

## St. Cloud State University theRepository at St. Cloud State

---

Economics Faculty Working Papers

Department of Economics

---

2011

# Twin Deficits or Distant Cousins? Evidence from India

Artatrana Ratha

St. Cloud State University, [aratha@stcloudstate.edu](mailto:aratha@stcloudstate.edu)

Follow this and additional works at: [https://repository.stcloudstate.edu/econ\\_wps](https://repository.stcloudstate.edu/econ_wps)

 Part of the [Economics Commons](#)

---

### Recommended Citation

Ratha, Artatrana, "Twin Deficits or Distant Cousins? Evidence from India" (2011). *Economics Faculty Working Papers*. 5.  
[https://repository.stcloudstate.edu/econ\\_wps/5](https://repository.stcloudstate.edu/econ_wps/5)

This Working Paper is brought to you for free and open access by the Department of Economics at theRepository at St. Cloud State. It has been accepted for inclusion in Economics Faculty Working Papers by an authorized administrator of theRepository at St. Cloud State. For more information, please contact [rswexelbaum@stcloudstate.edu](mailto:rswexelbaum@stcloudstate.edu).

# **Twin Deficits or Distant Cousins? Evidence from India\***

Artatrana Ratha  
Associate Professor  
Department of Economics  
St. Cloud State University  
St. Cloud, MN 56301  
[aratha@stcloudstate.edu](mailto:aratha@stcloudstate.edu)

**Abstract:** The twin-deficits theory has intrigued economists and policy-makers alike for the past few decades. In a Keynesian economy, budget deficit increases the absorption of the economy, causes import expansions, and thereby, worsens the trade deficit. It also causes domestic interest rates to rise, domestic currency to appreciate, and thereby, contributes to trade deficits. However, according to the Ricardian Equivalence Hypothesis (REH), rising budget deficits implies higher future tax-liabilities so people would save more and consume less. As a result, an inter-temporal shift between taxes and budget deficits would have no impact on the real interest, or the trade deficit. Thus, the issue of whether the twin-deficits phenomenon holds becomes more of an empirical question, and the recent fiscal expansions to curb recession makes it timely to revisit the phenomenon, especially for the developing countries confronting both the deficits on a chronic basis. To this end, we make a case study of India, using the bounds-testing approach to cointegration and error-correction modeling on monthly and quarterly data over 1998-2009. Our results suggest that the twin-deficits theory holds for India in the short-run (validating the Keynesian channel) but not in the long run (validating the REH).

**Key Word:** Bounds-Testing, Budget Deficit, Fiscal Stimulus, India, Trade Deficit, Twin Deficits

**JEL Classification:** F 32, H 62

---

\* The title of the paper was inspired by Enders and Lee (1990). The author thankfully acknowledges valuable comments from an anonymous referee. The usual disclaimer applies.

# **Twin Deficits or Distant Cousins? Evidence from India**

## **I. Introduction**

Fiscal stimulus is a buzz word today. In trying to catapult their flailing economies, Governments world over have resorted to fiscal stimuli and embraced escalations in budget deficits. Despite the slowdown in economy activity, current account deficits have not subsided either, especially in India, where inflation has accelerated to 10.7% and the Government is under pressure to rein in the budget deficit from a 16-year high of 6.8% to a more reasonable level.<sup>1</sup> Moreover, will a reduction in budget deficit help improve her trade deficit which has been trending up since the mid-90s? While a growing trade deficit may not necessarily be a cause of concern for a growing economy, trade deficit coupled with increasing budget deficit and the resultant inflation could lower the country's sovereign ratings and trigger a capital flight, reminiscent of the Asian crisis, or the recent chaos in the euro-area. Deficit reductions, while difficult, need to be the guiding principle in the forthcoming budget.

Interestingly budget deficit and trade deficit, commonly known as the twin-deficits, tend to go hand in hand, and, if they indeed do, establishing their causality will go a long way in formulating public policy. Accordingly, a vast body of literature has come up trying to establish the nexus between the two deficits. In terms of theory, the literature has evolved along two broad strands, viz. the *conventional* (or Keynesian) approach and the *neoclassical* (or Ricardian) approach: the conventional approach establishes a link between budget deficit and trade deficit; the neoclassical approach finds no such relationships. Given this theoretical ambiguity and its policy-implications, it is no surprise that the empirical literature examining the twin-deficits phenomenon is quite rich.

For example, the Keynesian absorption theory asserts that budget deficits increase domestic absorption which leads to import expansion and worsens the trade deficit. Also budget deficits imply greater spending on domestic as well as foreign goods, the former pushing the exports down and the latter pulling the imports up, especially in an economy with supply bottlenecks. In a Mundell-Fleming model, budget deficits cause interest rates to rise (Cebula, 1988, 2003; Cebula and Rhodd, 1993; Modeste, 2000), surge in capital inflows, and currency appreciation (Feldstein, 1986; Rosensweig and Tallman, 1993). Currency appreciation implies imports get cheaper and exports dearer so trade deficit deteriorates (Bahmani-Oskooee and Ratha, 2004; Bundt and Solocha, 1988; Piersanti, 2000). However, according to the Ricardian Equivalence Hypothesis (REH), foreseeing higher tax-liabilities (due to current fiscal expansions), people would save more and consume less. As a result, an intertemporal shift between taxes and budget deficits would have no impact on the real interest, or the trade deficit (Barro, 1974; Enders and Lee, 1990; Evans, 1988). Thus, if REH holds for a country, the explanation for a persistent trade deficit must be found somewhere else such as international competitiveness, capital mobility, etc. (Ahmed and Ansari, 1994). However, if it does not, i.e. the twin-deficits phenomenon holds, then taming one deficit (depending on causality) will also tame the other! While the results are mixed, it appears that the twin-deficits hypothesis generally holds for the developed countries: budget deficits tend to worsen to trade deficits. See for example, Bernheim (1988), Rosensweig and Tallman (1993), and for a recent literature survey, Saleh and Harvie (2005).

