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Does Devaluation work for India?

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Abstract

Whether currency devaluation helps economic growth is an empirically open question. Despite its policy-implications, the issue has received relatively scant econometric attention. Since the results are specific to the sample, model, and techniques employed, country-specific studies have received renewed interest. Coexistence of successive currency devaluations and a booming economy makes India a unique case-study. Using latest data and the bounds-testing approach to cointegration and error-correction modeling, this paper finds that rupee's devaluation is expansionary in India.

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1. Introduction

Since the launch of economic reforms in 1991, the Indian rupee has undergone a series of devaluations and is getting weaker in recent times. Should the Reserve Bank of India (RBI) curb this decline, or let the rupee fall further? The answer depends on whether currency devaluation is expansionary in India. While there is no denying the fact that currency devaluation and growth have coexisted in India, it is not clear how the rupee's devaluation may have impacted her growth. Within the Keynesian framework, currency devaluation boosts economic growth by promoting net exports, aggregate demand, and output through the multiplier effect. However, this is only a necessary condition for devaluation to be expansionary, not a sufficient one. For example, by making imported inputs more expensive, devaluation can contract the aggregate supply curve, and cause inflation.[1] For the same reason, it can also lower investment, a key component of aggregate demand. Moreover, if it is a crisis-driven devaluation, it could damage the country's reputation and lead to a flight of capital and destabilize the economy.[2] Thus, the net effect on output is theoretically ambiguous and remains an empirically open question.

The state-contingent finding is important in view of the timing of the rupee's devaluation in 1991. The country's foreign exchange reserves had fallen to record low levels and a crisis was eminent.[3] Should the rupee have been devalued then? Or, given the unprecedented boom, *now* is a better time to devalue the rupee? In this paper, we test the contractionary devaluation hypothesis for India using the bounds-testing approach to cointegration and error-correction modeling, proposed by Pesaran, et al., 2001 – a recent technique requiring no unit-root testing and is also deemed appropriate for small samples.[4] The exchange rate sensitivity of real output, being of main interest, is studied using a reduced-form model. To complement the findings, we also check: (i) whether a nominal devaluation of the rupee leads to its real devaluation, and subsequently, (ii) if a real devaluation of the rupee improves India' trade balance. To this end, a review of the literature is provided in Section 2, followed by an outline of the models and methodology in Section 3. Empirical results are discussed in Section 4; Section 5 concludes. Data, definitions, and sources are cited in the Appendix.

2. Review of Related Literature

A country under a fixed exchange rate regime could boost her exports by devaluing her currency. Devaluation, however, makes her imports more expensive, and results in inflationary side effects. If her exports sector is heavily reliant on imported inputs, then these side effects will cause cost-push inflation in the export sector as well,

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[1] This is why IMF packages prescribing currency devaluation (expenditure-switching policies) often required tightening of fiscal and monetary policies (expenditure reducing policies).

[2] Rajan and Shen (2001) find that larger the level of short-term indebtedness, ceteris paribus, the stronger the contractionary effect of a currency devaluation.

[3] India's foreign exchange reserves had fallen to less than three weeks of import in 1990. Also easing the quantitative controls on imports (in 1991 liberalization package) implied that the trade balance had to be boosted through alternative measures such as devaluation of the rupee. Das and Pant (1997) find that rupee was actually overvalued in the 1980s, necessitating its devaluation.

[4] Since most of the older studies did not test for the staitionarity of the data, they likely suffered from the problem of spurious regressions. Moreover, recent studies that did test for stationarity employed different unit-root tests with varying explanatory power and outcomes.

and diminish the competitiveness of her exports.[5] To ensure that devaluation is not self-defeating, it is important that a nominal devaluation of the currency leads to its *real* devaluation as well. Studies such as Vaubel (1976), Bruno (1978), Donovan (1981), Morgan and Davis (1982) show that nominal devaluation leads to real devaluation at least in the short to medium term. In a study of 21 African countries, Bahmani-Oskooee and Gelan (2006) found that the short-run effects lasted into the long-run only in 3 cases, viz. Burundi, Kenya, and Seychelles. In a previous study of 19 LDCs, Bahmani-Oskooee and Miteza (2002) reported favorable long-run effects in as many as 16 cases, including India. However, the error-correction term was not only insignificant but also had the wrong sign. Previously Marwah (1970) had found that rupee's devaluation in 1966 was indeed inflationary.

By making exports cheaper and imports dearer, real devaluation helps boost the country's net exports, and therefore, aggregate demand, output, employment, and real income. However, trade balance may not improve unless the Marshall-Lerner condition (henceforth ML condition) is met.[6] Since the short-run elasticities are usually smaller than their long-run counterparts, the ML condition may not hold in the short-run.[7] There are also reasons why demand may actually contract: Devaluation typically raises profits in the export and import-competing sectors. Other sectors, particularly those relying on imported inputs suffer from declining investment. As mentioned earlier, inflation becomes a necessary by-product of devaluation that erodes the purchasing power of wage-earners who tend to have a higher marginal propensity to consume than the profit-earners.[8] If part of this increased profit accrues to the rest of the world, there is a leakage from the multiplier process. Additionally, there is an adverse real balance effect as real wealth drops (due to inflation), resulting in a further drop in spending. Moreover, if bulk of the foreign-debt is in foreign-currency (as was the case for Mexico in 1994), the country's debt-burden worsens, and drains-off resources from alternatives uses.

Devaluation can be contractionary on the supply side as well. Aggregate supply contracts because imported inputs get costlier (Krugman and Taylor, 1978; Edwards, 1986; and van Wijnbergen, 1986) following a real devaluation. Given the inflationary environment, factor prices (including wages and interest rates) rise and further reduce the aggregate supply.

