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AND REAL EXCHANGE RATE BEHAVIOUR:
AN ANALYSIS OF MONTHLY DATA
SINCE JANUARY 1980**

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January 1997

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Abstract

The study observes that in the 1980s, India's balance of trade deficit showed a tendency to decline in the face of a more rapid growth of exports than imports. The five year period under NEP(1991-96), however, did not accelerate the process. Rather there is some indication for its failure on the balance of trade front. Contrary to the claim made in certain pro-NEP circles, exports did not pick up, while imports accelerated. Due to its failure to control domestic inflation vis-a-vis India's trading partners, the real (effective) exchange rate of the rupee appreciated in spite of substantial depreciation of nominal (effective) exchange rate.

I

Introduction

The oil price hikes in the 1970s gave a great shock to the Indian economy. Trade deficit mounted up and crossed the \$7 billion mark by the beginning of the 1980s. But at the same time, the balance of invisible trade started showing a rising surplus and touched the record figure of \$5.5 billion (Sarkar, 1996, pp. 532-33). The growing surplus on

invisible account owed much to the growth of net private transfers, mainly remittance from the Indian workers employed in the petro-dollar rich Gulf countries. Because of the growing surplus on invisible account, India could square her balance of payments deficit and her foreign exchange (FOREX) reserve improved. In the late 1970s, proper utilisation of accumulated FOREX posed some problem for the policy makers.

It is an irony that by the end of the 1980s, a FOREX crisis started showing up its head. As argued in Sarkar (1996), the root of the crisis lies in the declining flow of petro-dollars in the 1980s and the consequent growing deficit in the balance of payments on current account in spite of a declining balance-of-trade deficit. By June 1991, India's FOREX crossed the danger mark and reached its lowest level.

In the face of this FOREX crisis, India approached IMF for help. In accordance with the standard IMF/World Bank policy packages (see Sarkar, 1991), the Indian currency, rupee, was devalued, import controls started to diminish, more and more liberal entry to foreign capital was granted and so on. Thus the Indian economy has been experiencing a new regime marked by the New Economic Policy (NEP); it is a major departure from the post-independence model of state controls and 'mixed economy'.

With this background in mind, the present study examines India's balance of trade and real exchange rate behaviour since 1980 with special reference to the NEP period that started around July 1991. Monthly data are collected in order to get sufficient observations specially for

the NEP period. In the next section, data source and methodology are described along with the findings. In Section III, summary and conclusions are presented.

II

Data Source and Methodology

Monthly data on Indian foreign trade and real exchange rates are available from Reserve Bank of India Bulletin and IMF International Financial Statistics. The period of coverage of our study is January 1980-May 1996 for which we have been able to assemble monthly data.

In order to study the trend-behaviour of all the series a log-linear trend equation has been fitted:

$$\log Y_t = a + b.t + u_t \quad (1)$$

where Y_t is the time series under study, a is the intercept, b is the slope, t is the time variable taken as natural numbers¹ 1, 2, 3, etc. and u_t is the error term.

The estimate of the parameter, b , of equation (1) gives a measure of the rate of growth in the series under study.

Initially the trend equation is fitted through the OLS (Ordinary Least Squares) technique. On the basis of OLS residuals, a 12-order Lagrange Multiplier (LM) test is conducted to ascertain the appropriate error process and the trend equation is reestimated through the Gauss-Newton Iterative technique (Pesaran et al., 1991). Only the statistically significant lags in the error process are taken into account in the final estimates of the parameters of the

trend equation.

In using monthly data, the problem of seasonality in the series may crop up. To tackle this problem, monthly seasonal dummies are added to the trend equation. This process of seasonal corrections does not alter much the estimates of the parameters. So, to save space, the estimates obtained by adding seasonal dummies to the regression are not reported.

In order to examine structural shifts in the series under the NEP regime, the period of our study is sliced into two sub-periods - pre-NEP period (January 1980-June 1991) and NEP period (July 1991-May 1996). Two separate regressions are considered - one for the pre-NEP period and the other for the NEP period, respectively:

$$\text{I. } \log Y_t = a + b.t$$

$$\text{II. } \log Y_t = a' + b'.t$$

These two regression equations are combined into a multiple regression by adding intercept and slope dummies to equation (1):

$$\log Y_t = a + b.t + (a' - a)D_t + (b' - b)D_t.t + u_t \quad (2)$$

where Y_t is the time series under study, t is the time variable, a and b are the parameters for the pre-NEP period, a' and b' are the parameters for the NEP period, D_t is the intercept dummy which assumes the value one during the NEP period and zero during the pre-NEP period and $D_t.t$ is the slope dummy which is nothing but the time variable during the NEP period and zero otherwise.