For developing countries, however, the literature is rather sparse and the results mixed (Kouassi, *et. al*, 2004). Some recent studies supporting the Keynesian channel (i.e., budget deficit causing trade deficit) include Somadi (2006) for Egypt, Kulkarni and Ericsson (2001) for

India, Saleh and Nair (2006) for Philippines, Saleh, *et al* (2005) for Sri Lanka, Akbostanci and Tunc (2006) for Turkey, although the models, methodology, and the sample period, vary quite a bit.<sup>2</sup> This paper contributes to this literature by reexamining the twin-deficits theory for India, especially during the post-reforms era. Interestingly, almost all of the India-specific studies that we came across are based on data from the pre-liberalization era.<sup>3</sup> Ghatak and Ghatak (1996), for example, employed multi-cointegration analysis on data over 1950-1986 and found no evidence in favor of the REH, i.e., it is possible that the India's budget and trade deficits could be related. Indeed, using data over the 1965-1993 time-periods, Anurao and Ramchander (1997, 1998) found that trade deficit Granger causes budget deficit in India. Kulkarni and Ericsson (2001), on the other hand, employed data over comparable time-period (*viz.* 1969-1996) but found the contrary, i.e., budget deficit Granger causes trade deficit in India. Another study we came across was by Kouassi, *et al* (2004) who found no casual relationship between the two on Indian data over the 1975-97 time-period and suggested including additional macro-variables in the model. Accordingly, in this paper, we employ a model involving more macro-variables, *viz.* domestic and foreign incomes, real effective exchange rate, besides the two deficits. Moreover, we improve on the previous approaches on three fronts: (i) we define the variables in non-negative, real, and unit-free terms such that biases stemming from using different units are reduced and also the model can be estimated in log form;<sup>4</sup> (ii) we employ the bounds-testing approach, proposed by Pesaran, *et al* (2001) – a relatively recent cointegration technique requiring no pre-unit testing and is also deemed appropriate for small samples; and (iii) our sample comprises of recent high frequency data, *viz.* monthly as well as quarterly data over 1998-2009 – a period reflecting an advanced stage of economic reforms in India. The rest of the paper is organized as follows: Section II provides an outline of the model and methodology, Section III discusses the

empirical results, and Section IV concludes. Data, definitions, and sources are cited in an appendix.

## II. Outline of the Model and Methodology

The national income identity for an open economy is:

$$\text{Total income} = \text{Total expenditure},$$

$$\text{i.e., } C+S+T = C+I+G+(X-M) \dots (1)$$

where  $C$ =consumption,  $S$ =savings,  $T$ =taxes,  $I$ =investment,  $G$ =government expenditure,  $X$ =exports, and  $M$ =imports. Rearranging terms yields:

$$(M-X)=(I-S) + (G-T),$$

$$\text{i.e., } \frac{M}{X} = \left[ 1 + \frac{I-S-T}{X} \right] + \frac{T}{X} \cdot \frac{G}{T} \dots (2)$$

Equations (2) holds by definition. While it establishes a direct link between the budget and current account deficits, it does not necessarily imply that they are twins, unless  $S$  and  $I$  are strongly correlated. However, it provides the basis for a reduced form model such as:

$$\ln TB_t = \alpha + \beta \ln BD_t + \varepsilon_t \dots (3)$$

which, in line with previous literature, is further augmented to include domestic and foreign incomes, real effective exchange rate ( $Y$ ,  $YF$ ,  $RER$ , respectively)<sup>1</sup>:

$$\ln TB_t = a + b \ln Y_t + c \ln YF_t + d \ln RER_t + f \ln BD_t + \varepsilon_t \dots (4)$$

where the variables  $TB_t$  is trade deficit defined as the ratio of imports to exports such that an increase implies a deterioration of the trade balance;  $Y_t$  and  $YF_t$  are domestic and foreign incomes respectively;  $RER_t$  is the real effective exchange rate such that an increase implies an appreciation of domestic currency;  $BD_t$  is budget deficit measured by the ratio of expenditures to receipts ratio of the government so that an increase implies an escalation of budget deficit. All

---

<sup>1</sup> See for example Rose and Yellen (1989), Bahmani-Oskooee (2007).

variables are real. In fact, defining the trade deficit and the budget deficit in ratio-form is helpful on two grounds: (i) there is no need to find a suitable price-index to deflate the nominal variables to arrive at their real counterparts as the ratio is already *real*, and (ii) since they are necessarily non-negative, they allow running the model in log form such that the coefficients are actually the *elasticities* of trade deficit with respect to the corresponding variables (Rose and Yellen, 1989).

The coefficients of the model are theoretically ambiguous, however. While presence of income effects would imply positive coefficients for the income variables (i.e.  $Y_t$  and  $YF_t$ ), it is possible that the increase in the latter stems mostly from expansion of import competing industries in which case they can take on negative coefficients. Likewise, unless the sum of exports and imports demand elasticities add up to more than one, currency depreciation may or may not boost the trade balance so  $d$  the coefficient of  $RER_t$  can be positive as well as negative.<sup>5</sup> The same is true of  $f$ , the coefficient of budget deficit: if the Keynesian channel is dominant, it will be positive; otherwise it would be negative and/or insignificant. Thus, the signs of the coefficients are best determined empirically. Given the coexistence of high unemployment and wage-price rigidities and the consequent adjustment lags, however, it appears that the Keynesian model better characterizes the Indian economy.

The sample is comprised of monthly data over the past 11 years (viz. 1998:M1-2009:M3; 1998:Q1-2009:Q1), partly dictated by availability of data but deemed appropriate as: (i) the period also reflects an advanced stage of the economic reforms that India launched in 1991, and also (ii) the deficits seem to be escalating during this period. In the absence of monthly GDP data for India, industrial production index is used as proxy. For an investigation of the twin-deficits theory, cointegration and error correction modeling seems quite appropriate as the

technique helps decipher both the long run as well as the short-run dynamics. To avoid spurious relations problem, it is necessary to pre-test the stationarity of the variables although tests tend to lack robustness. Since the bounds-testing approach,<sup>6</sup> proposed by Pesaran, *et al* (2001), requires no pre unit-root testing and is also deemed appropriate for small sample sizes (Narayan, 2005), we employ the technique to estimate equation (4). The error-correction mechanism for the long-run equation (4) is specified as:

$$\begin{aligned} \Delta \ln TB_t = & a + \sum_{i=1}^m b_i \Delta \ln TB_{t-i} + \sum_{i=1}^n c_i \Delta \ln Y_{t-i} + \sum_{i=1}^p d_i \Delta \ln YF_{t-i} \\ & + \sum_{i=1}^q f_i \Delta \ln RER_{t-i} + \sum_{i=1}^r b_i \Delta \ln BD_{t-i} + \delta_1 \ln TB_{t-1} \quad \dots \quad (5) \\ & + \delta_2 \ln Y_{t-1} + \delta_3 \ln YF_{t-1} + \delta_4 \ln RER_{t-1} + \delta_5 BD_{t-1} + v_t \end{aligned}$$

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

The estimation procedure consists of three-steps:

- (i) An *F-Test* where the null of no cointegration (i.e.,  $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ ) is tested against its alternative (i.e.,  $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$ ). Pesaran, Shin, and Smith (2001) provide a method of estimating the new critical values comprising of a lower bound and an upper bound for large samples: If the calculated F-statistic falls above the upper bound, the null hypothesis is rejected; if it falls below the lower bound the null hypothesis cannot be rejected; if it falls in-between the results are inconclusive. Finally, a negative and significant error-correction term would indicate cointegration among the underlying variables. See for example, Kremers, *et. al* (1992).
- (ii) A *Choice of Optimal Lag-Structure* is necessary because the F-test results are sensitive to the lag-structure of the error-correction model. The *Schwartz-Bayesian Criterion* (SBC) as well as the *Akaike Information Criterion* (AIC) are used to determine the optimal lag structure.



