India's trade with USA and her trade balance: An empirical analysis

Tiwari, Aviral and Shahbaz, Muhammad

ICFAI University Tripura, Management Sciences, COMSATS Institute

4 January 2011

India's trade with USA and her trade balance: An empirical analysis

Aviral Kumar Tiwari
Research scholar and Faculty of Applied Economics,
Faculty of Management, ICFAI University Tripura,
Kamalghat, Sadar, West Tripura, Pin-799210
Email-Id: aviral.eco@gmail.com & aviral.kr.tiwari@gmail.com

Muhammad Shahbaz
Management Sciences, COMSATS Institute,
Lahore Campus, Pakistan
Email: shahbazmohe@live.com
Phone: (0092-334-366-4657)

Abstract:

This study explores the affect of India's exchange rate with US on Indian trade balance over the period of 1965-2008. We use ARDL bounds testing approach to cointegration and for dynamic analysis IRFs and VDs. For dynamic analysis impulse response functions and variance decompositions are used. We find cointegrating relationship among the tested variable, positive impact of depreciation in Indian rupee against US dollar and trade policies in previous period on Indian trade balance while an negative impact of money supply and economic growth on trade balance in short span of time. Moreover, J-curve is validated in case of India with US.

Keywords: ARDL, VDs, IRFs, exchange rate, J-curve, India-US trade relationship

1. Introduction

Indian economy is now much more connected to the global economy than it was 20 years ago or so. In this globalised world, economy of individual country and hence economic policy is influenced by changes in world trade patterns and prices, changes in global capital market conditions and associated investor perceptions, changes in technology and so on and so forth. The steps towards globalization by any economy (hence for Indian economy too) brings both opportunities and also poses challenges and risks.

If we consider economic and trade relations between the India and United States (US) we find a number of swings experienced by Indian economy since independence. CSR reports RL34161 (2007) states that during 1950s and early 1960s the US was a leading trading partner for India by providing the nation with about a third of its total imports. However, first downswings come during Indo-Pakistani war of 196when India started to promote closer ties with the Soviet Union (SU). However, for the next 40 years, political and economic associations between India and the US were relatively cool. In 1991 India took initiatives in full fledged form for economic reform under the guidance of congress-led government though motivation to initiate these reforms were not internal rather external (Tiwari, 2009; Tiwari, 2010a; 2010b). However, economic reform efforts stagnated under weak alliance governments later in years and Asian financial crisis of 1997 and international sanctions on India (as a result of its 1998 nuclear tests) to further dampen the economic outlook. Further, in 1999 when the BJP was elected in parliamentary elections launched second-generation economic reforms which includes major deregulation, privatization, and tariff-reducing measures but not limited to these steps only.

Since 2004, Washington and New Delhi have been pursuing a "strategic partnership" based on numerous shared values and improved economic and trade relations[1]. Being India's largest trade and investment partner, the US strongly supports New Delhi's continuing economic reform policies. In this regard, in 2005, an 'US-India Trade Policy Forum' was setup to expand bilateral economic engagement and provide a venue for discussing multilateral trade issues. Despite the growth in bilateral trade and the improvement in trade relations, there are still a number of economic and trade issues between India and the US. Both nations seek better market access to the other's domestic markets, as well as the lowering of perceived trade barriers. In addition, both India and the US would like to see changes in the other nation's legal and regulatory policies to help guard and encourage exports and foreign direct investment.

1.1 India's Trade Policies and India-US trade relation

India's trade policies since the beginning itself have generally been coordinated with its overall economic policies in order to minimizes the negative impact of opening up of domestic economy to rest of the world. In this regard prior to the economic reforms of the 1990s, India adopted a fairly comprehensive import licensing system in order to restrain the domestic economy from excess supply of good in the domestic economy which may arise due to uncontrolled inflow of imported goods. Therefore, Indian government banned the number of import items and applied quantitative restrictions over 1,400 products. However, these import control mechanisms which were in the form of quantitative restrictions were transformed gradually to a tariff based system that favored the import of some necessary products, but deterred the import of other types of products.

Nonetheless, India's tariff system had been remained complex and obscure for long time. India had a more isolated range of tariff rates, even among similar types of products and a comparatively high average tariff rate. Further, India had granted some sort of relaxation to "most favored nation" (MFN) in the name of exemptions or exceptions to the standard tariff rate which is making it difficult for foreign companies to determine the correct tariff rate for their exports. But most of these apparent problems with India's tariff system have improved with the lowering of its average tariff rate and the simplification of its tariff structure. For example, in the fiscal year 1991-92 India's average tariff rate was almost around 130% and in the fiscal year 1997-98 (according to the WTO) India's average tariff rate was 35.3%, with a peak rate of 260%. However, by the fiscal year 2001-2002, the average rate had declined to 32.3%, with a peak rate of 210% and further by 2005, India's average tariff rate had declined to 19.5%. In addition that number of different tariff rates has also been reduced by Indian government. For example, in the fiscal year of

2006-07, the peak tariff rate reduced to 30% for most agricultural goods and 12.5% for most non-agricultural goods which was 100% and 182% for agricultural goods and non-agricultural goods respectively.

1.1.1 India-U.S. Economic and Trade Relations

Though economic and trade relations between the United States and India have been problematic in the last years however, currently they are comparatively pleasant. In the Indian political system now U.S. policymakers have shared core values which have facilitated increasingly friendly relations and trade and investment reforms implemented by the Indian government over the last 15 years have improved trade relations between the government of the India and U.S. Nonetheless, the trade relationship between India and U.S has not been uniform because of diverse view of politicians rather that economics differences in opinions. For example, major divergence on the political level came on May 13, 1998, when the United States imposed trade sanctions on India in response to its nuclear weapons tests. Further, on economic aspects Report on Foreign Trade Barriers (2007) of the United States documented about several other aspects of India's trade policy beyond its tariff rates and import restrictions. Report stated that India provides trade-distorting subsidies for di-ammonium phosphate (DAP) fertilizer. However, the United States had also shown his concern about India's standards and certification requirements and in some cases, the United States believes that the scientific basis of the standards is questionable; in other cases, it sees the certification requirement as forming a non-tariff trade barrier.

If we consider the trade pattern of India and its nature we find that over years India trade with US has increased despite the small fall in few years. According to the US trade statistics the bilateral trade of US with India was $4.0 billion in 1986 which has increase to $31.9 billion by 2006-nearly an eight-fold increase. According to RBI statistics, India was the 22nd largest export market for US goods in 2005 and US exports and imports from India in 2007-08 had an estimated value of Rs. 84625.1 crore and Rs. 83388.1 crore respectively. Further, if we look into the data we find that US dependence on India's imports has declined which India's dependence on US imports has increased. And according to the Balance of Payments (BOP) statistics for the year 2009-10 released by the Reserve Bank of India, the deficit has increased from Rs. 368532 crore in 2007-08 to Rs. 542113 crore in 2008- 09. This increase of Rs. 174 crore has resulted in the deficit swelling from 8.5 percent of GDP at market prices in 2007-08 to almost 11 percent in 2008-09.

Therefore, taking into account these considerations in the present paper we have made an effort to analyze whether bilateral trade of India with US has any impact on the trade deficit of India. Further, we have also made an attempt to analyze the static and dynamic relationship between the bilateral trade and trade deficit.

Rest of the paper is organized as follows. Section 2nd presents a brief review of literature followed by objectives, model, variables definition and methodology adopted for empirical analysis in section third. Section 4th presents the data analysis and findings followed by conclusions and policy implications are drawn in section 5th.