Whether devaluation is contractionary or expansionary depends on the relative shifts of the aggregate demand and supply curves. Bahmani-Oskooee and Miteza (2003) review the literature along the four strands it has taken: (i) The *before-after literature* compares output growth before and after devaluation (Cooper, 1971); (ii) The *control-*

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[5] Sen and Mukhopadhyay (1994) note that in India imports mostly comprised of raw materials and intermediate inputs and therefore have a critical bearing on output growth.

[6] The net-exports improve if the sum of the export- and import-demand elasticities add up to more than one – a condition known as the Marshall-Lerner Condition.

[7] In the early 1970s, the ML condition was met, $ was devalued yet the US trade balance continued to deteriorate. Magee (1973) explained this in terms of the J-Curve effect. For more on J-Curve, see Bahmani-Oskooee and Ratha (2004).

[8] Rajan and Shen (2001) find weak support in favor of the hypothesis that a country with a lower per capita income is more likely to suffer from a contractionary devaluation. Berry (1974) find no strong evidence of economic growth aggravating income distribution. Bahmani-Oskooee (1996) tests a version of the Kuznet's hypothesis that includes an exchange rate variable in the regression and finds evidence that devaluation worsens income distribution.

group approach compares output growth in the devaluing countries with the same in a set of non-valuing countries, called the control-group (Donovan, 1981; Edwards, 1989); (iii) The *macro-simulation approach* involves theoretical models and/or simulations involving different transmission mechanisms (Krugman and Taylor, 1978; Barbone and Rivera-Batiz, 1987; Gylafson and Schmid, 1983; van Wijnbergen, 1986; Agenor, 1991; and Taye, 1999); and (iv) The *econometric approach* estimating the effects of different stabilization policies (Sheehey, 1986; Bahmani-Oskooee and Rhee, 1997).

While there is no consensus yet, there is ample evidence in favor of devaluation being (i) contractionary in Latin American countries, and (ii) expansionary in pre-1997 Asia, and (iii) contractionary in post-1997 Asia. Is it because of speculative attacks? Kim and Ying (2007) comment that with financial liberalization and improvement in information technology, devaluation may be more contractionary than before as it worsens the balance of payments of countries with heavy foreign currency liabilities. Also there is an adverse effect on the country's reputation impairing her ability to raise foreign capital. Therefore, they note, devaluation can be contractionary in post-1997 East Asia just as well as in Mexico and Chile.

India was one of the countries studied by Gylfason and Schmid (1983) and Bahmani-Oskooee (1998) but the results were neutral, meaning devaluation had no long-run implications for growth. Given that devaluation and growth have coexisted in India, at least since the 1990s, should we anticipate another round of devaluation? Using cross-section data from 23 LDCs, Agenor (1991) shows that anticipated devaluation is contractionary whereas unanticipated devaluation is expansionary. From his case study of Turkey (1960-1990), Domac (1997) finds no evidence of contractionary devaluation but confirms the expansionary effect of unanticipated devaluation. Since multi-country studies tend to overlook features specific to each country, country-specific studies have received renewed interest. The present study adds to this growing literature.[9]

3. Outline of the Models and Methodology

In the absence of money illusion, a nominal devaluation is effective only if it also leads to a real devaluation. In order to find whether the latter is true, we estimate a simple model:

$$\ln REER_t = a + b \ln NEER_t + \varepsilon_{1t} \ \dots \ (1)$$

where ln stands for natural logarithm, $REER_t$ is the real effective exchange rate, and $NEER_t$ is the nominal effective exchange rate of the rupee.

Whether a real devaluation improves the trade balance, can be tested using a version of the trade balance model proposed by Rose and Yellen (1989) and extensively used in the literature:

$$\ln TB_t = a + b \ln REER_t + c \ln Y_t + d \ln YF_t + \varepsilon_{2t} \ \dots \ (2)$$

[9] See for example, Solimano (1986) for Chile, Roca and Priale (1987) for Peru, Kamin and Rogers (1997) for Mexico, and Taye (1999) for Ethiopia find evidence of contractionary devaluation whereas Taylor and Rosenweig (1984) for Thailand, and Bahmani-Oskooee and Rhee (1997) for Korea point to the contrary. Upadhyaya (1999) finds that devaluation is contractionary in Pakistan and Thailand but has no long-run effects in India, Sri Lanka, Malaysia, and the Philippines.

where TB_t is the trade balance defined as the ratio of exports to imports, such that an increase implies an improvement of the trade balance.[10] Y_t and YF_t are indices of domestic and world income, respectively. The coefficient of REER, *b,* is of key interest here. For real depreciation of the rupee to improve Indian trade balance, it must be negative and significant.

Finally, following previous research, we estimate a reduced form model where output depends on all three stabilization policies, fiscal, monetary, and exchange rate policy; ceteris paribus[11]:

$$\ln Y_t = a + b \ln G_t + c \ln M_t + d \ln REER_t + \varepsilon_{3t} \quad \ldots(3)$$

where Y_t is the real GDP, G_t is the real government expenditure, M_t is the real M2 money supply, and $REER_t$ is the rupee's real effective exchange rate, all set in index form. While the coefficients of fiscal and monetary variables (i.e., *b* and *c*) are expected to be positive, *d* can be positive or negative, depending on whether devaluation is contractionary or expansionary.

