Is trade deficit sustainable in India? An inquiry

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Abstract

This study examines the sustainability of trade deficit with allowance of structural breaks and seasonal adjustments as both variables have been subject to structural changes and affected by seasons. We find that, in all the cases, there is long run relationship between export and import. This implies that foreign trade deficit is sustainable in the Indian context.

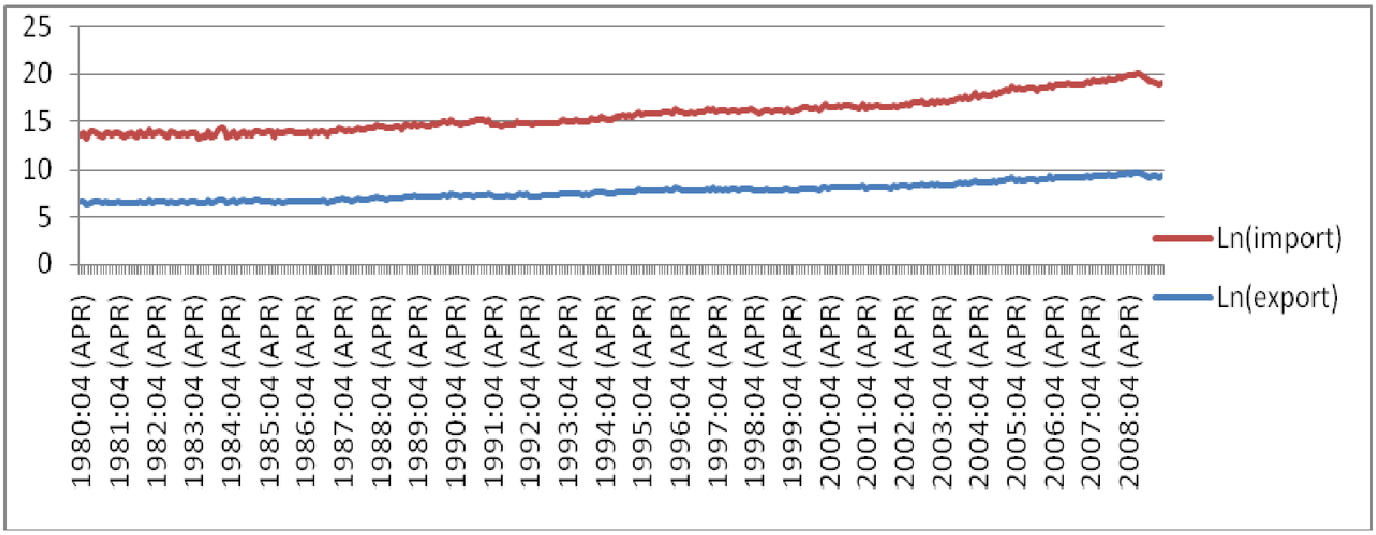
Key words: export, import, unit root, structural breaks, seasonal adjustment, cointegration.

JEL classification: C12, C13, C22, F14.

Introduction

Sustainability of foreign trade deficits has become the major concern of the policy makers, central banks and the market analysts of the emerging economies. Husted (1992) has shown that the existence of cointegrating relationship between exports and imports implies that countries do not violate their international budget constraint and therefore supports the effectiveness of their macroeconomic policies in re-storing the long-run equilibrium. In simple foreign trade multiplier terms an increase in exports leads to an increase in domestic income which increases import. Therefore, a country's import intensity depends on its export ability; nonetheless it is not the only one determining factor. This is why, the objective of this study is to examine whether the foreign trade deficit in India is sustainable i.e., whether India's export and imports are cointegrated. For a developing country like India, the current account deficit occupies the centre stage in policy discussions, as the persistent discrepancies in current account and rising levels of trade deficit pose risks to the sustainability of high economic growth and macroeconomic stability. The Indian macro-economy has been prone to frequent and continuing shocks and regime shifts in recent decades. Macroeconomic crises (for example 1965-67, early 1980s and 1991) in India have almost always been dominated by balance of payments difficulties and India has been forced to devalue its currency either by external or internal factors. It is evident from the figure 1 that there are more fluctuations in the series of the import vis-à-vis the exports. This is because import intensity is not only depends on countries export ability but also on the market exchange rate. In the imports there are fluctuations in early 1984. However, in the both series fluctuations are evident in the late 2008.