2. Literature Review

There are a number of studies that have followed the traditional approach to analyze the posed problem above and have estimated import and export demand elasticities to determine whether the Marshall-Lerner (ML thereafter) condition holds (for example, Kreinin, 1967; Houthakker and Magee, 1969; Khan, 1974, 1975; Goldstein and Khan, 1976, 1978; Wilson and Takacs, 1979; Haynes and Stone, 1983; Warner and Krein, 1983; and Bahmani-Oskooee, 1986 among others). As per the ML condition as long as the sum of price elasticity of export and import demand functions is greater that one, devaluation will improve the trade balance. Moreover, there are few studies which have estimated trade elasticities for developing countries. For example, Bahmani-Oskooee and Niroomand (1998) have estimated long run price elasticities and tested Marshall-Lerner condition for thirty developed and developing countries[2]. Lal and Lowinger (2002) confirmed the existence of both short-run and long-run relationships between nominal exchange rate and trade balances for South Asia countries.

However, the basic criticisms of these studies has been the use of aggregate trade data which may create the problem of so-called “aggregation bias,” and hence as (Bahmani-Oskooee and Goswami, 2004) argued a significant price elasticity with one trading partner could be more than offset by an insignificant elasticity. This problem of aggregation bias has opened a new research area for the study of trade elasticities on a bilateral basis.

There are few studies on the bilateral trade between the US and one or more of its trading partners (for example, Cushman, 1990; Haynes et al., 1996; Bahmani-Oskooee and Brooks, 1999; Nadenichek, 2000 among others). There are few studies which has analyzed the bilatrlal trade relationship other that the US (for example, Bahmani-Oskooee *et al.,* 2005 studied bilateral trade in Canada, Hatemi-J and Irandoust, 2005 and Irandaust *et al.,* 2006 studied bilateral trade in Sweden, and Harriigan and Vanjani, 2003 studied the bilateral trade of manufacturing goods in Japan). Further, Wang and Ji (2006) and Liu *et al.,* (2007) studied the bilateral trade in China and Hong Kong respectively. This study aims to fill this gap and study bilateral trade elasticity between India and its major trading partner that is US. Bahmani-Oskooee and Harvery (2006), by utilizing the ARDL approach, suggest that a real depreciation of the Malaysian Ringgit can increase Malaysians trade balance with China, France, Germany, Indonesia, and the U.S. Narayan (2006) investigated the nexus between China’s trade balance and the real exchange rate vis-a`-vis the USA. Using the bounds testing approach to cointegration, the author found evidence that China’s trade balance and real exchange rate vis-a`-vis the USA are cointegrated. Further, using the autoregressive distributed lag model the author find that in both the short run and the long run a real devaluation of the Chinese RMB improves the trade balance; as a result, there is no evidence of a J-curve type adjustment.

Yol and Baharumshah (2007) utilized the panel cointegration technique to examine the effects of exchange rate changes on the bilateral trade balance between 10 African countries and the U.S. Their study revealed that a real exchange rate depreciation improves the bilateral trade balance for Botswana, Egypt, Kenya, Nigeria, Tunisia, and Uganda vis-à-vis the U.S., but worsens Tanzania's trade balance with the U.S. Harb

(2007) also used the panel cointegration technique to estimate the price and income elasticities of imports and exports between Arab countries and the Euro zone. The author reported that Arab imports from Europe are price elastic and income inelastic, however, the price and income elasticities of Arab exports to Europe are uncertain. Halicioglu (2008) empirically analyzed bilateral J-curve dynamics of Turkey with her 13 trading partners using quarterly time series data over the period 1985–2005. The empirical results indicated that whilst there is no J-curve effect in the short-run, but in the long-run, the real depreciation of the Turkish lira has positive impact on Turkey's trade balance in couple of countries. Aziz (2008) investigated the effect of exchange rate on trade balance for Bangladesh using cointegration and error correction method and found the existence of J-Curve phenomenon[3]. Kim (2009) assessing the impact of macroeconomic determinants on Korea's bilateral trade deficit with her trading partners e.g., Japan and US found the evidence of cointegrating relationship. Korean currency depreciation improved trade balance, while J-curve effect was found in the context of trade with Japan.

Shahbaz *et al,.* (2010) revisited the affect of devaluation on trade balance by splitting the data span into sub-samples i.e. fixed and floating exchange regimes. Their empirical exercise indicated inverse impact of devaluation on terms of trade or trade balance. Moreover, there is no existence of J-curve phenomenon in case of Pakistan analyzed by impulse response function. Herve *et al.,* (2010) found positive effect of exchange rate on trade balance following Marshal-Learner's condition for Cote d'Ivoire both in the short and the long run; and impulse response function indicated the J-curve phenomenon. Yi-Bin *et al.,* (2010) applied the heterogeneous panel cointegration method to examine the long-run relationship between the real exchange rate and bilateral trade balance of the U.S. and her 97 trading partners for the period 1973–2006. Using new annual data, the empirical results indicated that the devaluation of the US dollar deteriorates her bilateral trade balance with 13 trading partners, but improves it with 37 trading partners, especially for China. In the panel cointegrated framework, a long-run negative relationship between the real exchange rate and the bilateral trade balance exists for the U.S. Bahmani-Oskooee and Harvey (2010) examined the relation between the Malaysian trade balance and her real exchange rate. The authors utilized disaggregate data by country and consider Malaysia's bilateral trade balance with her 14 largest trading partners. However, the long-run results revealed improvement in Malaysia's bilateral trade balance at least in four cases. Furthermore, in two of these cases, the new definition of the J-curve received empirical support.

Petrović and Gligorić (2010) showed that exchange rate depreciation in Serbia improves trade balance in the long run, while giving rise to a J-curve effect in the short run. These results added to the already existent empirical evidence for a diverse set of other economies. The author used both Johansen's and autoregressive distributed lag approach and found similar long-run estimates showing that real depreciation improves trade balance. Corresponding errorcorrection models as well as impulse response functions indicated that, following currency depreciation, trade balance first deteriorates before it later improves, i.e. exhibiting the J-curve pattern. These results are relevant for policy making both in Serbia and in a number of other emerging Europe countries as they face major current account adjustments after BoP crises of 2009. Shahbaz *et al.,* (2011) re-investigated the impact of currency devaluation on trade balance in presence of absorption and monetary approaches using Pakistani data. The results indicated that an increase in currency devaluation has inverse affect on trade balance. Moreover, money supply is negatively linked with trade balance. The absorption approach does not exist for long run and findings confirmed the validation of Keynesian view that '*income increases will encourage general public to purchase more imported goods and thus deteriorate the trade balance*' and evidence about J-curve was not found.

3. Modelling, and data source

In the present study we have developed a model for empirical analysis which is based on the seminal work of Bickerdike (1920) and generalized and modified by Robinson (1947) and Metzler (1948) what is known as elasticity approach or Bickerdike- Robinson-Metzler (BRM) model. This concept is based on the fundamental of substitution effect in consumption, in explicit terms, and production, in implicit terms, that is seems to be induced by relative price (measured in terms of domestic price relative to foreign price) movements that happens due to nominal devaluation. This imperfect substitution model is basically partial equilibrium approach that provides sufficient condition for improving the trade balance through devaluation in exchange rate. The requirement of this condition is the absolute values of summation of demand elasticities of exports and imports must be greater that exceed unity. The economic thinkers of this presumption support the argument that nominal exchange rate devaluation has recovered the trade balance or stabilized the foreign market.

There is another approach of balance of payment in international economics which has emerged in 1950s that is due to particularly from the seminal work of Harberger (1950) and later Meade, (1951); Alexander, (1952, 1959); Krueger, (1983) and Kenen, (1985) which focus on economic analysis of balance of payments. This approach in the economic theory is known as the absorption approach (AA) to the balance of payments[4]. The fundamental nature of this approach is the proposition that improvement in trade balance requires an increase in income over total domestic expenditures. According to the absorption approach the devaluation process in a country causes deterioration in its terms of trade, and thus deterioration in its national income[5]. This approach presumes that devaluation will result in a decrease in the price of exports measured in foreign currency. It is important to be mentioned that deterioration in the terms of trade only does not necessarily imply that the trade balance is going to deteriorate however, it can worsen the trade balance provided that the foreign currency price of exports sinks far enough relative to the price of imports to outweigh the trade balance improvement implied by the rise in export volumes and the drop in import volumes (Lindert and Kindleberger, 1982). Therefore, we can say that the net effect of devaluation on the trade balance will depend on the combined substitution and income effects.