The bounds testing approach to cointegration, proposed by Pesaran et. al. (2001), involves no unit root testing, and therefore, was chosen to detect both the long-run and the short-run dynamics. For each of the long-run equations (1) through (3) noted above, this approach specifies the following error-correction counterparts:

$$\begin{aligned}\Delta \ln REER_t = {} & a + \textstyle\sum_{i=1}^{n} b_i \Delta \ln REER_{t-i} + \sum_{i=1}^{n} c_i \Delta \ln NEER_{t-i} \\ & + \delta_1 \ln REER_{t-1} + \delta_2 \ln NEER_{t-1} + u_t \end{aligned} \quad \ldots \text{ (1a)}$$

$$\begin{aligned}\Delta \ln TB_t = {} & a + \textstyle\sum_{i=1}^{n} b_i \Delta \ln TB_{t-i} + \sum_{i=1}^{n} c_i \Delta \ln Y_{t-i} \\ & + \textstyle\sum_{i=1}^{n} d_i \Delta \ln YF_{t-i} + \sum_{i=1}^{n} f_i \Delta \ln REER_{t-i} + \delta_1 \ln TB_{t-1} \\ & + \delta_2 \ln Y_{t-1} + \delta_3 \ln Y_{t-1} + \delta_4 \ln REER_{t-1} + v_t \end{aligned} \quad \ldots \text{ (2a)}$$

$$\begin{aligned}\Delta \ln Y_t = {} & a + \textstyle\sum_{i=1}^{n} b_i \Delta \ln Y_{t-i} + \sum_{i=1}^{n} c_i \Delta \ln G_{t-i} \\ & + \textstyle\sum_{i=1}^{n} d_i \Delta \ln M_{t-i} + \sum_{i=1}^{n} f_i \Delta \ln REER_{t-i} + \delta_1 \ln Y_{t-1} \\ & + \delta_2 \ln G_{t-1} + \delta_3 \ln M_{t-1} + \delta_4 \ln REER_{t-1} + w_t \end{aligned} \quad \ldots \text{ (3a)}$$

where a linear combination of the lagged-level variables approximates the error-correction term in each case.

[10] Note that this ratio is unit free, and is the nominal as well as real trade balance. Since it cannot be negative, we can run the regressions in log form so the coefficient estimates are also elasticities of the concerned variables.

[11] See for example, Bahmani-Oskooee, et. al (2002), Bahmani-Oskooee and Miteza (2006), and Narayan and Narayan (2007).

The estimation procedure comprises of three-steps: (i) An *F-Test* where the null of no cointegration (i.e., $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$) is tested against its alternative (i.e., $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$). Pesaran, et. al. (2001), provide a method of estimating the new critical values comprising of a lower bound and an upper bound for large samples, but for small samples such as ours, Narayan (2005) provides yet another set of critical values that we use: If the calculated F-statistic falls above the upper bound, the null is rejected; if it falls below the lower bound the null cannot be rejected; if it falls in-between the results are inconclusive. Also a negative and significant error-correction term would indicate cointegration among the underlying variables. See for example, Kremers, et al. (1992); (ii) *Choice of Optimal Lag-Structure*. This is necessary as the F-test results depend on the lag-structure of the error-correction model. We accomplish this using the *Schwartz-Bayesian Criterion* (SBC);[12] (iii) The *Long-run Model* which is estimated by normalizing the coefficient of the lagged dependent variable in each case. Finally, the stability of the estimated coefficients is tested using the CUSUM and CUSUMSQ test proposed by Brown et al. (1975).

4. Empirical Results

Does a nominal devaluation result in real devaluation?

Figure 1 (lower panel) is a plot of detrended values of NEER and REER, 1970-2006.[13] While the two series tend to move together, there is a marked departure beginning around 1998, and since then, the gap has widened. While the NEER kept falling during 1998 -2004, the REER did not (or at least not as much), perhaps because of the prevailing inflation in the country. From 2004 onwards we see the rupee rising in nominal terms, and to a lesser extent, in real terms.

Equation (1) is estimated using annual data on REER and NEER over the 1973-2006 period, and the results are reported in Table 3. NEER carries a coefficient of 0.24 which is positive and highly significant. This implies that while a nominal devaluation of the rupee does lead to a real devaluation, the impact is less than proportionate - a 1% nominal devaluation results in 0.24% real devaluation.

This may have been because of inflationary pressures stemming from devaluation. A negative and significant error correction term in Table 2 further confirms that NEER and REER are cointegrated in India. Looking at the coefficient estimates of $\Delta \ln NEER_{t-i}$, one can infer that nominal devaluation has its greatest impact during the first year. This is in line with previous findings for many LDCs in the literature. Interestingly, the coefficient of the error-correction term is not only larger (and significant) than the same found by Bahmani-Oskooee and Miteza (2002), but also carries the expected negative sign. Also, the F-test results, reported in Table 1, show strong evidence of cointegration between NEER and REER of the rupee. In policy terms, it means nominal devaluation of the rupee improves the global competitiveness of Indian goods.

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[12] The Schwartz-Bayesian Criterion, being a parsimonious model, was chosen because of the small sample size – the sample comprises of 34 observations (annual data over the 1973-2006 period) on each variable.

[13] The series are all detrended using the Hodrick-Prescott Filter (HPF).

Does a real devaluation improve India's trade balance?

