} = \omega\left[\delta\left\{WX^{-1}(X) - W^0X^{-1}\left(X^0\right)\right\} - \left\{l_e^s(i^e, i^u, \frac{1}{\rho}dH)\right\} - \theta\right]; \omega > 0$$

$$\frac{di^u}{dt} = \gamma\left[P_Y\left\{I^u\left(i^u\right)\right\} - \left\{\frac{1}{\rho}dH^* - l_e^s(i^e, i^u, \frac{1}{\rho}dH) - \theta\right\}\right]; \gamma > 0$$

Given these adjustment mechanisms, the equilibrium values of the interest rates, given the values of X, dH and P_Y or ε are stable if the trace of the following matrix (signs of whose elements are given by eqs.(8) and (19)).

Derivation of Equilibrium Values of i^u and i^e, given the values of X, dH and P_Y or ε.

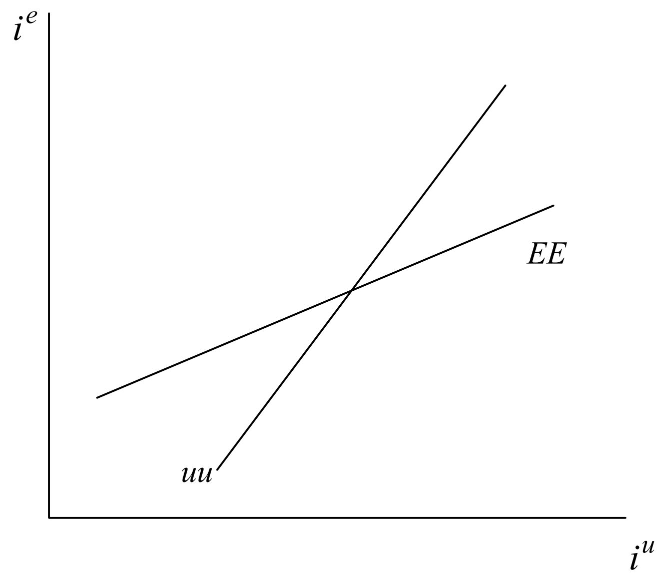

Figure 8

$$\begin{bmatrix} \underset{(-)}{-l_1^e} & \underset{(+)}{-l_2^e} \\ \underset{(+)}{l_1^e} & \underset{(-)}{\left(l_2^e + P_Y I^{u'}\right)} \end{bmatrix}$$

is negative, i.e., if

$$\left(-l_1^e\right) + \left(l_2^e + P_Y I^{u'}\right) < 0 \tag{A.1}$$

and if the following determinant is positive

$$\begin{vmatrix} \left(-l_1^e\right) & \left(-l_2^e\right) \\ l_1^e & \left(l_2^e + P_Y I^{u'}\right) \end{vmatrix} > 0$$

i.e., if

$$\left(\frac{di^e}{di^u}\right)_{uu} \equiv \frac{-\left(l_2^e + P_Y I^{u'}\right)}{l_1^e} > \left(\frac{-l_2^e}{l_1^e}\right) \equiv \left(\frac{di^e}{di^u}\right)_{EE} \tag{A.2}$$

From the signs of the partial derivatives of (8) and (19) it follows that the condition (A.1) is satisfied. (A.2) is satisfied if the slope of uu representing eq.(9) in the (i^u ,i^e) plane (Figure 8) and given by the LHS of (A.2) is steeper than that of EE, which represents eq. (8) in the same plane in Figure 8. The slope of EE is given by the RHS of (A.2).

Since ε equilibrates the foreign exchange market only through its impact on the planned supply of X, we assume that X and ε adjust simultaneously to their equilibrium values, given Y, dH and the exogenous variables. From equations (22) and (23) we get i^e and i^u as functions of X and ε , given dH and all exogenous variables. Thus

$$\tilde{i}^e = \tilde{i}^e(X,\varepsilon); i_1^e > 0, i_2^e > 0 \tag{A.3}$$

$$\tilde{i}^u = \tilde{i}^u(X,\varepsilon); i_1^u > 0, i_2^u > 0 \tag{A.4}$$

Let us explain the signs of the partial derivatives of (A.3) and (A.4) with the help of Figure 8. An increase in X, vide (22) and (23), shifts *EE* upward leaving *uu* unaffected. This implies an increase in the equilibrium values of i^u and i^e. Again, an increase in ε, vide (22) and (23), shifts *uu* rightward leaving *EE* unaffected. This also raises equilibrium values of i^u and i^e. This explains the signs of the partial derivatives of (A.3) and (A.4).