Further development took place in the later part of 1950 decade that is now commonly known as in theory monetary approach of balance of payments or "modern" theory of trade balance. This approach says that balance of payments is monetary phenomenon that is also known as global monetarist approach (Mundell, 1968, 1971;, Dornbusch, 1973; Whitman, 1975; Frankel and Johanson, 1977 and Corden, 1994). According to this approach any excess demand for goods, services and assets created deficit in balance of payments are reflected in an excess supply or demand for stock of money. Therefore, the analysis of balance of payment should be according to the demand for money and supply of money. Put simply, we can say that an imbalance (excess of or lack of it) would be fulfilled through the inflows or outflow of money from abroad to improve balance of payment.

The basic objective of this study is to analyse the dynamic relationship between India's trade with US and her trade deficit. Following the above literature, empirical equation is being modelled as following:

$$\ln TB_t = \alpha_1 + \alpha_2 \ln EXR_t + \alpha_3 \ln M_t + \alpha_4 \ln EG_t + \mu_i \quad (1)$$

Where, trade balance (TB_t) proxied by ratio of unit value of exports to unit value of imports with USA, EXR_t indicates the exchange rate i.e. Indian rupee against US dollar, M_t has captured by adding real money supply and EG_t is real GDP per capita for absorption approach. If depreciation in exchange rate improves terms of trade then sign would be $\alpha_2 > 0$ and vice versa. Similarly, $\alpha_3 > 0$ if demand for money by people is more than money is being supplied by the central bank, the excess demand would be fulfilled through the inflows of money from abroad to improve balance of payment and vice versa. If Indian population demands foreign goods increases as their income increases then it has inverse impact of terms of trade and in return, trade balance will be deteriorated and $\alpha_4 < 0$.

The data period of study is from 1965 to 2008. Data on real GDP per capita has been collected from World Development Indicators (WDI, CD-ROM, 2010). The International Financial Statistics (IFS, CD-ROM, 2010) has combed to collect data on real money supply, exchange rate, unit value of exports and unit value of imports.

4. Methodological Framework

To analyse the stationary property of the data there are several test like Augmented Dickey Fuller (ADF) (1981), Phillips and Perron (PP) (1988), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) (1992), and Ng and Perron (NP) (2001) test however, these test do not incorporate the structural beaks that a usual time series posses and therefore, are biased in favour of the null hypothesis. Hence, to test the stationarity property of the data we have carried out unit root analysis following Saikkonen and Lütkepohl (2002) and Lanne *et al.,* (2002) for the equation

$$y = \mu_0 + \mu_1 t + f_t(\theta)^{'}\gamma + x_t \qquad (2)$$

Where $f_t(\theta)^{'}\gamma$ is a shift function and θ and γ are unknown parameters or parameter vectors 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. $f_t^{'} = d_{1t} : \begin{cases} 0, t < T_B \\ 1, \geq T_B \end{cases}$. The 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 the Lanne *et al.*, (2001). They recommend to chose a reasonably large AR order in the first step and then pick the break date which minimizes the GLS objective function used to estimate the parameters of the deterministic part.

After checking the stationary property of the data series of variable which we are utilising for our analysis in the presence of potential structural breaks the next step is to go for cointegration. This paper applies a recent approach developed by Pesaran *et al.*, (2001) and termed as autoregressive distributed lag (ARDL) bounds testing approach to cointegration. This approach is utilized in our paper because of certain advantages of this approach. First, the short- and long- runs parameters are estimated simultaneously. Secondly, it can be applied irrespective of whether the variable are integrated of order zero i.e., *I(0)* or integrated of order one i.e., *I(1)* Thirdly, it has better small sample properties vis-à-vis multivariate cointegration test i.e.,-it is more useful when sample size is small (Narayan, 2004). Fourth, ARDL bounds testing approach to cointegration is free from any problem faced by traditional techniques such as Engle-Granger (1987), Philips and Hansen (1990); Johansen and Juselius (1990); Johansen (1991) and Johansen (1992) maximum likelihood ratio in economic literature. The error correction method integrates the short-run dynamics with the long-run equilibrium, without losing long-run information. The ARDL bounds testing approach involves the unconditional error correction version of the ARDL model to investigate which is being modeled as follows:

$$\Delta \ln TB = \alpha_{\circ} + \alpha_T T + \alpha_{TB} \ln TB_{t-1} + \alpha_{EXR} \ln EXR_{t-1} + \alpha_M \ln M_{t-1} + \alpha_{EG} \ln EG_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln TB_{t-i}$$
$$+ \sum_{j=0}^{q} \alpha_j \Delta \ln EXR_{t-j} + \sum_{l=0}^{n} \alpha_k \Delta \ln M_{t-l} + \sum_{n=0}^{n} \alpha_l \Delta \ln EG_{t-n} + \mu \qquad (2)$$

Where TB is the trade balance, T is time trend function, EXR is exchange rate, M is the broad measure of money supply and EG is Indian gross-domestic product, ln denotes log transformation of the series, Δ denotes first difference of the variable. The decision about cointegration in ARDL bounds testing approach to cointegration depends upon the generated critical bounds by Pesaran *et al.,* (2001). The null hypothesis of no cointegration is $H_{\circ} : \alpha_{TB} = \alpha_{XER} = \alpha_M = \alpha_{EG} = 0$ while the alternative hypothesis of cointegration is $H_a : \alpha_{TB} \neq \alpha_{XER} \neq \alpha_M \neq \alpha_{EG} \neq 0$. Then next step is to compare the calculated F-statistic with lower critical bound (LCB) and upper critical bound (UCB) tabulated by Pesaran et al. (2001). The null hypothesis of no cointegration may be rejected if calculated value of F-statistic is more than upper critical bound. The decision may be about no cointegration if lower critical bound is more than computed F-statistic. Finally, if calculated F-statistic is between UCB and LCB then decision about cointegration is inconclusive. To check the reliability of the results reported by ARDL model, we have conducted the diagnostic and stability tests. In the diagnostic tests, we examine for the presence of serial correlation, incorrect functional form, non-normality and heteroscedisticity associated with the model. The stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals ($CUSUM_{SQ}$).

After evaluating that our specification of the model is correct impulse response functions (IRFs) and variance decomposition are computed[6] in order to analyze the dynamic properties of the system. Impulse response function traces the impact of a shock in a variable into the system, over a period of time (in present study 10 years). More specifically, an IRF traces the effect of a one standard deviation shock to one of the innovations (error terms) and its impact on current and future values of the endogenous variables.

4. Data analysis and empirical findings

First of all descriptive statistics and correlation of variables has been analysed and it is found that all variables to be incorporated in our model have normal distribution at 5% level of significance and there is no evidence of problem of multicollinearity as correlation among the regressors is comparatively low (detailed results are presented in appendix 1, Table 1). In the next step stationary property of the data series of all test variables has been found through Saikkonen and Lütkepohl (2002) unit root test and results are reported in Table-1.

Table 1: SL Unit root analysis

Unit Root Test with structural break: Constant and Time trend included					
Variables	Shift dummy and used break date is 1991	Saikkonen and Lütkepohl (k)	Variables	Shift dummy and used break date is 1976	Saikkonen and Lütkepohl (k)
$\ln EXR_t$	Yes	-0.9626 (2)	$\ln TB_t$	Yes	-2.4670 (0)
$\Delta \ln EXR_t$	Yes	-2.6488* (0)	$\Delta \ln TB_t$	Yes	-6.1296***(0)
	Shift dummy and used break date is 1975	Saikkonen and Lütkepohl (k)	Variables	Shift dummy and used break date is 1975	Saikkonen and Lütkepohl (k)
$\ln M_t$	Yes	1.5600 (1)	$\ln EG_t$	Yes	4.3231 (0)
$\Delta \ln M_t$	Yes	-4.4245***(0)	$\Delta \ln EG_t$	Yes	-4.9813***(0)

Note: (1) ***, ** and * denotes significance at 1%, 5% and 10% level respectively. (2)"k" Denotes lag length. (3) Critical values are -3.55, -3.03, and -2.76 which are based on Lanne et al. (2002) at 1%, 5%, and 10% respectively.