Trade is an important part of Indian economy, and its relative importance in total GDP continues to grow. Perhaps a direct upshot of the economic reforms launched in 1991, the share of trade in GDP rose from less than 13% in 1990 to almost 35% in 2006. Consistent with the economic theory, Figure 2 shows that REER and the trade balance in India have moved in opposite direction. Of particular interest is the lower panel in the same figure showing that the above pattern is not due to their trend growth. The F-statistic from Table 1, the sign and significance of the error correction term in Table 2, and the long-run coefficients of the trade balance equation (i.e., Model 2), all confirm that the variables TB, REER, Y, and YF are all cointegrated. The REER carries a (significant) coefficient of -1.08. This implies a real devaluation of the rupee helps improve India's trade balance in the long-run. Arora, et al. (2003) arrived at the same conclusion when they studied India's bilateral trade with Australia, Germany, Italy and Japan. In fact, the recent surplus in the current account may have been due to the past devaluations of the rupee (leading to its real depreciation as well).[14]

It may also be noted that Y carries a coefficient of -0.72, implying that the recent boom in Indian economy likely has an adverse impact on the country's trade balance. This is not surprising considering the unprecedented growth the country is going through. A boom not only enhances the country's purchasing power (and therefore increases imports), but also calls for increased imports of intermediate inputs.[15] However, the repercussion effect, viz. growth in foreign income (YF) increasing demand for Indian goods, seems to have been rather weak.

The lagged response of trade balance to changes in REER is the strongest in the second year. Since the dlREER carries a negative coefficient for both lags, we infer that there is no evidence of a J-Curve, i.e., trade balance begins to improve right after currency depreciation. If improving the trade balance is the goal, then devaluing the rupee is an effective policy option.

Is a real devaluation Expansionary in India?

We find that devaluation has been expansionary in India. The F-test confirms cointegration amongst the variables LY, LRG, LRM, and LREER, justifying their inclusion in our model. The corresponding coefficients all point in one direction - as far as growth is concerned, fiscal policy, monetary policy, and exchange rate policy can all be considered effective policy tools.

Much of the literature to-date has focused on the short-run. In a theoretical world comprising of 100% tradables and with perfectly competitive markets, nominal

[14] Using the same data set, we find the elasticity of exports and imports with respect to REER to be -1.62 and 0.35, respectively. This means Indian exports (agricultural products, engineering goods, precious stones, cotton apparel and fabrics, gems and jewelry, handicrafts, tea) are price-elastic; Indian imports are not. This is plausible considering that intermediate inputs (petroleum, machinery and transport equipment, electronic goods, edible oils, fertilizers, chemicals, gold, textiles, iron and steel) figure high in Indian imports. Moreover, with the opening up of the economy and rising incomes, there is a surge in consumerism. Imported goods, from cosmetics to luxurious cars, have made their way into the middle and upper-income households who do not seem to mind the prices too much.

[15] If the rise in income is due to increased production of import-substitutes, then the country would import less, and experience an improvement in her trade balance. This possibility is ruled out as the coefficient is negative.

devaluations will lead to proportionate increases in prices and will have no long-run impact on the real exchange rate, with no long-run impact on the output.[16] However, this is a rather stringent assumption, especially in developing countries. As shown above, nominal devaluation of the Rupee does lead to its real devaluation and therefore, has implications for the long-run.

The short-run dynamics in Table 2 are consistent with previous findings: devaluation may be contractionary in the short-run. See Kamin and Klau (1997) for example. DLREER carries a positive coefficient of 0.12. However it is insignificant. The error correction term is negative and highly significant indicating fast convergence to the long-run equilibrium. Figure 3 also confirms this pattern.

Compared to her imports, India's exports are relatively more sensitive to the rupee's external value.[17] Accordingly, currency devaluation boosts her trade balance without significantly hurting her imports, including imports of intermediate inputs.

Stability Tests

Figure 4 shows the CUSUM and CUSUMSQ statistics plotted against their break points. The coefficients are stable in almost all cases.

5. Summary and Concluding Remarks

Whether currency devaluation helps growth has intrigued economists and policy-makers alike for the past few decades. In a Keynesian economy with excess capacity, devaluation boosts net exports and through the multiplier effect, fosters the growth process. This channel, however, does not have much empirical support. We make a case study of India using latest data, technique, and a relatively uncontroversial model.

India, especially after 1991 when the reforms were launched, has seen multiple devaluations of her currency (the rupee) and has, at the same time, grown tremendously. We find that nominal devaluation of the rupee results in its real devaluation, and that a real devaluation of the rupee improves India's trade balance. The recent surplus in current account may have been due to past devaluations of the rupee. This follows from the above finding, and can potentially resolve the apparent paradox: *how come a booming economy reports a current account surplus?* We believe that the recent boom in Indian economy likely has an adverse impact on the country's trade balance, as may be expected but the successive devaluations of the rupee have helped improve her trade balance. Currency devaluation is expansionary in India, and can be an effective policy tool. This is in contrast to previous studies including Gylfason and Schmid (1983), and Bahmani-Oskooee (1998) who found no long-run impact. Although it was a crisis-induced devaluation (at least to begin with), it has been expansionary in India. This may have been because of the major reforms introduced in 1991, and a favorable productivity shock, especially in the information technology (IT) sector, amongst others.

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[16] Let E=nominal exchange rate of the rupee, say rupees per dollar, such that an increase in E implies a nominal devaluation of the rupee. The real exchange rate is defined as EP^*/P where P^* is the US price level, and P is the domestic price level. As mentioned earlier, as E rises (i.e., the rupee is devalued), P also rises. If P rises proportionately, then there will be no change in the real exchange rate.

[17] The estimates, based on the same data set and the theme of another paper, are available upon request.

Appendix

Data: Definitions, and Sources

Definitions

TB = India's trade balance, defined as her exports over imports. Thus, an increase in this ratio implies an improvement of the trade balance.

Y = Index of real GDP for India.

YF = Index of real GDP of Industrial countries together, used as a proxy for the world GDP.

NEER = Nominal effective exchange rate of the rupee. An increase in N*EER* implies a nominal appreciation of the rupee.