(iii) The *Long-run Model* is estimated by normalizing the coefficients of the lagged dependent variables in (5).

Finally, stability of the estimated coefficients is examined using the CUSUM and CUSUMSQ test proposed by Brown, Durbin and Evans (1975).

### **III. Empirical Results**

A glance at Figure 1(a) suggests that India's budget deficit and trade deficit, both expressed as a % of her GDP, have opposing trends, indicating no long run comovement between the two. More precisely, budget deficits have been trending down since the early 90s and trade deficits trending up since the mid-90s. However, both have their own short run spikes, and are particularly surging up the past couple of years. Figure 1(b) presents the detrended values of the deficits. Interestingly, it appears that the detrended values comoved during the 1980s but have been countering each other since the early 1990s. Overall, they exhibit a meager correlation of 0.13. However, this is only a preliminary observation calling for a more robust investigation of the twin-deficits phenomenon. Accordingly, we proceed to estimate equation (2) by imposing a maximum of 18 lags in case of monthly data and 4 lags in case of quarterly data (the maximum that the data permitted) but the optimal lag-structure(s) are determined using the SBC as well as the AIC. The F-statistics corresponding to the optimum lag-structures are reported in Table 1, panels A and B.

*[Figure 1(a) and 1(b) go about here]*

*[Table 1 goes about here]*

Given the lower and upper bounds of 2.645 and 4.805 (at 5% levels), respectively, the null hypothesis of non-cointegration may be rejected for the SBC model but cannot be rejected for the AIC model. However, according to Kremers, *et. al* (1992), if the lagged-error correction term

carries a significant, negative coefficient - as is the case here in Table 2 under both SBC and AIC - there exists a long run relation among the variables. In fact the size of the coefficients indicates relatively fast convergence to the long-run equilibrium in each case. Table 2 also contains the coefficients of  $\Delta \ln BD_{t-i}$ , the variable of interest.<sup>7</sup> In case of monthly data (Panel A), it appears that budget deficits have no short run impact on trade deficit in the SBC model. However, the AIC model points to the contrary: budget deficits contribute to the trade deficits in the short-run! In case of quarterly data (Panel B),  $\Delta \ln BD_t$  is significant at the 10% level under both SBC and AIC.<sup>8</sup> These findings may suggest prevalence of the Keynesian channel in the short-run.

*[Table 2 goes about here]*

Table 3 summarizes the long run relations. As may be noted, except for domestic income, all of the variables are insignificant under both SBC and AIC, regardless of the frequency of data. Of particular interest is the budget deficit carrying an *insignificant* coefficient in both cases, providing evidence in favor of the REH in the long run. These findings are consistent with those of Kouassi, *et al* (2004) for India.

*[Table 2 goes about here]*

Thus, it appears that the Keynesian channels explain the Indian data in the short-run but fall through in the long run. This finding is consistent with those of Bachman (1992) for US (1974-1988) and Kearney and Monadjemi (1990) for Australia, UK, Canada, France, Germany, Ireland, Italy and the US (1972-1987).

How stable are our estimates? For this, CUSUM and CUSUMSQ statistics are plotted against their break points in Figure 2 for the SBC model, and Figure 3 for the AIC model.

Interestingly, the coefficients estimates are stable in most cases, except for some instability under CUSUMSQ in case of monthly data (Panel A in Figures 2 and 3).

*[Figures 2 and 3 go about here]*

#### **IV. Summary and Concluding Remarks**

The twin-deficits theory has intrigued economists and policy-makers alike for the past few decades. In a Keynesian economy, budget deficit increases the absorption of the economy, causes import expansions, and thereby, worsens the trade deficit. It also causes domestic interest rates to rise, domestic currency to appreciate, and thereby, contributes to trade deficits. Using monthly and quarterly data over 1998-2009 and the bounds testing approach to cointegration, we find evidence that the twin-deficits theory holds for India in the short-run. Thus, by exercising fiscal restraint, the Government of India should be able to rein in on the country's trade deficit in the short run. In the long run, fiscal discipline as such a policy tool loses its significance. The latter finding is supportive of the Ricardian Equivalence Hypothesis (REH) that negates any relationship between two deficits. Therefore, apart from the foregoing policy-implication, this finding may help reconcile the two dominant views in the literature: the Keynesian views prevail in the short run, and the neo-classical in the long run.

However, how long is the long run? Also, going by Keynes' famous quote 'in the long run we all are dead!', it only seems prudent to reduce the budget deficit, although it is easier said than done. More so for a for a developing country like India whose growth trajectory calls for ever increasing spending on power generation, infrastructure building (see, for example, Mallick, 2001) , not to mention the anti-poverty measures including provision of basic necessities to a booming population. Thus, of necessity, fiscal discipline has to come mostly from the revenue side where there is room for growth: tax-reforms targeted at broadening the tax-base (by taxing

hitherto untaxed or under-taxed sectors including the parallel economy), cutting tax-loopholes, and minimizing tax-evasion. It appears that mitigating corruption will go a long way in boosting the tax revenue as well as achieving both internal and external balance.