It is evident from table 1 that all variables are non-stationary at their level form. Further, all series are transformed into first difference form and unit root analysis has been conducted for the transformed series and we found that in the transformed series all variables has turned to be stationary (except LM, which was again transformed in to second difference form and in second difference form it become stationary). This implies that all variables are first order autoregressive i.e. AR(1). Therefore, to proceed further, for cointegration requires careful examination. Since cointegration is affected by lag incorporated therefore, lags length selection test has been performed[7] and we found that all criteria's of lag length selection test suggest lag order of one to be used for the analysis. Further, we have proceeded to test the evidence of cointegration among the test variables through the application of ARDL bounds testing approach to examine the long run relationship. Results of ARDL bounds testing approach to cointegration are pasted in Table-2.

Table-2: The Results of ARDL Cointegration Test

Panel I: Bounds testing to cointegration

Estimated Equation	$\ln TB = f(\ln EXR, \ln M, \ln EG)$	
Optimal lag structure	(2, 1, 1, 0)	
F-statistics (Wald-Statistics)	9.651*	
Significant level	Critical values (T = 44)#	
	Lower bounds, $I(0)$	Upper bounds, $I(1)$
1 per cent	10.265	11.295
5 per cent	7.210	8.055
10 per cent	5.950	6.680
Panel II: Diagnostic tests	Statistics	
R^2	0.7129	
Adjusted- R^2	0.5898	
F-statistics (Prob-value)	5.7944 (0.0006)	
Durbin-Watson	1.9659	
J-B Normality test	0.0373 (0.9815)	
Breusch-Godfrey LM test	0.8462 (0.4405)	
ARCH LM test	0.9074 (0.4126)	
White Heteroskedasticity Test	0.4705 (0.9153)	
Ramsey RESET	0.3864 (0.5394)	

Note: The asterisk * denote the significant at 1% level of significance. The optimal lag structure is determined by AIC. The probability values are given in parenthesis. # Critical values bounds computed by surface response procedure (Turner, 2006).

It is evident from Table-2 that the test variables included in equation-2 are cointegrated as calculated F-statistic i.e. 9.651 is higher than the upper critical bound i.e. 8.055 at 5 % level of significance using unrestricted intercept and unrestricted trend. In the next step we have estimated long run cointegration equation and results are reported in Table-3.

Table-3: The Long Run Results of OLS Regression

Dependent Variable = lnTB			
Panel-I			
Variable	Coefficient	T-Statistic	Prob-value
Constant	0.9159	0.5907	0.5582
$lnTB_{t-1}$	0.6406	5.9972*	0.0000
lnEXR	0.2577	2.7543*	0.0090
lnM	-0.0856	-2.0297**	0.0494
lnEG	-0.0742	-0.3730	0.7112
Panel-II diagnostic Test			
R-squared		0.6313	
Adjusted R-squared		0.5925	
F-statistics		16.2698*	
Durbin-Watson		1.8341	
Breusch-Godfrey LM Test		0.5011 (0.6100)	
ARCH LM Test		0.0591 (0.9427)	
W. Heteroskedasticity Test		1.4014 (0.2166)	
Ramsey RESET		0.18391 (0.6662)	

Note: * and ** indicates significance at 1% and 5% respectively while Prob-values are shown in parentheses

The results in Table-3 reveal that impact of one year lagged trade balance and exchange rate is positive and highly significant on the Indian trade balance while impact of money supply is negative and significant. Further, impact of EG is also negative on Indian trade balance but it is not significant. Negative and significant impact of money supply shows that an increase in money supply by Reserve Bank of India (RBI), Indian monetary authority, increases purchasing power of the nations and hence raises demand for more imported goods which ultimate leads to worsen the overall trade balance. The positive sign on the exchange rate (EXR) variable represents a devaluation of currency causes an improvement in trade balance in long run. This is findings is consistent with Shahbaz et al. (2011) for Pakistan, Ratha (2010) in case of India but contrast with Gylfason and Schmid (1983), and Bahmani-Oskooee (1998) who found no long-run impact. Reason may be due the time period which is studied in both studies. Therefore, our analysis reveals that depreciation in exchange rate increases the trade balance while an increase money supply is linked with deterioration of trade balance.

The diagnostic tests show that residual terms of both models are normally distributed and there is no evidence of serial correlation. The autoregressive conditional heteroskedasticity and white heteroskedasticity do not seem to exit. This show that our model is well functioned as shown by Ramsey Reset F-statistics in Table-3.

After having long discussion over long run findings, the next step is to present the results pertaining to short run dynamics of the test variables using ECM version of ARDL model. Results are reported in Table 4. It is evident from Table-4 that in the short run, lagged trade balance has positive impact on the current trade balance while lagged exchange rate carries negative and significant on the trade balance. Interestingly, we find that depreciation of Indian rupee in terms of US $ (that more Indian rupee is required to purchase one US $) has positive impact on the trade balance. The impact of economic growth and money supply on trade balance is negative and positive and it is statistically significant at 10% and 5% respectively. This implies that as economic growth rate increases in India this will be particularly import base i.e., India's economic growth increases India's imports vis-a-vis exports and hence worsens terms of trade. This provides support for Keynesian view that 'income increases will encourage general public to purchase more imported goods and thus deteriorate the trade balance[8]. Money supply found to be having positive impact meaning thereby increase in money supply increases domestic investment via reduction in the interest rate and hence promotes production and exports and helps in making favourable terms of trade. Error correction term carries negative and highly significant sign indicating that any disequilibrium will get corrected with the speed of adjustment of 19.38% rate per year.

Table-4: The Short Run OLS Regression Results

Dependent Variable = ΔlnTB			
Panel-I			
Variable	Coefficient	T-Statistic	Prob-value
Constant	-0.2595	-2.1984**	0.0346
$\Delta lnTB_{t-1}$	0.1463	7.1668*	0.0000
ΔlnEXR	0.4118	1.6710***	0.1036
$\Delta lnEXR_{t-1}$	-0.3086	-1.7065***	0.0968
ΔlnEG	-0.1214	-2.0870**	0.0442
ΔlnM	0.1898	2.5243**	0.0163
ECM_{t-1}	-0.1938	-6.3186*	0.0000

Panel-II diagnostic Test	
R-squared	0.5862
Adjusted R-squared	0.5153
F-statistics	8.26653*
Durbin-Watson	1.6985
J-B Normality Test	1.0134 (0.6024)
Breusch-Godfrey LM Test	0.6176 (0.5453)
ARCH LM Test	1.2043 (0.3114)
White Heteroskedasticity Test	1.1447 (0.4072)
Ramsey RESET	0.0190 (0.8912)

Note: *(**)*** indicates significance at 1% (5%) 10% and Prob-values are shown in parentheses.

Further, as Hansen (1992) cautions that in the time series analysis estimated parameters may vary over time therefore, we should test the parameters stability test since unstable parameters can result in model misspecification and so may generate the potential biasness in the results. Therefore, we have applied the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square ($CUSUM_{SQ}$) tests proposed by Brown *et al.*, (1975) to assess the parameter constancy. The null hypothesis to be tested in these two tests is that the regressions coefficients are constant overtime against the alternative coefficients are not constant. Brown *et al.,* (1975) pointed out that these residuals are not very sensitive to small or gradual parameter changes but it is possible to detect such changes by analyzing recursive residuals. They argued that if the null hypothesis of parameter constancy is correct, then the recursive residuals have an expected value of zero and if the parameters are not constant, then recursive residuals have non-zero expected values following the parameter change. We find the evidence of parameter consistency as in both cases that is in case of CUSUM and $CUSUM_{SQ}$ plot have been within the critical bounds of 5 % level of significance (see the appendix 2). Finally, short run model seems to pass diagnostic tests successfully in first stage. The empirical evidence reported in Table-4 indicates that error term is normally distributed and there is no serial correlation among the variables in short span of time. Model is well specified as shown by F-statistic provided by Ramsey Reset test. Finally, short run model passes the test of autoregressive conditional heteroscedisticity and same inferences can be drawn for white heteroscedisticity.