REER = Real effective exchange rate of the rupee. An increase in *REER* implies a real appreciation of the rupee.

G = Real Government Expenditure. Nominal expenditure is deflated by the CPI, and then converted into an index.

M = Real Money Supply. The M2 aggregate is deflated by the CPI, and then converted into an index.

All indices are computed with 2000 as the base year.

Sources

Annual data spanning over 1973-2006 are employed. Sources include:

(a) Reserve Bank of India website for data on the nominal and effective exchange rates. The indices, based on 36-country trade based weights, are available at: http://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy

(b) International Financial Statistics of IMF (CD-ROM). This is used for other data.

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Table 1: F-Test Results

Equation	*Lag-Structure Chosen by SBC*	*Calculated Value of the F-Statistic*
1a	*(5, 5)*	**32.46**
2a	*(3, 2, 5, 3)*	**11.07**
3a	*(3, 0, 2, 1)*	**8.34**

Note: *(i, j, k, l)* implies the first first-differenced variable takes *i* lags, the second *j* lags, and so on.

Table 2: Coefficient Estimates of Exchange Rate and Error Correction Term Based on Schwartz-Bayesian Criterion

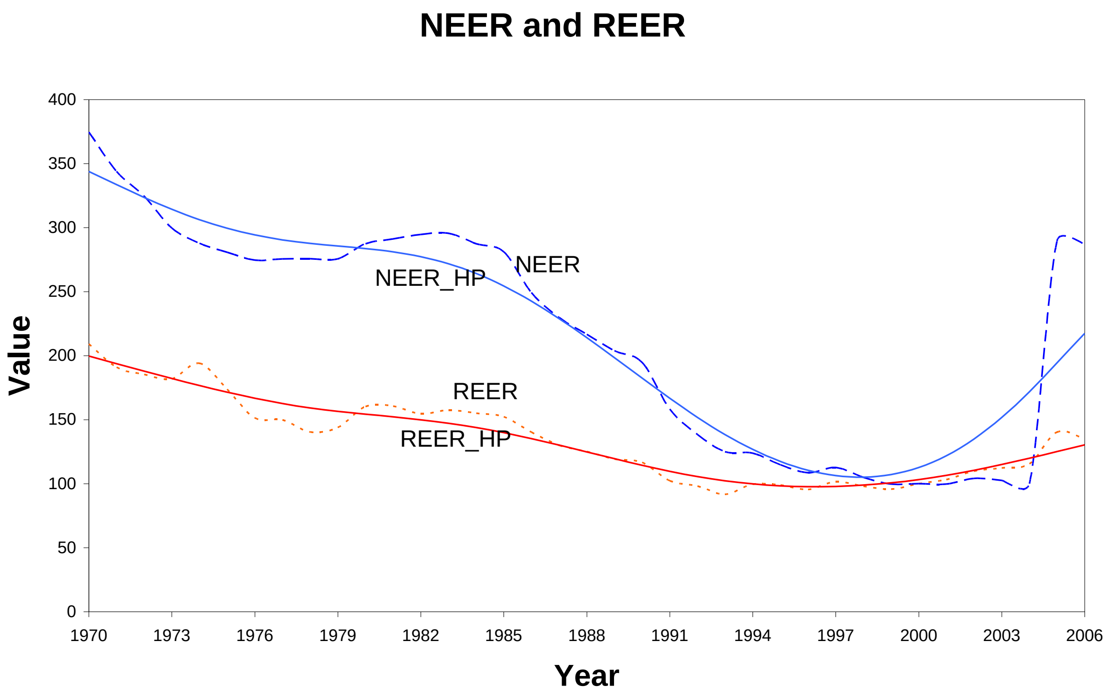
Model	*Dependent Variable*	*DLREER*	*DLREER1*	*DLNEER*	*DLNEER1*	*DLNEER2*	*DLNEER3*	*DLNEER4*	*EC(-1)*
1	*DLREER*	-	-	**0.81 (8.52)**	-0.14 (0.96)	**0.46 (3.14)**	-0.23 (1.60)	**0.46 (3.14)**	**-0.35 (4.62)**
2	*DLTB*	-0.15 (0.56)	**-0.87 (3.09)**	-	-	-	-	-	**-0.85 (5.27)**
3	*DLY*	0.12 (1.36)	-	-	-	-	-	-	**-1.06 (6.04)**

Table 3: Estimated Long Run Coefficients of the Bilateral Trade Balance Model Based on Schwartz-Bayesian Criterion

Model	*Dependent Variable*	*Constant*	*LNEER*	*LRG*	*LRM*	*LREER*	*LY*	*YF*
1	*LREER*	-	**0.24 (3.54)**	-	-	-	-	-
2	*LTB*	3.77 (1.75)	-	-	-	**-1.08 (9.68)**	**-0.72 (2.83)**	0.98 (1.43)
3	*LY*	**3.09 (9.42)**	-	**0.13 (2.28)**	**0.48 (10.10)**	**-0.28 (5.11)**	-	-

Note: *DLREER* = ln $REER_t$– ln $REER_{t-1}$, *DLREER1* = ln $REER_{t-1}$– ln $REER_{t-2}$, and so on. Figures in parentheses represent absolute values of t-statistic. Bold face denotes significance at 5% level. A dash (-) indicates the model did not include the concerned variable.

