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The existence of black market exchange rates of developing countries is common knowledge, and the Indian rupee has been traded in an unofficial "free" market for a long time (Pick 1975, p. 239). The emergence of the commodities black market in general and the currency black market in particular is the outcome of official control on the free market operation. In the case of the exchange rate, an additional factor is important--a government's perception of the currency's prestige. For example, the political stability of many governments in the developing countries is often at stake when the government decides to devalue currency, even when such a decision is economically sound. The possible political opposition explains partly why most developing countries opt for a fixed exchange rate regime and sticks to the overvalued exchange rate.[1] One strong opinion in favor of a fixed exchange rate is the following: the developing countries cannot follow an independent course in today's world regarding the exchange rate of their currencies. Either they peg their currencies to major world currencies, in which case it is a free floating exchange rate as the base currency floats, or they fix the exchange rate of their currencies vis-a-vis a basket of currencies, in which case it constitutes a managed float. What the developing countries fear most is the speculation with the exchange rate of their currencies. In this case, the country loses valuable foreign exchange. To safeguard national interest, the country chooses a fixed exchange rate regime. Along with the fixed exchange rate, an elaborate control mechanism operates in the case of both

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[1]Out of 146 members of the International Monetary Fund, 51 members followed a fixed exchange rate system, 17 members followed a basket of currency approach, and only 38 members followed a more flexible exchange rate in 1984 (I.M.F. 1984, p. 9).

exports and imports. The potential loss of welfare in the form of distortion in resource allocation is now well established in the literature (Bhagawati 1978; Bhagawati and Hansen 1973). One common outcome of these control mechanism is the emergence of black market.

A black market is the euphemism for an illegal market where the price of the commodity varies with the officially fixed minimum or maximum price. Such a market became very common after the World War II when even the mature western economies were subject to widespread control. The theory of the black market is analyzed in Boulding (1947), Bronfenbrenner (1947), and Michaely (1954). This tool of analysis has been applied to explain the specific behavior of the black market for foreign exchange in Culbertson (1975) and Sheikh (1976). Both models are based on partial equilibrium analysis and make restrictive assumptions regarding the sources of supply to the black market for foreign exchange. Although Sheikh emphasizes smuggling and underinvoicing of exports as the main sources, Culbertson stresses the resale of the officially allocated foreign exchange. The black market exchange rate behavior is analyzed in a macroeconomic framework by Nowark (1984) and Dicki and Noursi (1975). The latter explains the operation of officially sponsored parallel foreign exchange market for Syria. The analysis has been extended and applied for different countries, e.g., Gupta (1981) for India, Dornbusch et al. (1983) for Brazil, and Olgun (1984) for Turkey. The black market is integrated with smuggling in Nowak (1984) and Pitt (1984).

Since the early seventies, the monetary approach dominated explanation of exchange rate behavior. In the monetarist framework, the exchange rate is defined as the relative price of monies. As such, the domestic money stock should influence the black market exchange rate. The relation-

ship between the domestic stock of money and the black market exchange rate has been seen as a two-way relationship in the case of exchange control economies. While the expectations about the future exchange rate adjustment in the black market can influence the domestic demand for money, the change in the money supply in the domestic economy is expected to have effects on the exchange rate in the black market. Both these aspects have been studied theoretically and empirically by Blejer (1978 a, b). Regarding the first interrelationship, Blejer (1978 b) has shown that for some exchange control regimes the demand for money is significantly reduced when the expectations of a black market depreciation of exchange rates intensify. In the latter case, the expected return from holding foreign currency assets increases and individuals tend to substitute domestic assets with foreign ones as the opportunity cost of holding domestic money increases. This leads to a reduction in the demand for domestic cash balances. One implication of this interlink is the following: any intervention in the black market exchange rate by the government will have repercussions in the domestic demand for money, and this will complicate the effects of any stabilization policies.