Since short run and long run model have passed the diagnostic tests successfully therefore we can proceed to construct IRFs and VDs. IRFs are presented in the following figure 1 and VDs are shown in table 1 in appendix 3.

Figure-1 about here

IRFs analysis reveals that one standard deviation shock to exchange rate has positive impact on trade balance, negative impact on money supply and GDP (denoted by EG). Similarly, one standard deviation shock to money supply has negative impact on trade balance and GDP and "J" shaped impact on exchange rate. One standard deviation shock to GDP has negative impact on trade balance and exchange rate and positive (in the long run i.e., after 6^{th} year) impact on money supply. One standard deviation shock to trade balance has "J" shaped impact on exchange rate, very high and positive impact on money supply but negative impact on GDP. Similar conclusions can be drawn from the results of variance decomposition analysis in appendixes 3.

5. Conclusion and Policy Implications

The present study has attempted to analyze whether bilateral trade of India with US has any impact on the trade deficit of India after analyzing the important role of US and her policies, trade policies particularly, in India. Therefore, in this context study has made an attempt to analyze the static and dynamic relationship between the bilateral trade and trade deficit. Stationary property of data is analysis by using through SL (2002) unit root test and long run relationship is examined through ARDL approach to cointegration. Static and dynamic relationship is tested through Engle-Granger approach and IRFs and VDs.

Study found that all variables have autoregressive of order one except money supply variable after incorporating structural breaks in the system. We also find the evidence of cointegration relationship among the test variables using unrestricted intercept. Empirical evidence reports that in the long run impact of one year lagged trade balance and exchange rate is positive and highly significant on the Indian trade balance while impact of money supply is negative and significant. Impact of GDP is also negative on Indian trade balance though it is insignificant. However, in the case of short run we find that lagged trade balance has positive impact on the current trade balance while lagged exchange rate carries negative and significant affect on the trade balance. This finding is similar to the long run findings. In addition to it, short run analysis also reveals that, contrast to long run analysis, GDP has significant negative impact and money supply has positive significant impact. Negative and highly significant sign of error correction term indicates that any disequilibrium will get corrected with the speed of adjustment of 19.38% rate per year. Dynamic analysis (that IRFs and VDs analysis) reveals that one standard deviation shock to exchange rate has positive impact on trade balance and one standard deviation shock to money supply has negative impact on trade balance while one standard deviation shock to GDP has negative impact on trade balance.

Hence, findings of this study indicate that policymakers in India may use exchange rate policy to promote large balance of trade surpluses (in the context of US particularly) and hence economic growth, particularly in the long run. However, in the short run we find that exchange rate deteriorates trade balance. Hence, the J-curve phenomenon is seemed to be observed and the generalized impulse response analysis confirms that. In addition to that study find money supply also has positive impact on the trade balance. Therefore, our analysis suggests that, in order to achieve the desired effects on trade balance in the long run, the India should depend on policy that focuses on the variable of real exchange rate (which is the nominal exchange rate to aggregate price level) and money supply. Further, the devaluation-based policies that may get affected through changes in nominal exchange rate must cooperate with stabilization policies by ensuring domestic price level stability to achieve the desired level of trade balance. However, the causation to adopt such policy must be taken as it has serious negative economic impact also. For example devaluation-based policies would cause increases in the cost of import that might lead to bring in what we call "imported-inflation" that would damage the domestic firms primarily to those that are based on the use of imported inputs. In addition to that, the devaluation-based policies may not effective in improving trade balance if other countries also apply the devaluation-based policies at the same time. Further, in order to minimize the impact of devolution based policy, India should focus on the implementation of the policies that focuses on the production of imported-substituted goods i.e., import substitution policy might serve purpose in better way. This type of policy has advantage in two ways. First, it helps in improving domestic income and second, it helps in improving in trade balance. The study clearly indicates that depreciations of exchange rate have been positively associated with improvement of balance of trade in the India. However, complete credibility of trade partners on the exchange rate is important for stable trade flow.

Therefore, the implications of studies finding are very clear. They suggest that, provided the sufficient time, devaluations can improve the balance of trade of India. Hence, policy makers can thus improve the trade balance by changing the nominal exchange rates, given that such nominal exchange rate realignments are not offset by relative domestic price movements. Put differently, findings of the study provide empirical support for the elasticity optimists who view exchange rate changes as effective mechanisms for correcting trade imbalances. Further, government should focus on policies through money supply too but not income or economic growth in both case short and long run, economic growth has been found to having negative impact in the Indian context. This implies that with the growth of the income, Indian consumption shifts over imported commodities from US and hence deteriorates trade balance. Since, Indian economy has been traditionally aggrigrarian which is transforming very rapidly towards service sector however, a huge potential lies in the agriculture sector to earn foreign income and help in improving trade balance in two ways particularly first, by preventing the imports of consumption goods and second, by exports of the commodities. And for that government should open agricultural research and technical institutes to enhance the market share at local and international level. In addition to that to perk up the markets share of exports help of marketing activities i.e. good advertisements, well communication, introducing the hidden qualities of new exports items through research should also be utilised. Incentive policy should be explored to enhance exports especially to agricultural sector.

In nut shell few key points emerge from our empirical investigation. First, a depreciation of a Indian country's currency can lead to an improvement in her trade balance in the long run but in short run it deteriorates. Second, long run equilibrium will be restored if any deviation occurs in the exchange rate with the speed of adjustments 19% annual basis, though not very high. Third, the use of the impulse response function confirms the existence of the J-curve phenomenon for India in our sample period. Fourth, our results point to the potential role of money supply in influencing the trade balance i.e., other things being equal, higher money supply may sustain a trade deficit longer. Fifth, our results indicate that an increase in aggregate income of India, that is GDP can lead to deteriorate in her trade balance with US.

Endnotes

1. For a broader discussion of the bilateral relationship, see CRS Report RL33529, *India-U.S. Relations*, K. by Alan Kronstadt.
2. Included countries are Australia, Austria, Belgium, Canada, Colombia, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Mauritius, Morocco, Netherlands, Norway, New Zealand, the Philippines, South Africa, Spain, Sweden, Syria, Tunisia, the UK, the USA, and Venezuela.
3. Shahbaz (2009) and Wahid and Shahbaz (2009) found that nominal devaluation leads the real devaluation in Pakistan and Philippines respectively.

4. Absorption approach, in short run, predicts that real value of money stock falls after an increase in prices i.e. caused by nominal devaluation and subsequently improves the trade balance. This is due to the fact that people will reduce spending relative to income with an increase in prices which occurred due to devaluation in order to restore their real balances and holding other financial assets.
5. Exchange rate changes (devaluation), in the view of Keynesian approach, affect the relative prices of domestic goods in domestic currency in two ways. First, through a substitution effect that causes a shift in the composition of demand from foreign goods to domestic goods that is the exchange rate change causes an expenditure-substituting effect. Second, through income effect, this would increase absorption, and then reduce the trade balance.
6. To compute IRFs generalized approach has been preferred over Choleskey orthogonalization approach or other orthogonalization approaches because it is invariant of ordering of the variables as results of IRFs are sensitive to the ordering of the variables
7. Result of lag length selection is presented in table 2 in the appendix 1.
8. See Shahbaz et al. (2011) for more details.