Figure 1. Nominal Effective Exchange Rate and Real Effective Exchange Rate



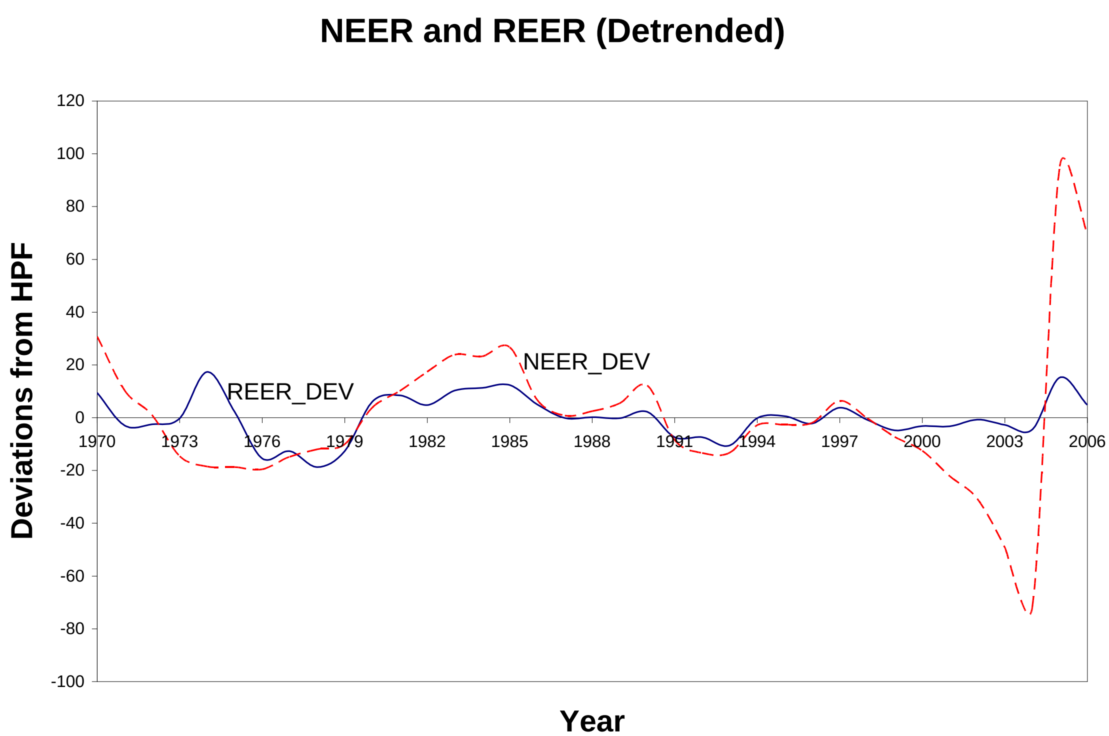


Figure 2. Real Effective Exchange Rate and Trade Balance

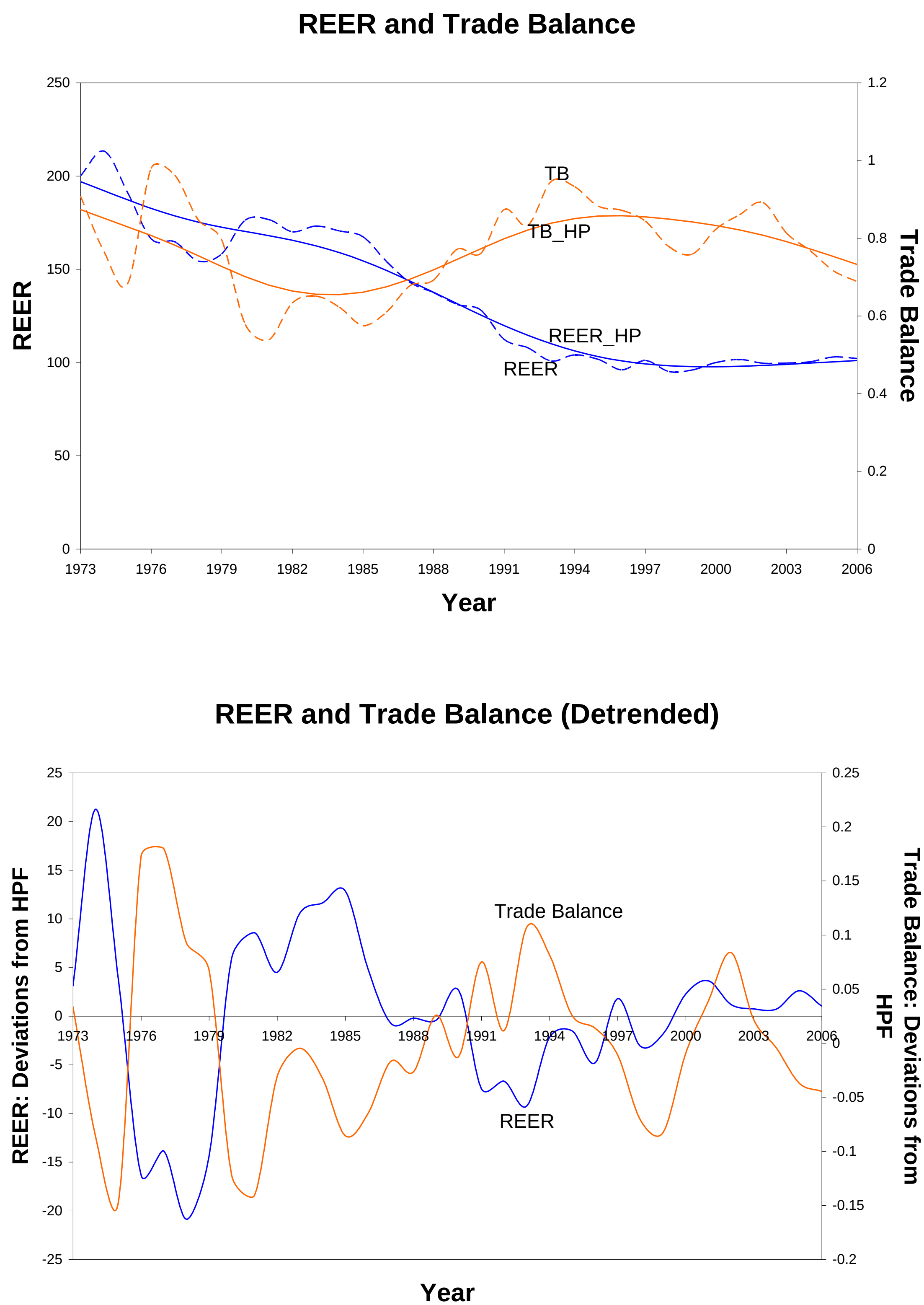