## References

- Ahmed, S. M. and Ansari, M. I., 1994. A Tale of Two Deficits: An Empirical Investigation for Canada. *The International Trade Journal*, VIII, No. 4, Winter, 483-503.
- Akbostanci, E. and Tunc, G. I, 2002. Turkish Twin Deficits: An Error Correction Model of Trade Balance, *ERC Working Papers in Economics*, 01/06.
- Anuruo, E. and Ramchander, S. 1997. Current Account and Fiscal Deficits: Evidence from India, *Indian Economic Journal*, 45(3), 66-80.
- Anuruo, E. and Ramchander, S. 1998. Current Account and Fiscal Deficits: Evidence from Five Developing Economies of Asia, *Journal of Asian Economics*, 9(3), 487-501.
- Akbostanci, E. and Tunc, G. I, 2002. Turkish Twin Deficits: An Error Correction Model of Trade Balance, *ERC Working Papers in Economics*, 01/06.
- Bahmani-Oskooee, M. 2007. Do budget deficits contribute to trade deficits in Spain?, *Informacion Comercial Espanola. Revista de Economia*, 835, March-April, 7-23.
- Bahmani-Oskooee, M., and Ratha, A. 2004. The J-Curve: A Literature Review, *Applied Economics*, 36, 1377-1398.
- Barro, R. J. , 1974. Are government bonds net wealth?, *Journal of Political Economy*, 82, 1095–1117.
- Brown, R.L., Durbin, J., Evans, J.M., 1975. Techniques for Testing the Constancy of Regression Relationships over Time, *Journal of the Royal Statistical Society, Series B* 37, 149–192.
- Bachman, D., 1992. Why is the US Current Account Deficit so Large? *Southern Economic Journal*, 59, 232-240.
- Bernheim, D. B. 1988. Budget Deficits and the Balance of Trade, *Tax Policy and the Economy*, Cambridge: MIT Press, 1-31.
- Bundt, T. and Soloch, A., 1988. Debt, Deficits, and Dollar, *Journal of Policy Modelling*, 10(4), 581-600.
- Cebula, R. 1988. Federal Government Deficits and interests in the US: A Brief Note. *Southern Economic Journal*, 55(1), 206-210
- Cebula, R. 1988. and Rhodd, R. (1993). A Note on Budget Deficits, Debt Service Payments, and Interest Rates, *The Quarterly Review of Economics and Finance*, 33, 439-445.
- Cebula, R. 2003. Budget Deficits and Interest Rates in Germany, *International Advances in Economic Research*, 9(1), 64-68.

- Enders, W. and Lee, B. S., 1990. Current Account and Budget Deficits: Twins or Distant Cousins? *The Review of Economics and Statistics*, 72, 373-381.
- Evans, P., 1988. Are Consumers Ricardian? Evidence from United States. *Journal of Political Economy*, 96, 983-1004.
- Fedstein, M. 1986. The Budget Deficit and the Dollar, NBER Macroeconomics Annual, edited by Stanley Fischer, Cambridge, MIT Press, 355-92.
- Ghatak, A., and Ghatak, S., 1996. Budgetary deficits and Ricardian equivalence: The case of India, 1950-1986, *Journal of Public Economics*, 60 (2): 267-282.
- Kearney, C. and Monadjemi, M., 1990. Fiscal and Current Account Performance: International Evidence on Twin Deficits, *Journal of Macroeconomics*, 12, 197-220.
- Kouassi, E., Mougoué, M. and Kymn, K.O., 2004. Causality tests of the relationship between the twin deficits, *Empirical Economics*, 29 (3): 503-525
- Kremers, J. J. M., Ericsson, N. R., and Dolado, J. J. 1992. The Power of Cointegration Tests, *Oxford Bulletin of Economics and Statistics*, 54, 325-348.
- Kulkarni, K. G. and Erickson, E. L., 2001. Twin Deficit Revisited: Evidence from India, Pakistan, and Mexico, *The Journal of Applied Business Research*, 17 (2), 97-103.
- Mallick, S. K., 2001. Dynamics of Macroeconomic Adjustment with Growth: Some Simulation Results, *International Economic Journal*, 15(1), Spring, 115-139.
- Modeste, N. C., 2000. The Impact of Budget Deficits on Long-Term Interest Rate in Jamaica, 1964-1996: An Application of the Error Correction Methodology, *International Review of Economics and Business*, 47(4), 667-678.
- Narayan, P. K., 2005. The Saving and Investment Nexus for China: Evidence from Cointegration Tests, *Applied Economics*, 37, 1979-90.
- Pesaran, M. H, Shin, Y, and Smith, R. J. 2001. Bounds Testing Approaches to the Analysis of Level Relationships, *Journal of Applied Econometrics*, 16, 289-326.
- Piersanti, G., 2000. Current Account Dynamics and Expected Future Budget Deficits: Some International Evidence, *Journal of International Money and Finance*, 19(2), 2555-2571.
- Rose, A. K.. and Yellen, J. L. 1989, 'Is there a J-Curve?' *Journal of Monetary Economics*, 24, July, 53-68.
- Rosensweig, J. A. and Tallman, E. W. 1993. Fiscal Policy and Trade Adjustment: Are the Deficits Really Twins?, *Economic Inquiry*, XXXI, October, 580-594.

- Samadi, A. H. 2006. The Twin Deficits Phenomenon in some MENA Countries, *Iranian Economic Review*, 10(16), Spring, 129-139.
- Saleh, A. S., Nair, M., and Agalewatte, T., 2005. The Twin Deficits Problem in Sri Lanka: An Econometric Analysis, *South Asia Economic Journal*, 2(6), 221-239.
- Saleh, A. S. and Harvie, C., 2005. The Budget Deficit and Economic Performance: A Survey, *The Singapore Economic Review*, 50(2), 211-243.
- Saleh, A. S. and Nair, M., 2006. The Twin deficits Phenomena in Philippines: An Empirical Investigation, *International Journal of Economic Research*, 3(2), 165-179.

## Appendix I

### *Data, Definitions, and Sources*

Monthly data over 1998:1-2009:9 and quarterly data over 1998Q1-2009Q1 are collected from various sources:

*TB* = India's trade balance, defined as imports over exports of goods and services; an increase in *TB* implies a deterioration of her trade balance. Exports and imports data are collected from the International Financial Statistics of the IMF.

*Y* = GDP index (volume). In the absence of monthly data on GDP, India's industrial production index was used as a proxy for her real GDP; Collected from the International Financial Statistics of the IMF.

*YF* = Industrial production index of the advanced economies, used as a proxy for the real income of the rest of the world; Collected from the International Financial Statistics of the IMF.

*RER* = Real effective exchange rate of the Indian National Rupee, collected from the Bank of International Settlement website.

*BD* = India's budget deficit, defined as total government expenditures over total receipts such that an increase implies an increase in budget deficit. Expenditures and receipts data are from the CGA of India website (Controller General of Accounts, Department of Expenditure, Ministry of Finance, Government of India). Quarterly data were based on monthly data from the above source.