Figure 1: India's exports and imports (expressed in natural log) in absolute million $ value)



In recent times, in the area of international trade, many empirical studies have been conducted to analyze the existence and the nature of long-run or cointegrating relationship between exports and imports. Husted (1992) is the pioneer one who by using quarterly US trade data for the period 1967–1989 has shown that exports and imports are cointegrated in the long run. In the Indian case, Upender (2007) has shown that India's nominal exports and imports were cointegrated by employing data for the period 1949-50 to 2004-05. Arize (2002) has also provided evidence of long-run equilibrium relationship between exports and imports for Indian economy by employing data for the period 1973 to 1998. Konya and Singh (2008), by employing data for the period 1949-50 to 2004-05 and by allows for a one-time structural break in 1992-93, have found no evidences of cointegrating relationship between India's exports and imports.

II. Objective, Data source and estimation methodology

II.I. Objective

The basic objective set in the study is to examine the sustainability of trade deficit for the Indian economy. Our contribution to the existing literature is twofold in the Indian case. *First*, we are incorporating endogenous structural breaks and seasonal adjustment in analysis as it may change the results and *second* we are allowing structural breaks and seasonal adjustments in cointegration analysis also

II.II. Data source and variables description

The data used are monthly observations of the (nominal)[1] million United States (US) $ values of export and import and has been transformed into natural log form. The data has been obtained from various issues of the Hand Book of Statistics of Indian Economy (HBSIE). Time period of the analysis is from April-1984-85 to March-2009-10[2].

II.III. Estimation methodology

We have used Hylleberg et al's. (1990) (HEGY) unit root test for analysis as the appropriate transformations, in order to remove possible (seasonal) unit roots follow directly from the procedure itself and do not have to be implemented a priori. Franses (1990) has developed a test in the framework of HEGY et al. (1990) for monthly series which is based on the estimation of the parameters of the following equation (1).

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[1] It should be noted that if we take real values of exports and imports the results may get change. Therefore, for the policy purpose the use of the results drawn in this paper should be carefully examined.

[2] It should also be noted that since we are using monthly observations therefore, even though sample size is large but time span of the study is small which may also affect our results so careful examination of results is required is for policy purposes.

$$\Delta_{12}y_t = \pi_1 z_{1,t-1} + \pi_2 z_{2,t-1} + \pi_3 z_{3,t-1} + \pi_4 z_{3,t-2} + \pi_5 z_{4,t-1} + \pi_6 z_{4,t-2} + \pi_7 z_{5,t-1} + \pi_8 z_{5,t-2} + \pi_9 z_{6,t-1} +$$

$$\pi_{10} z_{6,t-2} + \pi_{11} z_{7,t-1} + \pi_{12} z_{7,t-2} + \sum_{j=1}^{p} \alpha_j^* \Delta_{12} y_{t-j} + \varepsilon_t \text{.....................(1)}$$

Where

$$z_{1,t} = (1+L)(1+L^2)(1+L^4+L^8)y_t$$
$$z_{2,t} = -(1-L)(1+L^2)(1+L^4+L^8)y_t$$
$$z_{3,t} = -(1-L^2)(1+L^4+L^8)y_t$$
$$z_{4,t} = -(1-L^4)(1-\sqrt{3}L+L^2)(1+L^4+L^8)y_t$$
$$z_{5,t} = -(1-L^4)(1+\sqrt{3}L+L^2)(1+L^4+L^8)y_t$$
$$z_{6,t} = -(1-L^4)(1-L^2+L^4)(1-L+L^2)y_t$$
$$z_{7,t} = -(1-L^4)(1-L^2+L^4)(1+L+L^2)y_t$$
$$z_{8,t} = (1-L^{12})y_t$$

Where "L" denotes lag operators. In equation (1) the process y_t has a regular (zero frequency) unit root if $\pi_1 = 0$ and it has seasonal unit roots if any one of the other π_i (i = 2,…,12) is zero. For the conjugate complex roots, $\pi_i = \pi_{i+1} = 0$ (i= 3, 5, 7, 9, 11) is required. The corresponding statistical hypotheses can be checked by t- and F-statistics, critical values for which are given by Franses and Hobijn (1997). If all the π_i (i = 2,…,12) are zero, then a stationary model for the monthly seasonal differences of the series is suitable.

Finally, we have carried out unit root analysis following Lanne et al. (2002) for the equation $y = \mu_0 + \mu_1 t + f_t(\theta)'\gamma + x_t$.....................(2). Where $f_t(\theta)'\gamma$ is a shift function and θ and γ are unknown parameters and x_t is generated by AR(p) process with possible unit root. We used a simple shift dummy variable with shift date T_B. $f_t' = d_{1t} : \begin{cases} 0, t < T_B \\ 1, \geq T_B \end{cases}$ function does not involve any parameter θ in the shift term $f_t(\theta)'\gamma$, the parameter γ is scalar. Dates of structural breaks have been determined by following Lanne, Lütkepohl and Saikkonen (2001). They recommended to chose a reasonably large AR order in a first step[3] and then pick the break date which minimizes the Generalized Least Square (GLS) objective function used to estimate the parameters of the deterministic part.