The second aspect of the interrelationship between the change in the domestic money supply and the change in the free market exchange rate is in line with the broad monetarist tradition in which monetary variables are supposed to influence exchange rate behavior (Frenkel 1976; Dornbusch 1976; Mussa 1976). In an exchange control regime where the official exchange rate is fixed, any disequilibrium in the domestic money market in the form of an excess supply of money is expected to have a spillover effect on both balance of payment and exchange rate variation (Friedman 1953; Musha 1976).

When the official rate is fixed, the latter is reflected through the change in the exchange rate in the black market. This aspect has been analyzed within a standard monetarist framework in Blejer (1978 a), where the basic hypothesis tested empirically was that the exchange rate in the black market is freely determined by market forces and responds to disequilibrium in the domestic money market.

In the monetarist tradition Blejer has used the demand for money function in which the interest rate has not been incorporated as an argument. But the diversion of foreign exchange from the official market to the black market depends on two types of margin of choice. The first is between money and goods, and the second is between money and bonds. Although the first is relevant for the goods market, the second is relevant for the capital market. Blejer has emphasized the first margin of choice, because he argues that inflation is predominant for the countries in which he tested his model.

Although Blejer may be correct within the context of his study, the consideration of capital market is important for two reasons. First, in the absence of information about illegal trade across national boundaries, the latter is not incorporated in the model. Second, on the assumption of free movement of capital in the international market, the public diverts a portion of officially allocated foreign exchange to earn a profit. The latter depends on the difference between the domestic nominal interest rate and that of the foreign country.

Based on the above argument, it is imperative that we should retain the interest rate i the demand for money function. Accordingly, the monetarist model used by Blejer is modified in the present study. The model will be applied to the Indian economy. India presents a unique example of

a system of elaborate exchange controls under a fixed exchange rate system. Over time, the disequilibrium in the domestic money market in the form of excess supply of money has created inflation. Moreover, the black market exchange rate has deviated consistently from the official exchange rate (Figure 1). This relationship has not been explored in India's case. The present paper is an attempt to bridge this gap.

This paper is divided into several sections. Section II presents the theoretical framework where the basic model is explained. Section III deliberates the data and the empirical results. In the final section, the conclusion and the policy implication of this study is presented.

II. The Theoretical Framework

We make the following assumptions to keep the model simple. The black market is assumed as an outlet for capital transactions that are barred from the official market. The small country assumption is retained so that the prices of traded goods are exogenously given. There also exists a nontraded goods sector. There is full employment in the economy and monetary disequilibrium does not affect the rate of growth of real income.

In the money market, the money supply is determined by the relationship

$$Ms = k(R + D), \tag{1}$$

where

k = money multiplier

R = foreign exchange reserve

D = domestic credit component of the monetary base.