If the coefficient of, say, slope dummy, $(b' - b)$, is statistically significant and positive, it can be concluded that the regression equation for the NEP period is different from that of the pre-NEP period and that the rate of growth in the series is higher during the NEP period (as $b' > b$).

We have also examined the stationarity of all the series by using the Dicky-Fuller and Augmented Dicky-Fuller tests. It is observed that the export and import series are trend stationary. But the exchange rate series fail to satisfy the tests. However, the procedure of tackling the problem of autocorrelated residuals takes care of the problem of non-stationarity; the graph of the transformed residuals shows a clear case of stationarity in each case.

Trend Behaviour of India's Foreign Trade, 1980-1996

First consider the dollar values of India's exports (XDL). The series exhibited a trend rate of growth of 0.94 per cent per month over the period of our study, January 1980-May 1996:

$$\log XDL_t = 6.02 + 0.0094t + u_t$$

(105.55) (20.40)

where

$$u_t = 0.48u_{t-1} + 0.17u_{t-8} + \epsilon_t$$

(7.54) (2.64)

ϵ_t is the white noise error process, Adjusted R Square = 0.95, Durbin-Watson Stat. = 2.14 and $F(3,175) = 1137.7$. (t-ratios in parentheses) (3)

The trend rate of growth of the dollar values of imports (MDL) is estimated to be 0.58 per cent per month

during the same period:

$$\log \text{MDL}_t = 6.74 + 0.0058t + u_t$$

(99.75) (10.43)

where

$$u_t = 0.38u_{t-1} + 0.29u_{t-8} + \epsilon_t$$

(5.82) (4.32)

Adjusted R Square = 0.85, Durbin-Watson Stat. = 1.96
and $F(3,179) = 337.75$. (t-ratios in parentheses) (4)

In view of a lower rate of growth of imports, the percentage of dollar import bill that is paid for by export proceeds (= $\text{XDL} \times 100/\text{MDL}$), XM_t , rose at the statistically significant rate, 0.35 per cent per month:

$$\log \text{XM}_t = 3.90 + 0.0035t + u_t$$

(111.89) (11.77)

where

$$u_t = 0.39u_{t-1} + \epsilon_t$$

(5.65)

Adjusted R Square = 0.69, Durbin-Watson Stat. = 1.99
and $F(2,183) = 202.13$. (t-ratios in parentheses) (5)

There is also some evidence of decline in the deficit in India's balance of trade in dollar terms, BTDL_t . That is to say, the balance of trade series exhibited a trend-improvement at the rate of 0.21 per cent per month (in view of negative values, the log-linear trend is fitted by adding an arbitrary figure, 1200, to each value of the series so that it

becomes positive):

$$\log \text{BTDL}_t = 6.46 + 0.0021t + u_t$$

(100.44) (3.77)

where

$$u_t = 0.48u_{t-1} + \epsilon_t$$

(5.53)

Adjusted R Square = 0.23; Durbin-Watson Stat. = 2.02
and $F(2,183) = 34.54$. (t-ratios in parentheses) (6)

Changes in the Trend Behaviour of Foreign Trade under NEP, 1991-96

The question is whether there was any change in the trend behaviour of India's exports and imports under the NEP regime - whether the dollar values of India's exports and imports faced an acceleration or deceleration under a liberal regime.

Fitting Eq.(2) to the dollar values of India's exports (XDL), the following estimates are obtained:

$$\log \text{XDL}_t = 6.04 + 0.0092t - 0.48 D_t + 0.0029D_t.t + u_t$$

(90.99) (12.34) (-1.47) (1.39)

where

$$u_t = 0.46u_{t-1} + 0.17u_{t-8} + \epsilon_t$$

(7.01) (2.55)

Adjusted R Square = 0.95; Durbin-Watson Stat. = 2.12
and $F(5,173) = 683.37$. (t-ratios in parentheses) (7)

The estimates reported above show that none of the

coefficients of the dummies is statistically significant. That means the trend-growth path of the dollar values of India's exports is nothing but the continuation of that of the pre-NEP period (intercept and slope parameters of the regression of the NEP period are not different from those of the pre-NEP period). That is to say, the growth of India's exports (in dollar terms) did not accelerate during the NEP period (July 1991 - May 1996).