### Table 1. Cointegration Test Results

#### Panel A: Monthly Data (January, 1998 – September, 2009)

<i>Criterion</i>	<i>Lag-Structure</i>	<i>Calculated Value of the F-Statistic</i>
<i>Schwartz Bayesian Criterion (SBC)</i>	<i>(1, 1, 3, 0, 0)</i>	7.92*
<i>Akaike Information Criterion (AIC)</i>	<i>(18, 17, 15, 1, 16)</i>	2.19

Notes: For the lag-structure  $(i, j, k, l, m)$  implies  $i$  lags for the first variable,  $j$  lags for the second, and so on; an \* denotes significance at 5% levels; the corresponding critical value is 3.805.

#### Panel B: Quarterly Data (1998Q1-2009Q1)

<i>Criterion</i>	<i>Lag-Structure</i>	<i>Calculated Value of the F-Statistic</i>
<i>Schwartz Bayesian Criterion (SBC)</i>	<i>(4, 0, 3, 1, 1)</i>	4.13*
<i>Akaike Information Criterion (AIC)</i>	<i>(4, 3, 3, 3, 1)</i>	2.46

Notes: For the lag-structure  $(i, j, k, l, m)$  implies  $i$  lags for the first variable,  $j$  lags for the second, and so on; an \* denotes significance at 5% levels; the corresponding critical value is 4.123.

**Table 2. Short Run Model**

Panel A: Monthly Data (January, 1998 – September, 2009)

<i>Dependent Variable is <math>\Delta LTB_t</math></i>		
<i>Coefficient of</i>	<i>Chosen by SBC</i>	<i>Chosen by AIC</i>
$\Delta LBD_t$	-0.05 (1.38)	0.04 (0.92)
$\Delta LBD_{t-1}$	-	0.24 (1.63)
$\Delta LBD_{t-2}$	-	0.24 (1.72)
$\Delta LBD_{t-3}$	-	0.27* (1.92)
$\Delta LBD_{t-4}$	-	0.28* (2.10)
$\Delta LBD_{t-5}$	-	0.26* (2.03)
$\Delta LBD_{t-6}$	-	0.29* (2.41)
$\Delta LBD_{t-7}$	-	0.32* (2.79)
$\Delta LBD_{t-8}$	-	0.31* (2.89)
$\Delta LBD_{t-9}$	-	0.32* (3.19)
$\Delta LBD_{t-10}$	-	0.28* (2.96)
$\Delta LBD_{t-11}$	-	0.24* (2.79)
$\Delta LBD_{t-12}$	-	0.17* (2.29)
$\Delta LBD_{t-13}$	-	0.11** (1.75)
$\Delta LBD_{t-14}$	-	0.04 (0.92)
$\Delta LBD_{t-15}$	-	0.05 (1.43)
$ECM_{t-1}$	-0.58* (6.61)	-0.72* (6.48)

Note:  $LBD_t = \ln BD_t$ ; Only coefficients of  $\Delta LBD_{t-i}$ ,  $i=0, 1, 2, \dots$  and the lagged error-correction term,  $ECM_{t-1}$  are reported. Figures in parentheses are absolute values of the t-statistic; Asterisks \* and \*\* denote significance at the 5% and 10% levels, respectively; a dash (-) indicates the corresponding variable does not appear in the model;  $\Delta LBD_t = LBD_t - LBD_{t-1}$ ,  $\Delta LBD_{t-1} = LBD_{t-1} - LBD_{t-2}$ , and so on.

Panel B: Quarterly Data (1998Q1-2009Q1)

<i>Dependent Variable is <math>\Delta LTB_t</math></i>		
<i>Coefficient of</i>	<i>Chosen by SBC</i>	<i>Chosen by AIC</i>
$\Delta LBD_t$	0.04** (1.87)	0.05** (1.89)
$ECM_{t-1}$	-0.41* (2.88)	-0.34* (2.34)

Note:  $LBD_t = \ln BD_t$ ;  $\Delta LBD_t = LBD_t - LBD_{t-1}$ . Only coefficients of  $\Delta LBD_{t-i}$ ,  $i=0, 1, 2, \dots$  and the lagged error-correction term,  $ECM_{t-1}$  are reported. Figures in parentheses are absolute values of the t-statistic; Asterisks \* and \*\* denote significance at the 5% and 10% levels, respectively.

**Table 3. Long Run Model**

Panel A: Monthly Data (January, 1998 – September, 2009)

<i>Dependent Variable is <math>\Delta LTB_t</math></i>		
<i>Coefficient of</i>	<i>Chosen by SBC</i>	<i>Chosen by AIC</i>
<i>Constant</i>	-4.31** (1.87)	0.41 (0.09)
$LY_t$	0.45* (3.44)	0.76** (1.91)
$LYF_t$	0.63 (0.96)	-0.24 (0.14)
$LRER_t$	-0.07 (0.11)	-0.52 (0.85)
$LBD_t$	-0.05 (1.38)	-0.24 (1.25)