Reference

Alexander, S. S. (1952) Effects of devaluation on a trade balance, *International Monetary Fund Staff Papers*, 2, pp, 263-78.

Alexander, S. S. (1959) Effects of devaluation: a simplified synthesis of elasticities and absorption approaches, *American Economic Review*, 49, pp, 21-42.

Aziz, N. (2008) The Role of Exchange Rate in Trade Balance: Empirics from Bangladesh. University of Birmingham, UK.

Bahmani-Oskooee, M and Goswami, G. G. (2004) Exchange rate sensitivity of japan's bilateral trade flows, *Japan and the World Economy*, 16, pp, 1-15.

Bahmani-Oskooee, M and Niroomand, F. (1998) Long-run price elasticities and the Marshall Lerner condition revisited, *Economics Letters*, 61, pp, 101-109.

Bahmani-Oskooee, M. (1986) Determinants of international trade flows: the case of developing countries, *Journal of Development Economics*, 20, pp, 107–23.

Bahmani-Oskooee, M and Brooks, T. J. (1999) Bilateral J-curve between US and her trading partners, *Weltwirtschaftliches Archiv*, 135, pp, 156–165.

Bahmani-Oskooee, M. (1998) do exchange rates follow a random walk process in Middle eastern countries? *Economics Letters*, 58, pp, 339-344.

Bahmani-Oskooee, M., Goswami, G. G and Talukdar, B. K. (2005) The bilateral J-curve: Australia versus her 23 trading partners, *Australian Economic Papers*, (44), pp, 110-120.

Bahmani-Oskooee, M and Harvey, H., (2010) The J-curve: Malaysia versus her major trading partners, *Applied Economics*, 42, pp, 1067-1076.

Bickerdike, C. F. (1920) The instability of foreign exchanges, *The Economic Journal*, 30(117), pp, 118-122.

Brown, R. L., Durbin, J and Evans, J. M. (1975) Techniques for testing the constancy of regression relations over time, *Journal of the Royal Statistical Society*, (37), pp, 149-163.

Chiu, Y-B., Lee, C-C and Sun, C-H. (2010) The U.S. trade imbalance and real exchange rate: an application of the heterogeneous panel cointegration method, *Economic Modelling*, 27, pp, 705-716.

Corden, W. M. (1994) *Economic Policy, Exchange Rates and the International System*, (Chicago: The University of Chicago Press).

Cushman, D. O. (1990) US bilateral trade equations, forecasts and structural stability, *Applied Economics*, 22, pp, 1093-1102.

Haynes, S. E., Hutchison, M. M and Mikesell, R. F. (1996) US-Japanese bilateral trade and the yen-dollar exchange rate: an empirical analysis, *Southern Economic Journal*, 52, pp, 923-932.

Dickey, D. A and Fuller, W. A. (1981) Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica,* 49, pp, 1057-1072.

Dickey, D. A and Fuller, W. A. (1979) Distribution of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, 74, pp, 427-431.

Dornbusch, R. (1973) Devaluation, money and non-traded goods, *American Economic Review*, 63, pp, 871- 80.

Frenkel, J. A., and Johnson, H. G. (1977) The monetary approach to the balance of payments, in J. A. Frenkel and H. G. Johnson (Eds.), *The Monetary Approach to the Balance of Payments*.

Goldstein, M and Khan, M. (1978) The supply and demand for exports: a simultaneous approach, *Review of Economics and Statistics*, 60, pp, 275-286.

Goldstein, M and Khan, M. (1976) Large versus small price changes and the demand for imports, *IMF Staff Papers*, 23, pp, 200-225.

Gylfason, T and Schmid, M. (1983) Does devaluation cause stagflation? *Canadian Journal of Economics*, 16, pp, 641-654.

Halicioglu, F. (2008) The bilateral J-curve: Turkey versus her 13 trading partners, *Journal of Asian Economics*, 19, pp, 236-243.

Hansen, B. E (1992) Tests for Parameter Stability in Regressions with I(1) Processes, *Journal of Business and Economic Statistics*, 10, pp, 321-335.

Harberger, A. C. (1950) Currency depreciation, income, and the balance of trade, *Journal of Political Economy*, 58, pp, 47-60.

Harve, D. B. G., Shen, Y and Amed, A. (2010) The effects of real exchange rate on trade balance in cote d'ivoire: evidence from the cointegration analysis and error-correction models. Shanghai University 99 Shangda Road, Shanghai 200444, China.

Hatemi-J, A. and Irandoust, M. (2005) Bilateral trade elasticities, Sweden versus her trade partners, *American Review of Political Economy*, 3, pp, 38-50.

Haynes, S. E and Stone, J. A. (1983) Secular and cyclical responses of the us trade to income: an evaluation of traditional models, *Review of Economics and Statistics*, 65, pp, 87-95.

Houthakker, H. S and Magee, S. (1969) Income and price elasticities in the world trade, *Review of Economics and Statistics*, 51, pp, 111-125.

Irandoust, M., Ekblad, K and Parmler, J. (2006) Bilateral trade flows and exchange rate sensitivity: evidence from likelihood based panel cointegration, *Economic Systems*, 30, pp, 170-183.

Harrigan, J and Vanjani, R. (2003) Is Japan's trade (still) different? *Journal of the Japanese and International Economies*, 17, pp, 507-519.

Johansen, S and Juselius, K. (1990) Maximum likelihood estimation and inference on cointegration with applications to the demand for money, *Oxford Bulletin of Economics and Statistics*, 52, pp, 169-210.

Johansen, S. (1991) Estimation and hypothesis testing of cointegrating vectors in gaussian vector autoregressive models, *Econometrica*, 59, pp, 1551–1580.

Johansen, S. (1992) Cointegration in partial systems and the efficiency of single-equation analysis, *Journal of Econometrics*, 52, pp, 389–402.

Kenen, P. B. (1985) Macroeconomic Theory and Policy: How the Closed Economy Model was Opened, in R. Jones and P. Kenen (Eds.), *Handbook of International Economics*, Vol. 2, Amsterdam, North-Hollan, pp: 625-77.

Khan, M. S. (1974) Import and export demand in developing countries, *IMF Staff Papers*, 21, pp, 678-693.

Khan, M. S. (1975) The structure and behaviour of imports of Venezuela, *Review of Economics and Statistics*, 57, pp, 221-224.

Kim, A., (2009) An empirical analysis of korea's trade imbalances with the US and Japan, *Journal of the Asia Pacific Economy*, 14, pp, 211-226.

Kreinin, M. E. (1967) Spurious regression and residual-based tests for cointegration in panel data, *Journal of Econometric*, 90, pp, 510-516.

Krueger, A. O. (1983) *Exchange-Rate Determination*, (Cambridge: Cambridge University Press).

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P and Shin, Y. (1992) testing the null hypothesis of stationarity against the alternative of a unit root: how sure are we that economic time series have a unit root? *Journal of Econometrics*, 54, pp, 159 - 178.

Lal, A and Lowinger, T., (2002) The J-curve: evidence from East Asia, *Journal of Economic Integration*, 17, pp, 397-415.

Lanne, M., Lutkepohl, H and Saikkonen, P. (2002) Comparison of unit root tests for time series with level shifts, *Journal of Time Series Analysis*, 27, pp, 663-685.

Lindert, P. H., and Kindleberger, C. P. (1982) *International Economics*, (Homewood: Irwin Series in Economics, Homewood, IL).

Liu, L., Fan, K and Shek, J. (2007) Hong Kong's trade patterns and trade elasticities, *Hong Kong Monetary Authority Quarterly Bulletin*, March, pp, 21-31.

Meade, J. E. (1951) *The Balance of Payments*, (Oxford: Oxford University Press).

Metzler, L. (1948) A *Survey of Contemporary Economics*, (Homewood: Richard D. Irwin, INC, Homewood, IL).

Bahmani-Oskooee, M and Harvey, H. (2010) The J-curve: Malaysia versus her major trading partners, *Applied Economics*, 42, pp, 1067-1076.