Putting (A.3) into (16), we get

$$X = \overline{X}\left(\varepsilon, \tilde{i}^{e}(X,\varepsilon)\right) \equiv \tilde{X}(\varepsilon, X); \tilde{X}_1 > 0, \tilde{X}_2 < 0 \qquad \text{(A.5)}$$

The above equation gives the planned value of X corresponding to any (X,ε). Under the assumption that $\left(-\overline{X_2}\right)$ is sufficiently small, $\tilde{X}_1 > 0$. As we have already assumed, X and ε adjust simultaneously to their equilibrium values, given Y, dH and the exogenous variables. We assume adjustment equations of the following form:

$$\frac{dX}{dt} = \vartheta\left(\tilde{X}(\varepsilon, X) - X\right); \vartheta > 0$$

Linearising around the equilibrium values, we have

$$\frac{dx}{dt} = \vartheta\left((\tilde{X}_2 - 1)x + (\tilde{X}_1)\tilde{\varepsilon}\right); x \equiv X - X^*; \tilde{\varepsilon} \equiv \varepsilon - \varepsilon^* \qquad \text{(A.6)}$$

where $X^* \equiv$ equilibrium value of X and $\varepsilon^* \equiv$.equilibrium value of ε.

Now focus on the adjustment rule of ε :

$$\frac{d\varepsilon}{dt} = \beta\left(pY - \tilde{X}(\varepsilon, X)\right); \beta > 0 \quad \text{(see (21a))}$$

Linearising the above equation treating Y as fixed, we have

$$\frac{d\tilde{\varepsilon}}{dt} = \beta\left(-\tilde{X}_2 x - \tilde{X}_1\tilde{\varepsilon}\right) \tag{A.7}$$

From (A.6) and (A.7) it follows that the equilibrium values of ε and X are stable if the determinant of the following matrix is positive and the trace negative.

$$\begin{bmatrix} \underset{(-)}{\left(\tilde{X}_2 - 1\right)} & \underset{(+)}{\tilde{X}_1} \\ \underset{(+)}{-\tilde{X}_2} & \underset{(-)}{-\tilde{X}_1} \end{bmatrix}$$

Signs of the elements of the above matrix follow from (A.5).

Thus the equilibrium is stable if

$$\left(\tilde{X}_2 - 1\right) + \left(-\tilde{X}_1\right) < 0 \tag{A.8}$$

and

$$\begin{vmatrix} \left(\tilde{X}_2 - 1\right) & \tilde{X}_1 \\ -\tilde{X}_2 & -\tilde{X}_1 \end{vmatrix} = \left(\tilde{X}_2 - 1\right)\left(-\tilde{X}_1\right) + \tilde{X}_1\tilde{X}_2 > 0 \Rightarrow$$
$$\left(1 - \tilde{X}_2\right) = 1 + \left(-\tilde{X}_2\right) > -\tilde{X}_2 \tag{A.9}$$

Given our assumptions, both (A.8) and (A.9) are satisfied. Let us now turn to the dynamics of Y. We solve (21) for equilibrium value of X as a function of Y. This is given by

$$X = pY \tag{A.10}$$

From (A.5) we get

$$X = X^0(\varepsilon); X^{0'} > 0 \tag{A.11}$$

Substituting (A.11) into eq. (21a) or (A.10), we get the equilibrium value of ε as a function of Y, which is given by

$$\varepsilon = \varepsilon^0(Y); \varepsilon^{0'} > 0 \tag{A.12}$$

Substituting (21) and (A.4) into (20) and using (A.10) and (A.11), we rewrite it as

$$Y = cY + I\left(i^{u}\left(pY, \varepsilon^{0}(Y)\right)\right) \equiv cY + \tilde{I}(Y); \tilde{I}' < 0 \tag{A.13}$$

Now the adjustment rule of Y, using (A.13), may be written as follows:

$$\frac{dY}{dt} = \lambda\left[cY + \tilde{I}(Y) - Y\right]; \lambda > 0 \tag{A.14}$$

Linearising the RHS of (A.14), around the equilibrium value of Y, we have

$$\frac{dy}{dt} = \lambda\left[\left(c + \tilde{I}' - 1\right)y\right]; \lambda > 0 \tag{A.15}$$

where $y \equiv Y - Y^{*}; Y^{*} \equiv$ equilibrium value of Y. From (A.15) it is clear that the equilibrium value of Y is stable if $\left(c + \tilde{I}' - 1\right) < 0$. Since $0 < c < 1$ and $\tilde{I}' < 0$, this condition is obviously satisfied.

Thus we have chalked out above a plausible mechanism whereby the interest rates, exchange rate and outputs of the domestic and the export sector gravitate towards their equilibrium values, given dH and the exogenous variables. The only assumptions that we have made regarding the magnitudes of the partial derivatives for stability are that $\left(-\overline{X_2}\right)$ is sufficiently small.

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