For the dollar value of India's imports (MDL), the following estimates are obtained by fitting equation (2):

$$\log MDL_t = 6.79 + 0.0052t - 1.12 D_t + 0.0068D_{t-1} + u_t$$

(110.69) (7.30) (-3.17) (3.05)

where

$$u_t = 0.33u_{t-1} + 0.24u_{t-8} + \epsilon_t$$

(4.91) (3.50)

Adjusted R Square = 0.85; Durbin-Watson Stat. = 1.93
and $F(5,177) = 211.77$. (t-ratios in parentheses) (8)

The coefficients of intercept and slope dummies reported above are found to be statistically significant; it indicates a structural change in the trend-growth path. Since the coefficient of slope dummy is positive, it can be concluded that the rate of growth in the dollar value of India's imports (MDL) during the NEP regime (July 1991 - May 1996) is higher than that experienced by the pre-NEP period since January 1980. In other words, India's imports (in dollar terms) showed an accelerated growth under NEP.

In an earlier study (Sarkar, 1996) covering a shorter period, January 1980 - March 1995, there was a weak

evidence of acceleration in the growth of imports. The present study finds a strong evidence of acceleration as the data for the more recent period, April 1995 - May 1996, are included. It then seems that the tendency for imports to pick up becomes clear with the full bloom of the NEP regime.

In view of an accelerated growth in the dollar values of imports, the series on export-import ratio showed some evidence of decelerated growth under NEP (the coefficient of slope dummy is negative and significant):

$$\log XM_t = 3.89 + 0.0036t + 0.60D_t - 0.0035D_{t,t} \\ (89.79) \quad (7.28) \quad (2.42) \quad (-2.31)$$

where

$$u_t = 0.32u_{t-1} - 0.13u_{t-8} + 0.13u_{t-12} + \epsilon_t \\ (4.50) \quad (-1.86) \quad (1.86)$$

Adjusted R Square = 0.68; Durbin-Watson Stat. = 1.97
and $F(6,168) = 63.47$. (t-ratios in parentheses) (9)

This deceleration in the growth of export/import ratio does not necessarily imply an accelerated growth in the balance of trade deficit. In fact, the balance of trade series (BTDL) showed no sign of structural change under NEP:

$$\log BTDL_t = 6.54 + 0.0065t + 0.92D_t - 0.0043D_{t,t} + u_t \\ (56.89) \quad (0.51) \quad (1.65) \quad (-1.21)$$

where

$$u_t = 0.33u_{t-1} + 0.16u_{t-12} + \epsilon_t \\ (4.57) \quad (2.27)$$

Adjusted R Square = 0.28; Durbin-Watson Stat. = 2.00
and $F(5,169) = 14.22$. (t-ratios in parentheses) (10)

Behaviour of Exchange Rates of Indian Rupee since 1980

During the fixed exchange rate regime of Bretton Woods, the exchange rate of the rupee was kept more or less constant. In response to a balance of trade crisis, there was a once-for-all devaluation of the rupee in June 1966. Since 1971, with the collapse of the fixed exchange rate regime of Bretton Woods, the rupee started to float along with the other major currencies. The float of the rupee was under the management of the Indian monetary authority, the Reserve Bank of India (RBI). Under the RBI-managed float, the rupee started to depreciate. The process of depreciation was slow in the 1970s; it accentuated in the 1980s. The NEP regime started in July 1991 with a big bang - the rupee was devalued twice. In the name of introducing free market exchange rate of the rupee, there was another 20 per cent devaluation in March 1993.

The question is whether the nominal exchange rate depreciation/devaluation of the rupee led to a 'real' depreciation/devaluation.

To answer this question, a number of RBI series on effective exchange rates are analysed. For construction of these series, a sample of 36 countries was chosen. These countries provided a market for three-fifths of India's exports to and imports from the rest of the world. To get the nominal effective exchange rate (NEER), the bilateral exchange rates of the rupee - the SDR-prices of currencies of India's trading partners divided by the SDR-price of the

rupee - are aggregated by using weights.