The demand for money is

$$M_d = P \cdot m_d \tag{2}$$

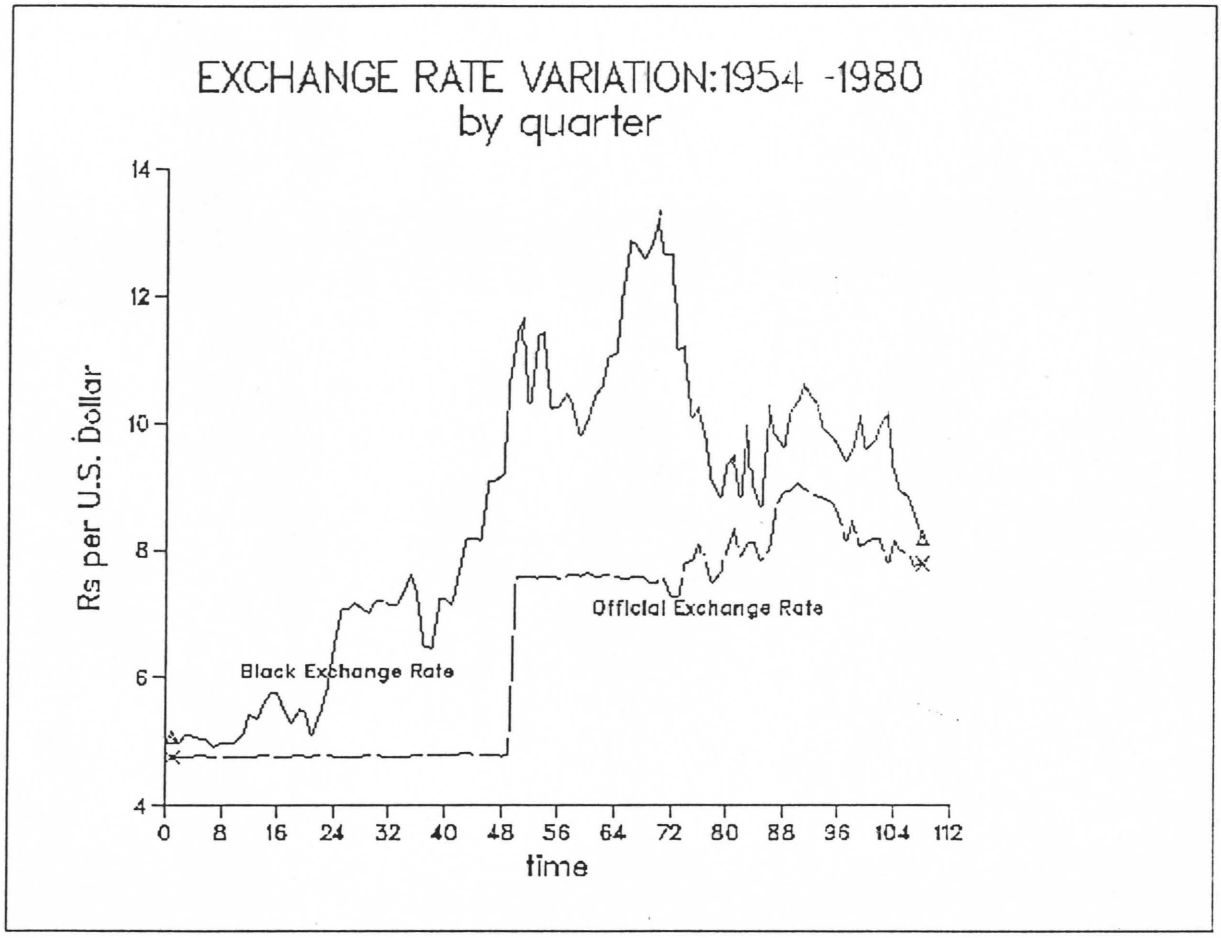

Figure 1: Exchange Rate Variation - 1954-80 (quarterly)

and

$$m_d = f(y, r\ P_e^*), \tag{3}$$

where P equals the price level, r equals the rate of interest, y equals the real permanent income, P_e^* equals the expected rate of domestic inflation, and the asterisk "*" indicates the time rate of change of the variable.

For stock equilibrium in the money market, the nominal quantity of money must be equal, ex post, to the demand for nominal cash balances. To satisfy this, the market must clear in each period and this requires the flow equilibrium, or

$$M_s^* = M_d^*, \tag{4}$$

or by substitution from equations (1) and (2), we obtain

$$k^* + (1 - r)\ R^* + rD^* = P^* + m_d^*, \tag{5}$$

where

$$r = \frac{D}{R + D}.$$

It has been established that the nominal money supply is endogenous in a small open economy under a fixed exchange rate. The central bank can only determine the ex ante quantity of money by changing the domestic credit component of the monetary base. This action and the flow demand for real balances create an ex ante excess flow supply of money. It is to that ex ante flow disequilibrium that the public reacts, and this reaction is reflected in changes in the foreign exchange reserve (R) through the balance of payment. This is long-run adjustment to restore monetary balance. In the short run, there is inflation. Therefore, the public determines the ex post nominal quantity of money.