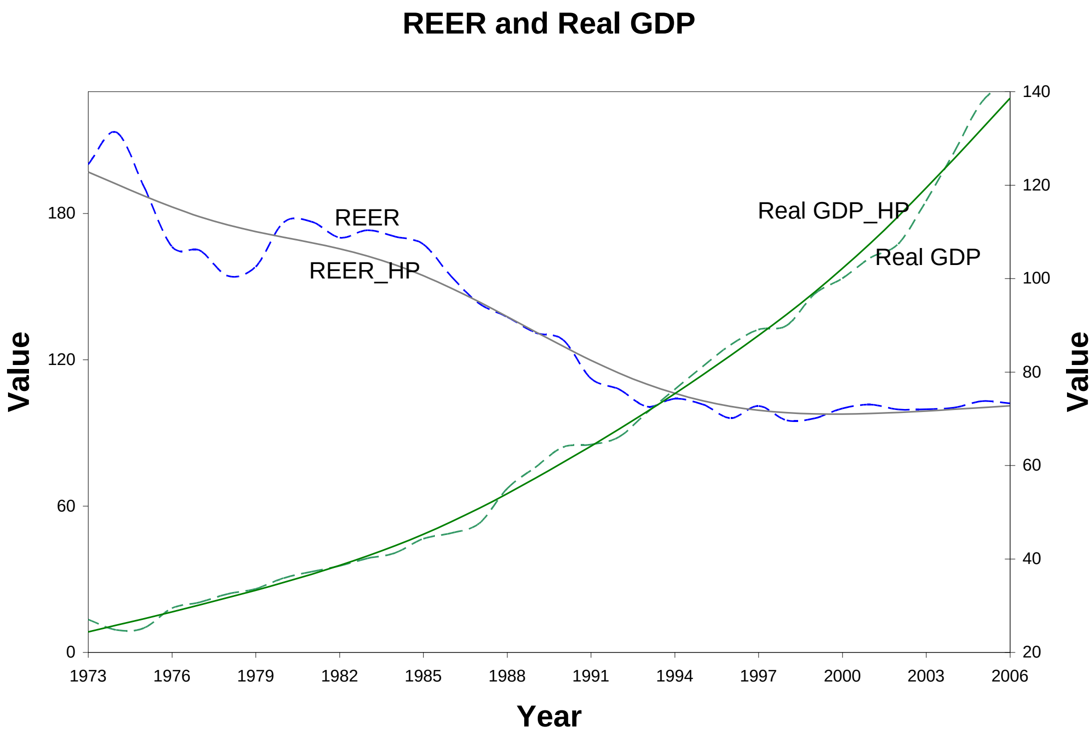


Figure 3. Real Effective Exchange Rate (REER) and Real GDP (Y)



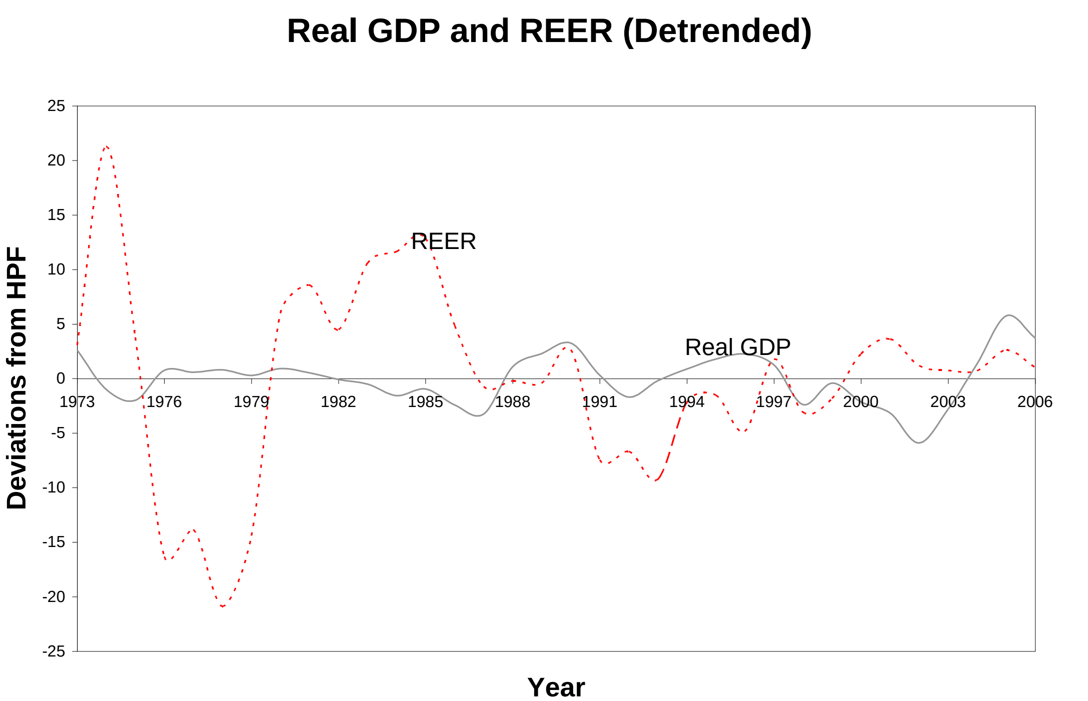
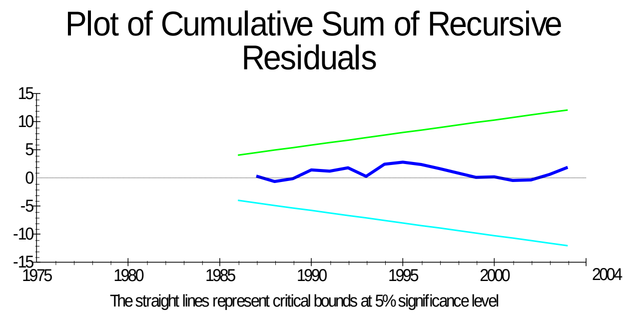
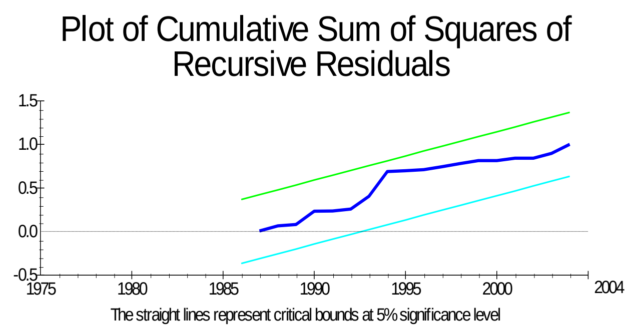