Mundell, R. A., (1968) *International Economics*, (NY: Macmillan).

Mundell, R. A., (1971) *Monetary Theory, 1971*, (Pacific Palisades).

Nadenichek, J. (2000). The Japan-US trade imbalance: a real business cycle perspective, *Japan and the World Economy*, 12, pp, 255-271.

Narayan, P. K., (2006) Examining the relationship between trade balance and exchange rate: the case of China's trade with the USA, *Applied Economics Letters*, 13, pp, 507-510.

Harb, N., (2007) Trade between Euro zone and Arab countries: a panel study, *Applied Economics*, 39, pp, 2099-2107.

Ng, S and Perron, P. (2001) Lag length selection and the construction of unit root test with good size and power, *Econometrica*, 69, pp, 1519-1554.

Petrović, P and Gligorić, M. (2010) Exchange rate and trade balance: J-curve effect, *Panoeconomicus*, 1, pp, 23-41.

Pesaran, M. H., Shin, Y and Smith, RJ. (2000) Structural analysis of vector error correction models with exogenous I(1) variables, *Journal of Econometrics*, 97, pp, 293–343.

Pesaran, M. H., Shin, Y and Smith, RJ. (2001) Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, 16, pp, 289–326.

Phillips, P. C. B and B. E, Hansen. (1990) statistical inference in instrumental variables regression with I(1) processes, *Review of Economic Studies*, 57, pp, 99-125.

Phillips, P. C. B. and P. Perron. (1988) Testing for a unit root in time series regression, *Biometrica*, 75, pp, 335-446.

Ratha, A. (2010) Does devaluation work for India? *Economics Bulletin*, 30, pp, 247-264.

Robinson, J. (1947) *Essays in the Theory of Employment*, *1947*, (Oxford: Oxford, Basil Blackwell).

Saikkonen, P and Lütkepohl, H. (2002) Testing for a unit root in a time series with a level shift at unknown time, *Econometric Theory*, 18, pp, 313-348.

Shahbaz, M., (2009) On nominal and real devaluations relation: an econometric evidence for Pakistan, *International Journal of Applied Econometrics and Quantitative Studies*, 9, pp, 86-108.

Shahbaz, M., Jalil, A and Islam, F. (2010) Real exchange rate changes and trade balance in pakistan: a revisit, *MPRA.ub.uni-muenchen.de/27631*.

Shahbaz, M., Awan, R and Ahmad, K. (2011) The exchange value of the pak-rupee & pak-trade balance: an ardl bounds testing approach, *Journal of Developing Areas*, 44, pp, 69-93.

Tiwari, A. K. (2009) Globalization and wage inequality: an empirical study for a developing country, *Conference Issue of Indian Economic Society*, l, pp, 914.

Tiwari, A. K. (2010a) Globalization and wage inequality: a revisit of empirical evidences with new approach, *Journal of Asian Business Management*, 2, pp, 173-187.

Tiwari, A. K. (2010b). Liberalization and wage inequality: evidence from indian manufacturing sector: a review of literature, *Asian Economic Review*.

Wahid, N. M. A and Shahbaz, M. (2009) Does nominal devaluation precede real devaluation? the case of Philippines, *Transition Studies Review*, 16, pp, 47–61.

Wang, J. and Ji, A. G. (2006) Exchange rate sensitivity of China's bilateral trade flows, *BOFIT Discussion Papers* 19.

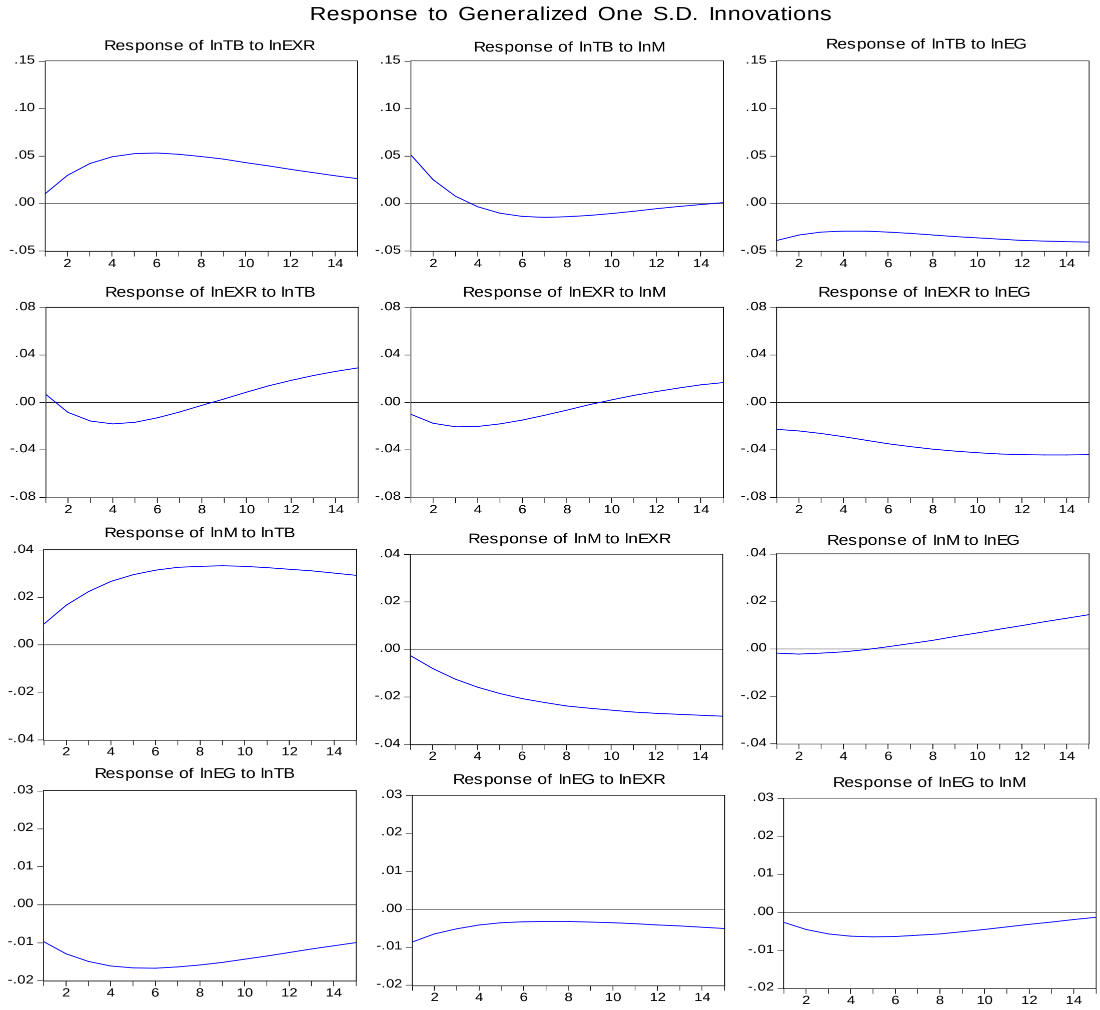
Warner, D and Kreinin, M. E. (1983) Determinants of international trade flows, review of economics and statistics, 65, pp, 96-104.

Whitman, M. V. (1975) Global monetarism and the monetary approach to the balance of payments, *Brookings Papers on Economic Activity*, 3, pp, 491-536.

Wilson, J. F. and Takacs, W. E. (1979) Differential responses to price and exchange rate influences in the foreign trade of selected industrial countries, *Review of Economics and statistics*, 61, pp, 267-279.

Yol, M. A and Baharumshah, A. Z. (2007) Estimating exchange rate and bilateral trade balance relationships: the experience of sub-Saharan African countries, *South African Journal of Economics*, 75(1), pp, 35-51.