The above discussion suggests that the operative measure of money market disequilibrium should be an ex ante measure excluding the endogenous reaction of the foreign exchange reserve. So the flow monetary disequilibrium in the model is measured as the difference between the expansion of the domestic credit component and the changes in the demand for a real cash balance.

The aggregate price level is the geometric mean of the prices of traded and nontraded goods:[2]

$$P = P_T^{\beta} P_N^{1-\beta}, \tag{6}$$

where β equals the share of traded goods in the total expenditure.

The rate of domestic inflation can be written as

$$P^* = \beta P_T^* + (1 - \beta) P_N^*. \tag{6a}$$

The price of traded goods is exogenously given and its rate of change is determined by the world rate of inflation (P_W^*) and by changes in the official exchange rate (E_o), or by

$$P_T^* = P_W^* + E_o^*. \tag{7}$$

An excess supply of money implies an excess demand for goods. We further assume that the excess demand for nontraded goods varies monotonically with excess demand throughout the economy. We now postulate the following equation for the rate of change of the prices of nontraded goods:

$$P_N^* = P_T^* + \lambda(rD^* + k^* - M_d^*), \tag{8}$$

where λ is the elasticity of the relative prices to monetary imbalance.[3]

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[2]The distinction between traded and nontraded goods follows traditional literature. See Riley (1982).

[3]Any change in the price of traded goods will affect the price of nontraded goods through elasticity of substitution in factors of production in case of production and marginal rate of substitution in consumption.

Substituting from equations (7) and (8) and then from the equation (6a), gives

$$P^* = h\,(P_w^* + E_o^*) + (1 - h)\,(rD^* + k^* - m_d^*), \tag{9}$$

where $h = \dfrac{1}{1 + \lambda\,(1 - \beta)}$.

The supply of foreign exchange in the black market varies positively with the profit possibility. The latter, again, varies directly with the differential of the official rate and the black market rate. Therefore, we postulate the following supply function of foreign exchange to the black market

$$\ln Fs = d_1 + d_2 \ln\left(\frac{E_b}{E_o}\right), \tag{10}$$

where E_b is the black market exchange rate.

The demand for foreign currency depends positively on the return derived from holding the asset and is negatively related to the return derived from holding the alternative asset. The return from holding foreign currency as an asset is a function of the expected rate of depreciation in the black market. Further, since expectations are formed in the future, people are likely to anticipate that any expected domestic inflation over world inflation will also be transmitted to the exchange rate. From this consideration, we postulate the following expression for the expected depreciation of the black market exchange rate:

$$E_b^* = (\ln P - \ln P_w - \ln E_b) + P_e^* - P_w^*. \tag{11}$$

The net return for holding a foreign asset is the foreign nominal interest rate minus the opportunity cost in the form of domestic nominal interest

rate. We assume that the nominal interest differential is denominated by the variation in the expected rate of inflation. The demand function for foreign exchange in the black market is specified as follows:[4]

$$\ln F_B^d = C_1 + C_2 (E_b^* + P_w^*) - q P_e^*. \tag{12}$$

From equations (11) and (12), we obtain

$$\ln F_B^d = C_1 + C_2 (\ln P - \ln P_w - \ln E_b + P_e^*) - q P_e^*. \tag{12a}$$

If we assume that own return elasticity is equal to alternative cost elasticity (q), then (12a) reduces to

$$\ln F_B^d = C_1 + C_2 (\ln P - \ln P_w - \ln E_b). \tag{13}$$

From equations (10) and (13) after differentiation, we obtain

$$F_B^{s*} = d_2 (E_b^* - E_o^*) \tag{14}$$

$$F_B^{d*} = C_2 (P^* - P_w^* - E_b^*). \tag{15}$$

The flow equilibrium condition in the black market require that

$$F_B^{s*} = F_B^{d*},$$

and from equations (14) and (15), we have

$$d_2 (E_b^* - E_o^*) = C_2 (P^* - P_w^* - E_b^*),$$

or

$$E_b^* = \frac{d_2}{d_2 + C_2} \cdot E_o + \frac{d_2}{d_2 + C_2} (P^* - P_w^*). \tag{16}$$

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[4]This specification assumes that no legal risk is involved in dealing in the black market since the operation of this market is tolerated by the government.