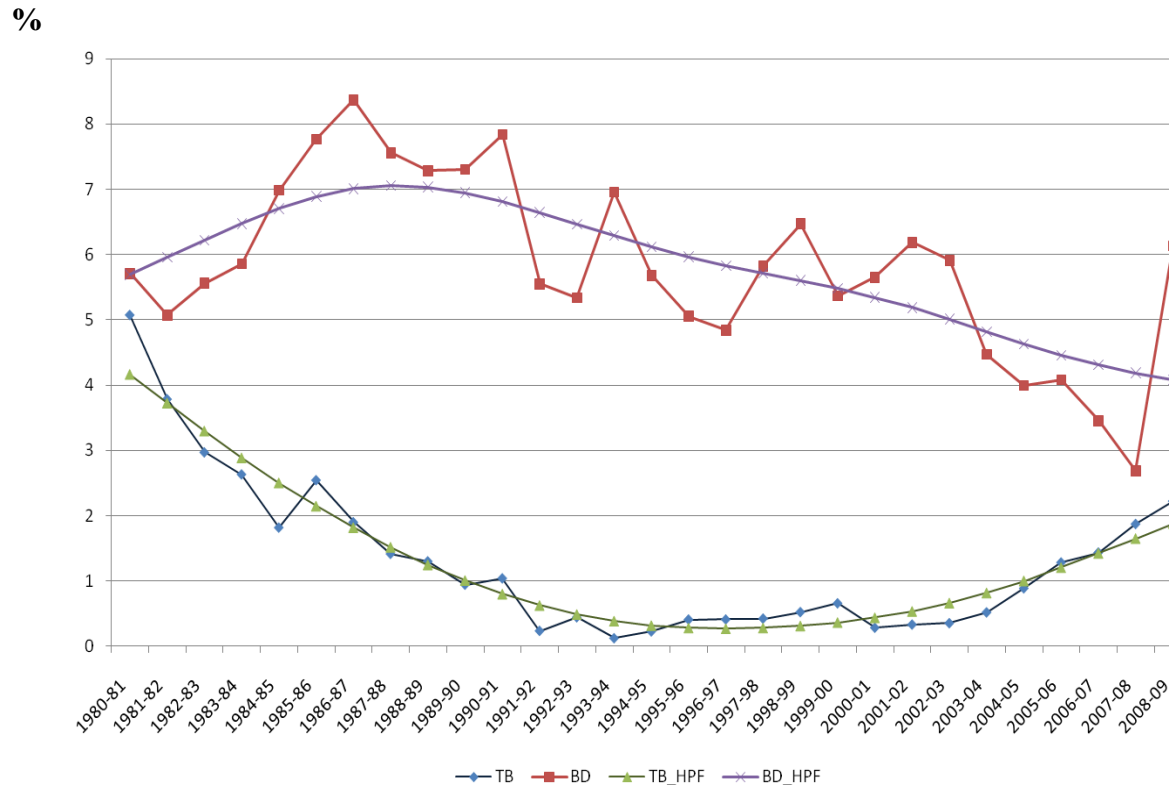
Note:  $LY_t = \ln Y_t$ ,  $LYF_t = \ln YF_t$ , etc.; figures in parentheses are the absolute value of the t-statistics.

Panel B: Quarterly Data (1998Q1-2009Q1)

<i>Dependent Variable is <math>\Delta LTB_t</math></i>		
<i>Coefficient of</i>	<i>Chosen by SBC</i>	<i>Chosen by AIC</i>
<i>Constant</i>	-0.85 (0.27)	-5.65 (1.10)
$LY_t$	1.11* (2.71)	1.12* (2.21)
$LYF_t$	0.30 (0.22)	0.26 (0.15)
$LRER_t$	-1.16 (1.11)	-0.08 (0.05)
$LBD_t$	0.12 (1.17)	0.14 (1.03)

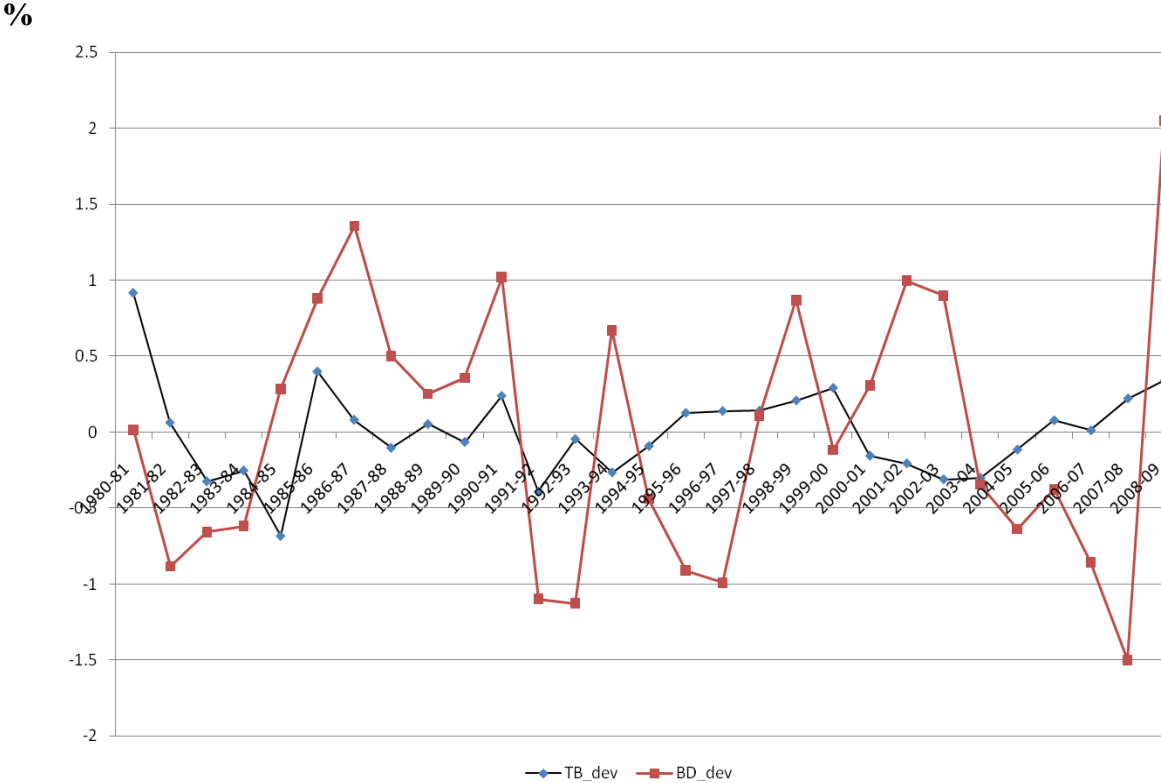
Note:  $LY_t = \ln Y_t$ ,  $LYF_t = \ln YF_t$ , etc.; figures in parentheses are the absolute value of the t-statistics.

**Figure 1(a). India's Budget Deficit and Trade Balance relative to GDP, 1980-2009**



Note: The trend is computed using the Hodrick-Prescott filter (HPF)

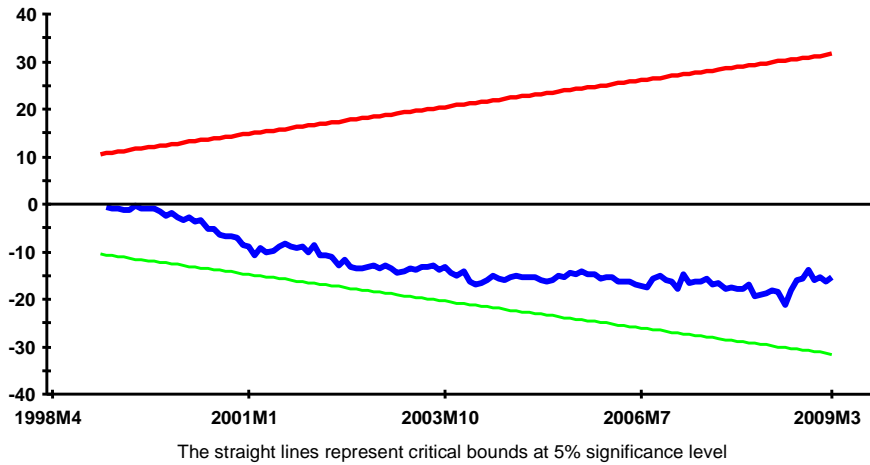
**Figure 1(b). India's Budget Deficit and Trade Balance relative to GDP, 1980-2009:  
Detrended from HPF**