Figure-1 Generalized Impulse Response Function



Appendix-1

Table-1: Descriptive Statistics and Correlation Matrix

Variables	lnTB	lnEXR	lnEG	lnM

Mean	-0.2805	2.7976	9.7301	11.864
Median	-0.2619	2.5481	9.6189	11.859
Maximum	0.0977	3.8838	10.5756	15.283
Minimum	-0.6195	1.5602	9.2433	8.6668
Std. Dev.	0.1772	0.7630	0.3856	2.0196
Skewness	-0.1095	0.2181	0.6418	0.0158
Kurtosis	2.0735	1.4088	2.2452	1.7512
Jarque-Bera	1.6617	4.9903	4.0658	2.8605
Probability	0.4356	0.0824	0.1309	0.2392
lnTB	1.0000			
lnEXR	0.2156	1.0000		
lnEG	-0.2362	-0.2534	1.0000	
lnM	-0.0572	-0.2179	0.0269	1.0000

Table-3: Lag Length Criteria

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6.2945	NA	1.94e-05	0.5021	0.6693	0.5630
1	307.1544	550.4470*	9.75e-12*	-14.0075*	-13.1716*	-13.7031*
2	321.4166	22.2628	1.09e-11	-13.9227	-12.4181	-13.3748
3	327.3689	8.1299	1.89e-11	-13.4326	-11.2593	-12.6412

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

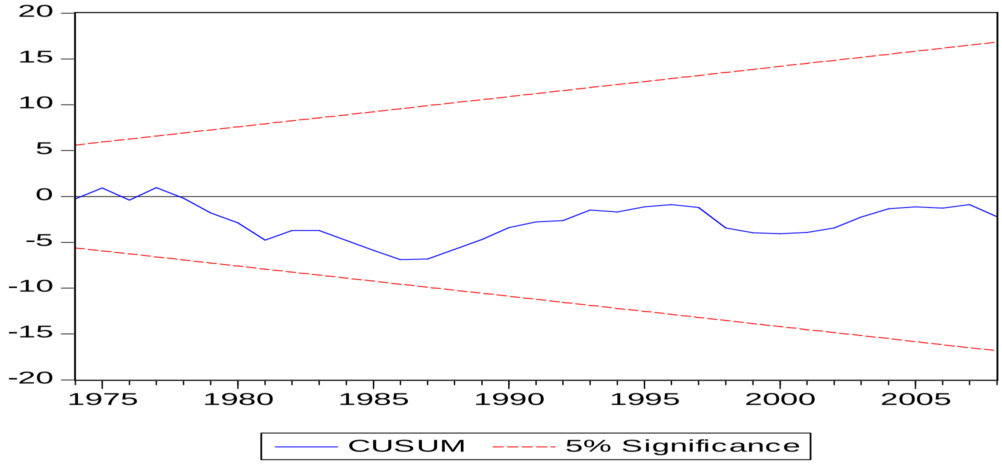
SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Appendix 2

Figure-1

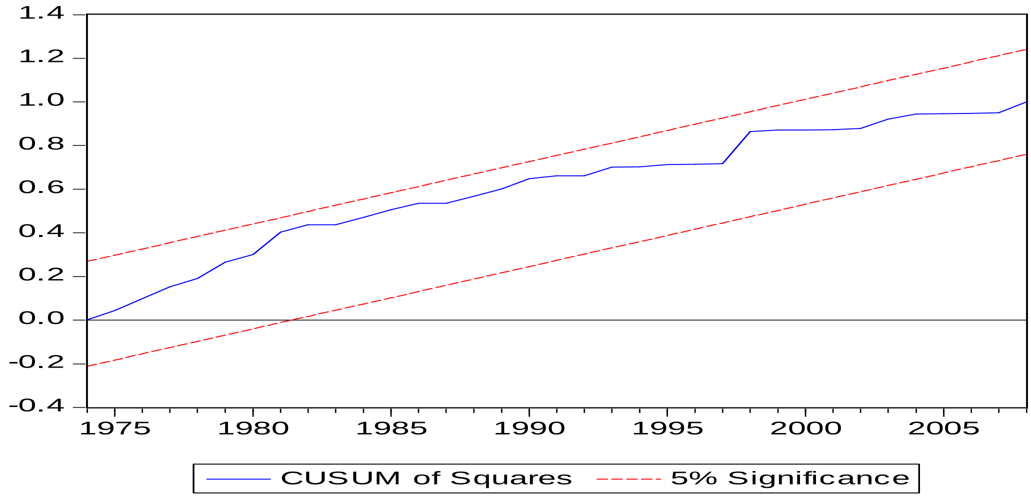
Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Figure-2

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Appendix 3

Table-5: Variance Decomposition Approach

Variance Decomposition of lnTB

Period	S. E.	lnTB	lnEXR	lnM	lnEG
1	0.1111	100.0000	0.0000	0.0000	0.0000
3	0.1422	89.4658	10.1637	0.0425	0.3278
5	0.1609	70.9967	27.3143	0.0958	1.5931
7	0.1800	56.8735	39.3064	0.1158	3.7041
9	0.1963	48.0081	45.4821	0.1142	6.3954
10	0.2031	44.8776	47.1145	0.1104	7.8973
11	0.2091	42.3491	48.0756	0.1059	9.4692
12	0.2144	40.2974	48.5186	0.1015	11.0823
13	0.2192	38.6359	48.5598	0.0974	12.7068
14	0.2236	37.3019	48.2907	0.0936	14.3136
15	0.2277	36.2459	47.7866	0.0902	15.8771

Variance Decomposition of lnEXR

Period	S. E.	lnTB	lnEXR	lnM	lnEG

1	0.0731	0.8699	99.1300	0.0000	0.0000
3	0.1335	2.0295	97.0318	0.0051	0.9335
5	0.1720	3.2392	93.8613	0.0321	2.8671
7	0.1964	3.0909	91.2572	0.0928	5.5589
9	0.2122	2.6836	88.3447	0.1892	8.7823
10	0.2183	2.6958	86.5698	0.2488	10.4854
11	0.2237	2.9532	84.5519	0.3135	12.1812
12	0.2287	3.4848	82.3134	0.3813	13.8204
13	0.2335	4.2860	79.9026	0.4499	15.3613
14	0.2381	5.3268	77.3827	0.5174	16.7729
15	0.2427	6.5605	74.8208	0.5822	18.0363

Variance Decomposition of lnM

Period	S. E.	lnTB	lnEXR	lnM	lnEG
1	0.0190	21.2516	3.24598	75.5023	0.0000
3	0.0452	41.9607	15.5161	42.3341	0.1889
5	0.0713	48.0539	21.9438	29.4019	0.6002
7	0.0953	49.5326	25.7001	23.5597	1.2075
9	0.1167	49.2414	28.2585	20.4890	2.0109
10	0.1265	48.7522	29.2783	19.4842	2.4852
11	0.1357	48.1165	30.1761	18.7009	3.0063
12	0.1444	47.3723	30.9750	18.0800	3.5725
13	0.1526	46.5467	31.6913	17.5804	4.1815
14	0.1604	45.6602	32.3366	17.1726	4.8306
15	0.1679	44.7283	32.9197	16.8351	5.5167

Variance Decomposition of lnEG

Period	S. E.	lnTB	lnEXR	lnM	lnEG
1	0.0276	12.2779	7.7205	0.0361	79.9652
3	0.0481	20.8730	4.3714	0.0436	74.7119
5	0.0620	26.5233	2.9221	0.0663	70.4881
7	0.0725	29.8026	2.2426	0.1081	67.8466
9	0.0806	31.4872	1.9146	0.1724	66.4256

10	0.0840	31.9127	1.8324	0.2138	66.0409
11	0.0870	32.1305	1.7932	0.2617	65.8144
12	0.0898	32.1806	1.7927	0.3161	65.7105
13	0.0922	32.0952	1.8283	0.3770	65.6994
14	0.0945	31.9007	1.8981	0.4443	65.7567
15	0.0965	31.6187	2.0004	0.5181	65.8626