For weighting purpose, two sets of alternative weights are used. One set of weights is based on the shares of the 36 trading partners as market for India's exports. The other set is based on the shares of these countries in India's total trade (exports plus imports). Accordingly, two series of nominal effective exchange rates (NEER) are available - export-weighted NEER, XNEER and trade-weighted NEER, TNEER.

In Figure 1, these series are plotted. The two series roughly correspond with each other and show a statistically significant monthly rate of decline of 0.7 per cent:

$$\log XNEER_t = 4.98 - 0.0069 t + u_t$$

(59.80) (-10.60)

where

$$u_t = 0.95u_{t-1} + 0.13u_{t-8} - 0.13u_{t-12} + \epsilon_t$$

(34.02) (2.84) (-3.81)

Adjusted R Square = 0.99; Durbin-Watson Stat. = 1.86
and $F(4, 180) = 15497$. (t-ratios in parentheses) (11)

For calculation of real effective exchange rate, the SDR-price of currency of each of 36 major trading partners of India is deflated by its consumer price index (which reflects the price Indian exporters face in that country) and the SDR-price of the rupee is deflated by India's wholesale price index (which reflects producers' cost in India). Thus the 'real' SDR-prices of the currencies are obtained. The ratio between the 'real' SDR-price of currency of each of India's trading partners and the 'real' SDR-price of the

India's Nominal Effective Exchange Rates, January 1980 - May 1996
(1985 = 100)

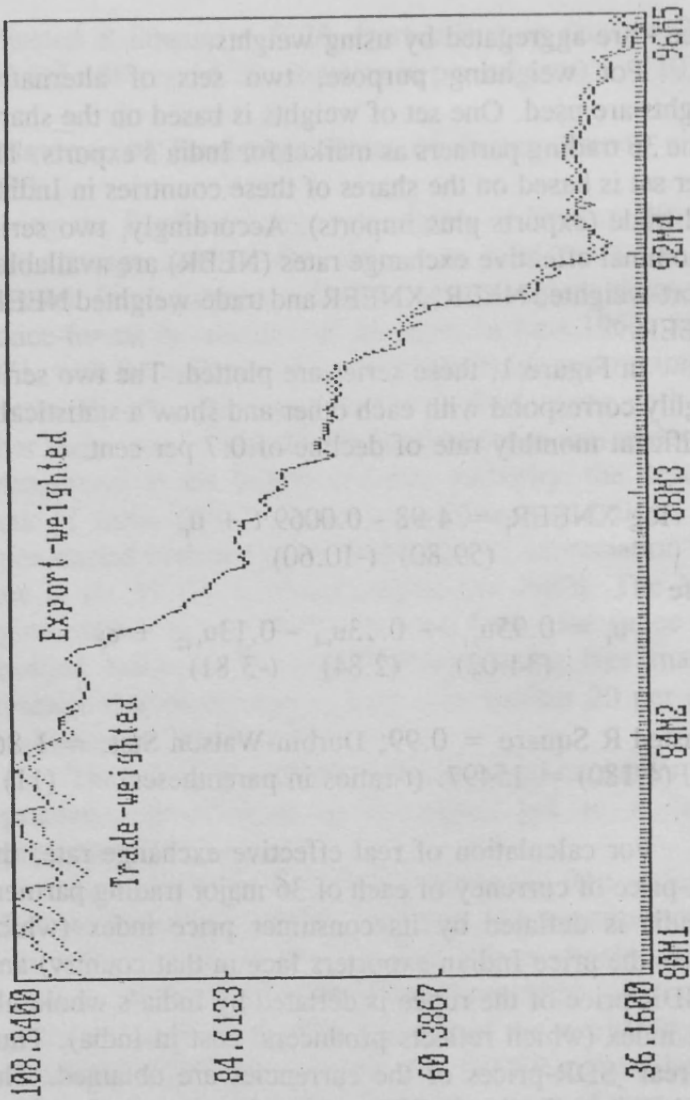


Figure 1

rupee gives the 'real' bilateral exchange rate of the rupee. The real bilateral rates are aggregated by using weights - export shares or trade shares - as was done in the case of constructing NEERs. Accordingly, two series of real effective exchange rates (REER) are available - export-weighted REER, XREER and trade-weighted REER, TREER.