## Figure 2. Stability of Model based on SBC

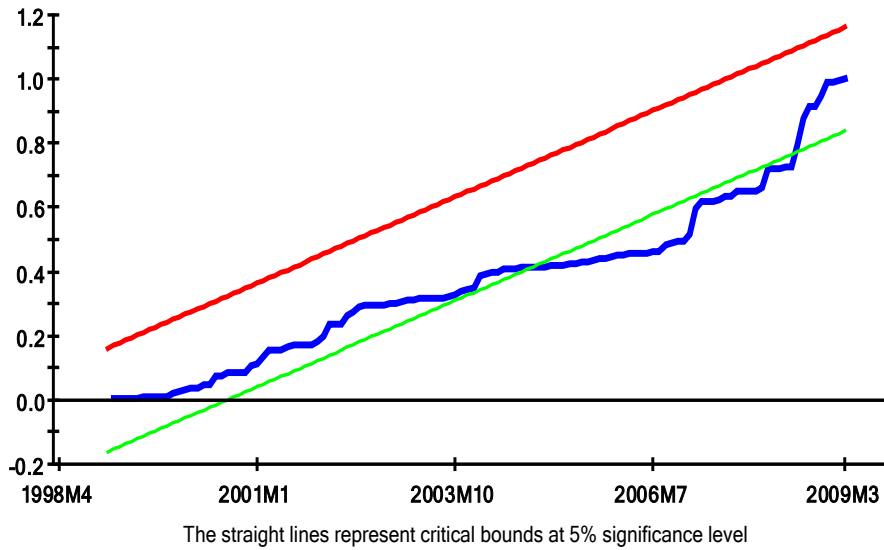
Panel A: Monthly Data (January, 1998 – September, 2009)

**Plot of Cumulative Sum of Recursive Residuals**



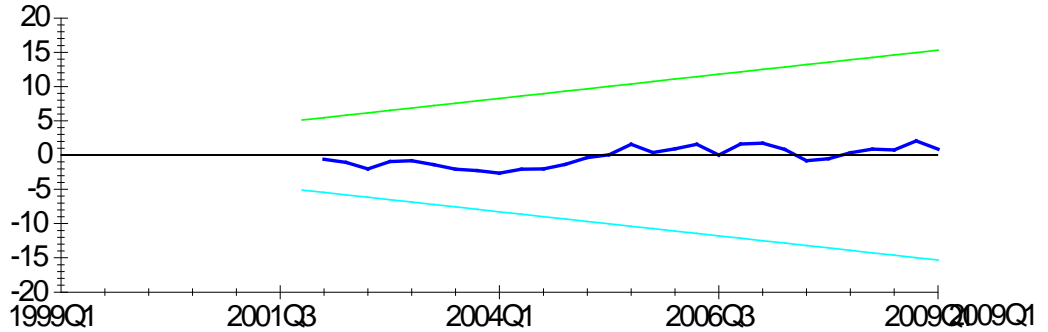
Panel A: Monthly Data (January, 1998 – September, 2009)

**Plot of Cumulative Sum of Squares of Recursive Residuals**



Panel B: Quarterly Data (1998Q1-2009Q1)

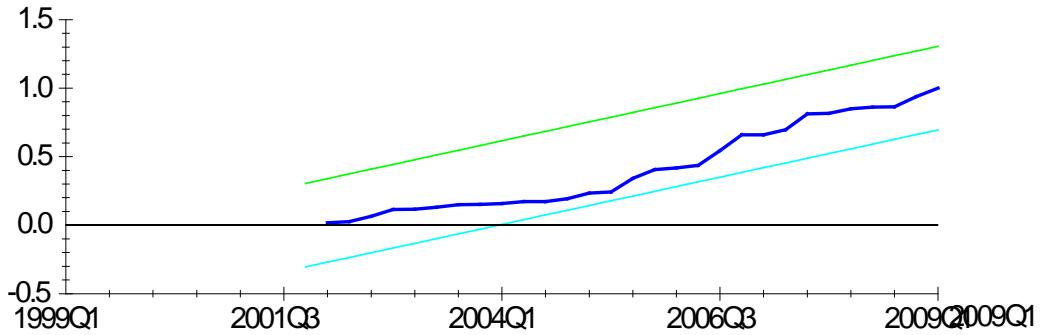
## Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Panel B: Quarterly Data (1998Q1-2009Q1)

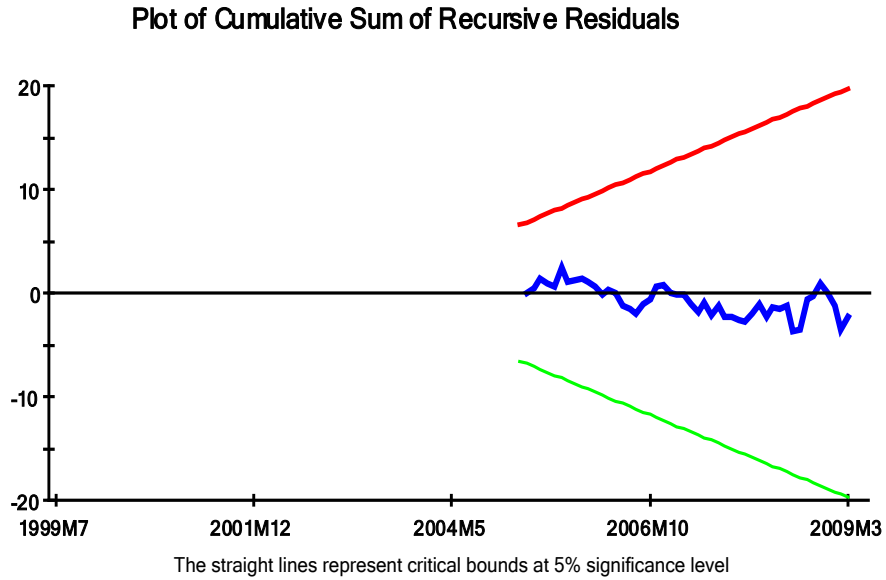
## Plot of Cumulative Sum of Squares of Recursive Residuals