For the cointegration analysis in this study we have preferred Johansen et al's. (2000) test as Saikkonen and Lütkepohl (SL) (2000) approach allows for testing the cointegration in the presence of only one structural breaks and it does not allows for structural breaks in trends.

III. Data analysis and results interpretation

First of all, unit root analysis has been carried out by employing HEGY test and the result has been presented in table 1.

Table 2: HEGY Unit root analysis

Ln(Export)			Ln(Import)	
Test statistics under HEGY unit root test				
	Model (k)		Model (k)	
	Intercept and Seasonal dummies (1)	Intercept, seasonal dummies and trend (1)	Intercept and seasonal dummies (1)	Intercept, seasonal dummies and trend (3)
t (π_1)	0.4596	2.5140	-1.1067	2.0128

[3]Here, we have fixed largest lag length 3 as time duration is too short nonetheless the sample size is large since in time series analysis sample size does not matters while time period/span matters.

t (π_2)	0.6279	2.3424	-0.1924	1.6931
F(π_3, π_4)	4.0391	3.5355	7.3361**	6.8575**
F(π_5, π_6)	25.6552 *	26.4003 *	26.4462*	26.5568*
F(π_7, π_8)	20.1563 *	20.7384 *	14.6096*	15.0762*
F(π_9, π_{10})	26.7586 *	27.7884 *	24.6022*	25.0423*
F(π_{11}, π_{12})	31.9872 *	33.1310 *	30.2234*	30.7774*
F($\pi_2 \ldots\ldots \pi_{12}$)	27.4157 *	27.7178 *	25.5081*	25.6308*
F($\pi_1 \ldots\ldots \pi_{12}$)	26.0063 *	25.7394 *	24.7327*	23.6254*
Note: "k" Denotes lag length.				
Source: Author's calculation				

It is evident from table 1 that in all the models the null hypothesis of unit roots at annual and semi-annual frequencies are not rejected at 1% level of significance. This implies that both exports and imports fallow random walk in annual and semi-annual series. Based on the F-value, on the other hand, the null hypothesis of π_3=π_4=0 has not been rejected only for export and all other conjugate complex roots the null hypothesis of unit root at quarterly and all other higher frequencies are rejected at 1% level of significance. Finally, we have presented the results of unit root analysis based on seasonal adjustment and structural breaks in table 2.

Table 2: SL Unit root analysis

Variable	Unit Root Test with structural break {searched range: [1980 M9, 2009 M1]}

s					
	time trend (impulse dummy and used break date is 1984 M1)	time trend and seasonal dummies included (impulse dummy and used break date is 1984 M2)	time trend (shift dummy and used break date is 1984 M3)	time trend and seasonal dummies included (shift dummy and used break date is 1984 M3)	Lanne et al. (2002) (k)
Ln(Import)	Yes	-----	-----	-----	-1.9201 (2)
Ln(Import)	------	Yes	-----	-----	-1.9678 (2)
Ln(Import)	------	-----	Yes	-----	-2.4030 (2)
Ln(Import)	------	-----	-----	Yes	-2.3558 (2)
	time trend (impulse dummy and used break date is 2004 M3)	time trend and seasonal dummies included (impulse dummy and used break date is 1984 M3)	time trend (shift dummy and used break date is 2008 M10)	time trend and seasonal dummies included (shift dummy and used break date is 2008 M9)	
Ln(Export)	Yes	-----	-----	-----	-2.2780 (2)
Ln(Export)	------	Yes	-----	-----	-1.6846 (2)
Ln(Export)	------	-----	Yes	-----	-2.3370 (2)
Ln(Export)				Yes	-1.6893 (3)
Note: (1) "k" Denotes lag length. (2) Critical values -3.55, -3.03 and -2.76 are obtained from Lanne et al. (2002) at 1%, 5%, and 10% respectively. (3) Mi (where i=1,2,…,12) number of denotes months.					

Source: Author's calculation

It is evident from table 2 that variable export and import are non-stationary in all cases as null hypothesis of unit root has not been rejected in any one of the cases.

Since both variables are non-stationary in their level form but stationary in the first difference[4] form after incorporating seasonal adjustment and structural breaks in the process of unit root analysis therefore, we can go for cointegration analysis. Using appropriate model (as graphical presentation of the data shows) and lag length (as suggested by Akaike Information Criterion (AIC) and Hannan-Quinn Information Criterion (HQIC)), we have carried out cointegration analysis for each possible combination of two structural break dates as obtained in the unit root analysis of both variables. The results of the cointegration analysis have been presented in table 3.