In Figure 2, the two real effective exchange rate (REER) series are plotted. These two series also roughly correspond with each other and exhibit a monthly rate of decline of 0.4 per cent:

$$\log XREER_t = 4.80 - 0.0040t + u_t$$

(75.69) (-7.75)

where

$$u_t = 0.94u_{t-1} + 0.14u_{t-8} - 0.14u_{t-12} + \epsilon_t$$

(33.18) (3.54) (-4.15)

Adjusted R Square = 0.99; Durbin-Watson Stat. = 1.82
and $F(4,180) = 5627$. (t-ratios in parentheses) (12)

In view of accelerated inflation under NEP (see Sarkar, 1996), the real effective exchange rate of the rupee, XREER, changed its pre-NEP (January 1980-June 1991) course of steady depreciation in spite of substantial devaluation under NEP (July 1991-May 1996):

$$\log XREER_t = 4.80 - 0.0040t - 0.77 D_t + 0.0043D_{t,t} + u_t$$

(123.97) (-9.45) (-4.58) (3.63)

where

India's Real Effective Exchange Rates, January 1980 - May 1996
(1985 = 100)

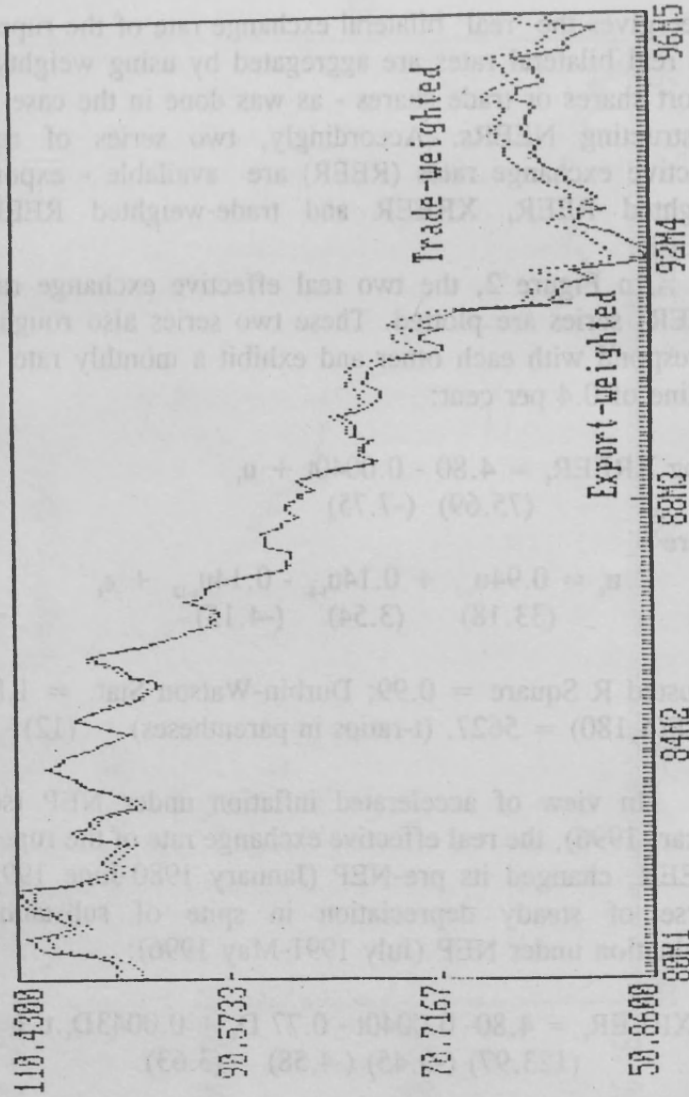


Figure 2

$$u_t = 1.12u_{t-1} - 0.21u_{t-2} + \epsilon_t$$

(15.68) (-3.08)

Adjusted R Square = 0.99; Durbin-Watson Stat. = 1.98
and $F(5,188) = 6807.3$. (t-ratios in parentheses) (13)

The nominal effective exchange rate (XNEER), however, continued to depreciate without any structural shift under NEP (July 1991- May 1996):

$$\log XNEER_t = 4.99 - 0.0064t - 0.45D_t + 0.0018D_{t,t} + u_t$$

(38.80) (-5.61) (-1.59) (0.88)

where

$$u_t = 0.99u_{t-1} - 0.23u_{t-5} + 0.18u_{t-6} + \epsilon_t$$

(26.69) (-2.64) (2.37)