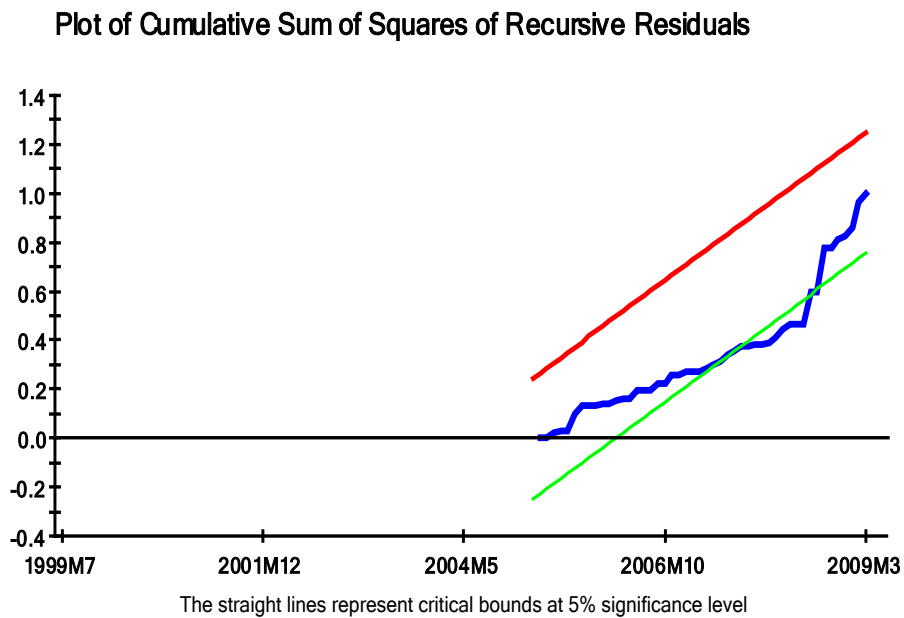
The straight lines represent critical bounds at 5% significance level

### Figure 3. Stability of Model based on AIC

Panel A: Monthly Data (January, 1998 - September, 2009)



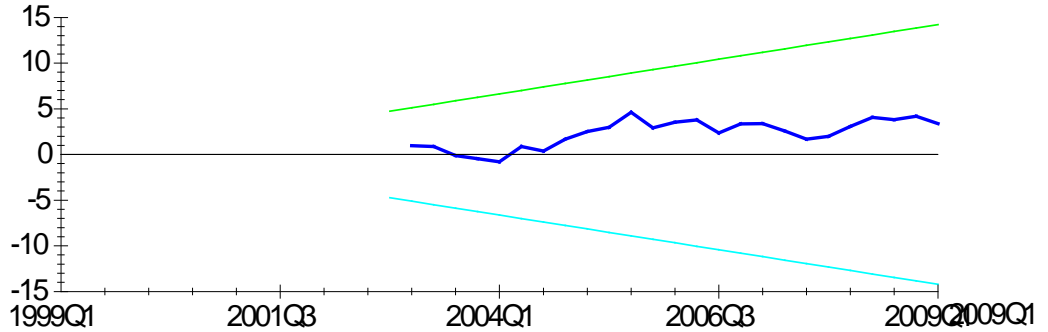
Panel A: Monthly Data (January, 1998 - September, 2009)





Panel B: Quarterly Data (1998Q1-2009Q1)

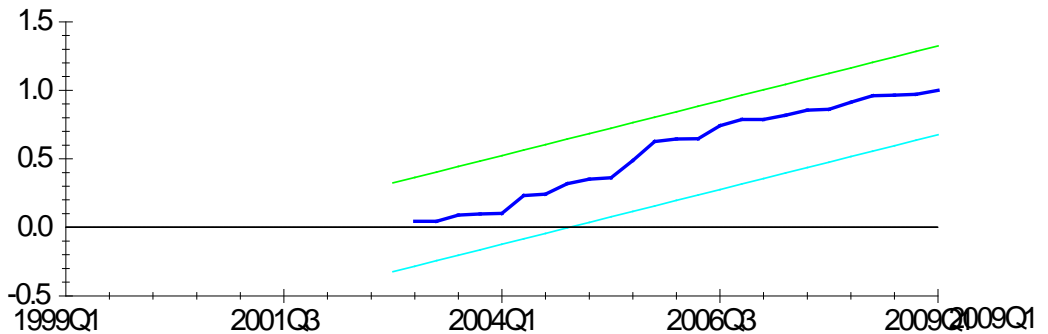
## Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Panel B: Quarterly Data (1998Q1-2009Q1)

## Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

## End Notes

---

<sup>1</sup> Given the staggering deficits of the provincial governments, it amounts to a consolidated budget deficits of about 13% of India's GDP.

<sup>2</sup> As would be expected, there are also evidence in favor of the reverse causality flowing from trade deficit to budget deficit (Islam, 1998; Anuruo and Ramchander , 1997, 1998; Khalid and Teo, 1999), as well as a bidirectional causality (Arize and Maliendretos, 2008).

<sup>3</sup> The Keynes-Ramsey rule states that in an efficient dynamic setting consumption would grow at a rate equal to the difference between the real interest rate and the rate of time preference. In the absence of full capital account convertibility, the risk-adjusted return on capital at home is likely to be lower than in rest of the world (ROW). This will induce households to save more and postpone consumption (more than in ROW). Lower domestic interest rates would lower the likelihood of currency appreciation, and the associated deterioration in current account. Thus budget deficit likely will have no impact on trade deficit (i.e., stronger support for REH). However, we may still see the impact based on the Keynesian absorption approach.

<sup>4</sup> This allows interpretation of the slope coefficients as elasticities.

<sup>5</sup> This is the famous Marshall-Lerner condition. Also presence of trade barriers would further weaken the income effects.

<sup>6</sup> Also known as the auto-regressive distributed lag (ARDL) approach to cointegration and error-correction modeling.

<sup>7</sup> The coefficients of other variables, available on request, are dropped for brevity's sake.

<sup>8</sup> Since no lagged values of  $\Delta \ln BD_{t,i}$  was chosen by AIC (i.e.,  $i=0$ ), Panel B (Table 2) includes only  $\Delta \ln BD_t$ .