Substitution of P^* from equation (9) gives

$$E_b^* = \left(\frac{d_2 + C_2 h}{d_2 + C_2}\right) E_o^* + \frac{C_2(1 - h)}{d_2 + C_2} (rD^* + k^* - m_d^* - P_w^*). \qquad (17)$$

Equation (17) formulates the depreciation rate of the black market exchange rate as a weighted average of the devaluation rate of the official exchange rate and the flow monetary disequilibrium.

The official exchange rate is regarded by the government as a policy instrument and the change in the official rate follows some policy decision. The latter can be assumed to depend on some form of reaction function that is aimed at maximizing government utility function.[5] One specification of this reaction function may be

$$E_o^* = b\,(P^* - P_w^*), \qquad (18)$$

$$0 \leq b \leq 1.$$

When $b = 1$, there will be a free floating exchange rate conforming to the purchasing power parity doctrine. When $b = 0$, there will be a fixed exchange rate independent of monetary disequilibrium in the domestic market.

If the official exchange rate is endogenously determined by the reaction function (18), we can write equation (17) as follows:

From equation (18) and using equation (9), we obtain

$$E_o^* = \frac{b(1 - h)}{1 - bh} [rD^* + k^* - m_d^* - P_w^*]. \qquad (19)$$

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[5] If the government reacts systematically to a particular macroeconomic variable, then there are behavioral functions describing how monetary policy responds to these policy goal variable. See Henderson and Turnovsky (1972), and Ujii (1978).

Next, by substituting from equations (19) and (17), we obtain

$$E_b^* = \frac{(C_2 + bd_2)(1 - h)}{(1 - bh)(d_2 + C_2)}[rD^* + d^* - m_d^* - P_w^*],$$

or

$$E_b^* = A\,(rD^* + k^* - m_d^* - P_w^*), \tag{20}$$

where

$$A = \frac{(C_2 + bd_2)(1 - h)}{(1 - bh)(d_2 + C_2)}\,.$$

In this form, the rate of depreciation of the black market exchange rate depends on the domestic monetary disequilibrium and the world rate of inflation.

Equilibrium in this system will be achieved when the monetary authority expands the money supply in such a rate that the ex ante excess flow supply of money is equal to the world rate of inflation. This occurs when the rate of expansion of the domestic credit component exceeds the growth in the demand for real balances by the world rate of inflation. Then the domestic rate of inflation will be at par with the world rate of inflation and both the official and the black market exchange rate will remain constant.

III. Data and Empirical Result

The period of the present study is from 1954 to 1980. The quarterly data used in this study are from International Financial Statistics, published by International Monetary Fund, except the data on national income. The quarterly data of India's national income are not available. The quarterly data have been estimated following the interpolation procedure as

in Boot et al. (1967). The estimation of the model (equation 20) has been done with the following steps:

The variable m_d^* is first estimated from equation (3) by using the following linear form:

$$\ln md = a_o + a_1 \ln y + a_2 \ln P_e^* + a_3 r.$$

Two variables, permanent income (y) and expected rate of inflation (P_e^*), are not observed. They have been estimated by utilizing adaptive expectation.[6]

The empirical estimation of the model (Equation 20) has been made on the basis of quarterly data and using both definitions of money (M_1 and M_2).[7] The results are shown in Table 1 and Table 2. The explanatory variable has been lagged once and a further increase in the lag does not lead to any improvement of the results. Therefore, only one lag is used. The results in both cases (two definitions of money) support the monetarist

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[6]To estimate the expected rate of inflation, a traditional adaptive expectation hypothesis is used:

$P_{et}^* = \beta P_t^* + (1 - \beta) P_{t-1}^*$, where the rate of inflation (P_t^*) is measured by the percentage change in the consumer price index and β is a constant.