Adjusted R Square = 0.99; Durbin-Watson Stat. = 1.86
and $F(6,184) = 18245$. (t-ratios in parentheses) (14)

Effects of Exchange Rate Movements on the Values of Exports and Imports

To examine the relationship between the real exchange rate series and the series of dollar values of exports and imports (Xdl and Mdl, respectively), a multiple regression equation has been fitted:

$$\log Y_t = a + b.t + c.\log XREER_t + u_t \quad (15)$$

where Y_t is either Xdl or Mdl.

In the case of dollar value of exports (XDL), the estimated

equation is:

$$\log XDL_t = 3.73 + 0.0116t + 0.46 \log XREER_t + u_t$$

(2.80) (8.16) (1.68)

where

$$u_t = 0.47u_{t-1} + 0.15u_{t-5} + 0.15u_{t-8} + \epsilon_t$$

(7.30) (2.38) (2.25)

Adjusted R Square = 0.96; Durbin-Watson Stat. = 2.13
and $F(5,173) = 659.81$. (t-ratios in parentheses) (16)

Estimates of the parameters given in Equation (16) show no statistically significant relationship between the real effective exchange rate series and the dollar values of India's exports.

The same result holds good for imports:

$$\log MDL_t = 4.94 + 0.0074t + 0.37 \log XREER_t + u_t$$

(3.39) (5.28) (1.22)

where

$$u_t = 0.40u_{t-1} + 0.30u_{t-4} + \epsilon_t$$

(6.24) (4.59)

Adjusted R Square = 0.84, Durbin-Watson Stat. = 1.96
and $F(6,178) = 659.81$. (t-ratios in parentheses) (17)

Using the nominal effective exchange rate series instead of the real one does not tell a different story. Structural shift analysis (adding intercept and slope dummies to Equation (15)) has also been undertaken to examine whether the situation changed under NEP. The conclusion

was negative for both exports and imports. This contradicts Nag et. al. 1994 (see also Sarkar, 1994).

III

Concluding Remarks

To sum up, the present study has analysed India's foreign trade data between January 1980-May 1996. The dollar value of India's exports exhibited a rapid growth since 1980, exceeding the rate of growth of the dollar value of imports. As a result, the percentage of dollar import bill paid for by export earnings registered a rising trend. The balance of trade deficit showed some tendency to decline. Real and nominal effective exchange rates of the rupee showed trends of depreciation. But the exchange rate movements had no statistically significant relationship with the dollar values of India's exports and imports.

It has also been observed that India's export performance under the NEP regime (1991-96) is nothing but the continuation of the trend of the 1980s. Trade liberalisation under NEP, however, has its effect on imports; it shows a tendency to pick up with the passage of time under NEP. As a result, the export/import ratio (the percentage of dollar import bill paid for by dollar export earnings) deviated from its trend growth path of the 1980s and showed some sign of deceleration. Although there is no evidence of structural change in the trend behaviour of India's balance of trade in the 1990s, the situation is expected to change in view of an accelerated growth in the dollar import bill.

India's exchange rate policy was also ineffective.

Although we find no evidence of statistically significant relationship between real exchange rates and the dollar values of exports or imports, nominal devaluation of the rupee was made to effect a real devaluation. But the NEP regime failed to control domestic inflation; it accelerated during the NEP regime (Sarkar, 1996). In view of rapid inflation vis-a-vis India's trading partners, a steady nominal depreciation of the rupee was more than counterbalanced. As a result, the real (effective) exchange rate deviated from its earlier course of steady depreciation and started showing a trend of appreciation during the NEP period.

Notes

1. Due to non-availability of data for some months, there are jumps in the time variable.
2. Estimates of the parameters of Equation (2) show that there was no trend growth in the balance of trade series during the pre-NEP period (January 1980 - June 1991) and there was no change in the situation during the NEP period. That means, the series exhibited trendlessness over the whole period; this contradicts our earlier findings given in (6). In view of insignificant slope and intercept dummies, estimates given in (6) are to be accepted.
3. The effective exchange rate series since March 1993 are based on Foreign Exchange Dealers' (FEDAI) indicative rates.

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