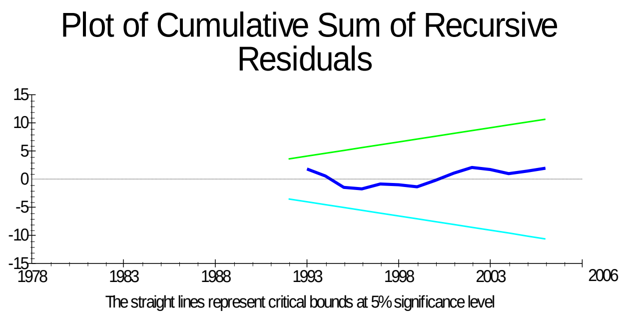
Figure 4: Stability Test Results

Model 1

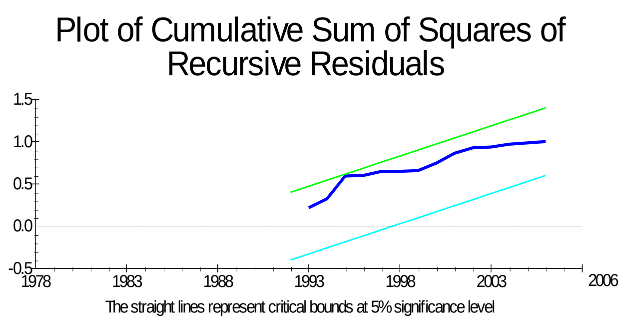




Model 2

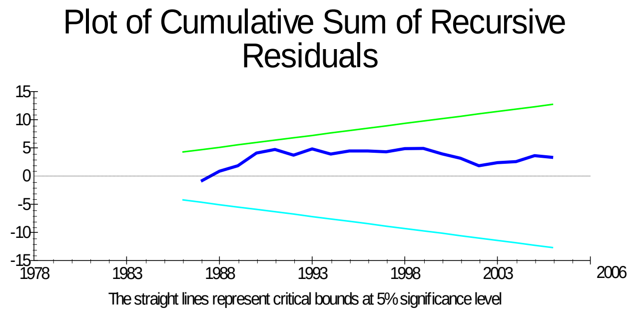


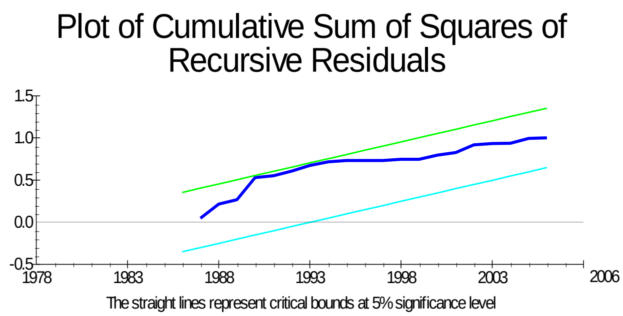
Plot of Cumulative Sum of Recursive Residuals
15
10
5
0
-5
-10
-15
1978
1983
1988
1993
1998
2003
2006
The straight lines represent critical bounds at 5% significance level



Plot of Cumulative Sum of Squares of Recursive Residuals
1.5
1.0
0.5
0.0
-0.5
1978
1983
1988
1993
1998
2003
2006
The straight lines represent critical bounds at 5% significance level

Model 3


Plot of Cumulative Sum of Recursive Residuals
15
10
5
0
-5
-10
-15
1978
1983
1988
1993
1998
2003
2006
The straight lines represent critical bounds at 5% significance level


Plot of Cumulative Sum of Squares of Recursive Residuals
1.5
1.0
0.5
0.0
-0.5
1978
1983
1988
1993
1998
2003
2006
The straight lines represent critical bounds at 5% significance level