Permanent income is defined as

$$Y_t = hY_t^c + (1 - h) Y_{t-1},$$

where Y_t^c is current income and Y_t is permanent income, both at constant prices, and h is a constant. To obtain the optimum values of β and h koyok transformation is used and regression technique applied. The estimated values of β and h gives highest value of R^2. These values of and h are used to estimate both the permanent income and the expected rate of inflation.

[7]The broad definition of money M_2 consists of M_1 and quasi money. The latter includes time deposits in the commercial banks. The data are taken from International Financial Statistics.

Table 1. The black market exchange rate equation, 1954-1980: M_1 definition of money

$$E_b^* = A_0 + A_1 (rD^* + k^* - m_d - P_w^*)_t + A_2 (rD^* + d^* - m_d^* - P_w^*)_{t-1}$$

	Intercept	A_1	A_2	R^2	$\overline{R}^2$	F	D-W Statistic
1.	1.053	0.413		0.311	0.298	23.69	1.59
Standard error	(0.415)	(0.092)					
t-statistics	(2.538)	(4.505)		-			
2.	0.817	0.402	0.145	0.32	0.31	16.68	1.55
Standard error	(0.448)	(0.092)	(0.097)				
t-statistics	(1.821)*	(4.381)	(1.498)**				

*Significant at the 10 percent level.

**Not significant at the 10 percent level.

Note: Other t-statistics are significant at the 5 percent level.

Table 2. The black market exchange rate equation, 1954-1980: M_2 definition of money

$$E_b^* = A_0 + A_1 (rD^* + k^* - m_d - P_w^*)_t + A_2 (rD^* + k^* - m_d^* - P_w^*)_{t-1}$$

	Intercept	A_1	A_2	R^2	$\bar{R}^2$	F	D-W Statistic
1.	0.692	0.535		0.36	0.35	29.87	1.53
Standard error	(0.424)	(0.098)					
t-statistics	(1.634)*	(5.486)					
2.	0.498	0.538	0.103	0.37	0.35	20.09	1.56
Standard error	(0.472)	(0.098)	(0.099)				
t-statistics	(1.057)*	(5.469)	(1.04)*				

*Not significant at the 10 percent level.

Note: Other t-statistics are significant.

position, as the signs of the coefficients are positive. The positive sign of the coefficients prove the theoretical position that a positive rate of growth of excess money supply will lead to a depreciation in the black market exchange rate. Further, the coefficients are significantly different from zero and in case of one lag, the sum of the coefficients is 0.55 in case of M_1 definition and about 0.64 in the case of the M_2 definition. Increasing the lag of the explanatory variable has led to the negative sign of the coefficients and therefore not reported here.

IV. Conclusion

The main purpose of this paper is to test the monetarist proposition that a disequilibrium in the domestic money market will have a spillover effect on the exchange rate of the country. Since India is a fixed exchange rate regime, the black market exchange rate can be taken as a proxy of free exchange rate. From the result, it is obvious that the monetarist proposition holds for the case of India to a significant extent. When the official exchange rate becomes flexible, as has been the case in India since 1971, this flexibility absorbs some shock of the domestic monetary disequilibrium. The black market exchange rate is supposed to fluctuate less and the gap between the two exchange rates should be narrowed down. This has happened in India, which is evident from Figure 1. The policy prescription that emerges from this paper is that the government should be cautious enough regarding the growth of domestic credit component of the monetary base. Any lack of control on the growth of domestic credit component will result in the loss of precious foreign exchange as the increasing gap between the black market exchange rate and the official rate will induce remittances of foreign currency through the unofficial channel.

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