Table 3: Results of cointegration analysis

Johansen Trace Test: Trend and intercept included and structural change occur in level and trend.[5]			
Seasonal dummies included {Restricted dummies: [1984 M1] [2004 M3] (3)}	Seasonal dummies included {Restricted dummies: [1984 M1] [2008 M9] (3)}	Seasonal dummies included {Restricted dummies: [1984 M1] [2008 M10] (3)}	Seasonal dummies included {Restricted dummies: [1984 M2] [2004 M3] (3)}

[4] Results of unit root analysis of variables in first difference form has not been presented to save space but can be assessed by request to the author.

[5] We have also analysed when (1) structural change occurs in level only (2) for one structural break date. However, findings are same as presented here and can be obtained by the request to the author.

<table>
<tr><td>R</td><td>LR</td><td>P-value</td><td>r</td><td>LR</td><td>P-value</td><td>r</td><td>LR</td><td>P-value</td><td>r</td><td>LR</td><td>P-value</td></tr>
<tr><td>0</td><td>51.39</td><td>0.0044</td><td>0</td><td>43.55</td><td>0.0063</td><td>0</td><td>39.42</td><td>0.0195</td><td>0</td><td>48.41</td><td>0.0102</td></tr>
<tr><td>1</td><td>16.59</td><td>0.1812</td><td>1</td><td>7.84</td><td>0.6442</td><td>1</td><td>6.80</td><td>0.7422</td><td>1</td><td>16.59</td><td>0.1834</td></tr>
<tr><td colspan="3">Seasonal dummies included {Restricted dummies: [1984 M2] [2008 M9] (3)}</td><td colspan="3">Seasonal dummies included {Restricted dummies: [1984 M2] [2008 M10] (3)}</td><td colspan="3">Seasonal dummies included {Restricted dummies: [1984 M3] [2004 M3] (3)}</td><td colspan="3">Seasonal dummies included {Restricted dummies: [1984 M3] [2008 M9] (3)}</td></tr>
<tr><td>R</td><td>LR</td><td>P-value</td><td>r</td><td>LR</td><td>P-value</td><td>r</td><td>LR</td><td>P-value</td><td>r</td><td>LR</td><td>P-value</td></tr>
<tr><td>0</td><td>42.13</td><td>0.0098</td><td>0</td><td>38.13</td><td>0.0280</td><td>0</td><td>47.51</td><td>0.0133</td><td>0</td><td>42.32</td><td>0.0095</td></tr>
<tr><td>1</td><td>8.35</td><td>0.5965</td><td>1</td><td>7.26</td><td>0.7004</td><td>1</td><td>17.15</td><td>0.1623</td><td>1</td><td>10.02</td><td>0.4426</td></tr>
<tr><td colspan="4">Seasonal dummies included {Restricted dummies: [1984 M3] [2008 M10] (3)}</td><td colspan="4">Seasonal dummies included {Restricted dummies[2004 M3] [2008 M9] (3)}</td><td colspan="4">Seasonal dummies included {Restricted dummies: [2004 M3] [2008 M10] (3)}</td></tr>
<tr><td>R</td><td>LR</td><td colspan="2">P-value</td><td>r</td><td>LR</td><td colspan="2">P-value</td><td colspan="2">r</td><td>LR</td><td>P-value</td></tr>
<tr><td>0</td><td>38.35</td><td colspan="2">0.0270</td><td>0</td><td>48.63</td><td colspan="2">0.0017</td><td colspan="2">0</td><td>46.49</td><td>0.0032</td></tr>
<tr><td>1</td><td>8.86</td><td colspan="2">0.5465</td><td>1</td><td>12.39</td><td colspan="2">0.2780</td><td colspan="2">1</td><td>13.18</td><td>0.2282</td></tr>
<tr><td colspan="12">Note: (1) “r” and “LR” denotes number of cointegrating relations/vectors and log likelihood ratio respectively. (2) Values in ( ) denotes the number of lag length used in cointegration analysis.</td></tr>
<tr><td colspan="12">Source: Author’s calculation</td></tr>
</table>

It is evident from table 3 that in all the cases there are strong evidences for the presence of a cointegrating vector between exports and imports i.e., trade deficit is sustainable in the Indian context.

IV. Conclusion

Based on the test of multiple break points, we may conclude that Indian government has been playing a crucial role in stabilizing the trade balance and all of India's macroeconomic policies have been effective in leading export and import to long run steady sate equilibrium relationship. Long run convergence between export and import also implies that the short run fluctuation between export and import are not sustainable. In the sense of Husted (1992), India does not violate her international budget constraint and therefore, supports the effectiveness of her macroeconomic policies in restoring the long-run equilibrium.

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