

## DETERMINANTS OF THE TRADE BALANCE IN INDIA. EVIDENCE FROM A POST-LIBERALISATION PERIOD

**Waseem A. Parray\***

Department of Economics, University of Kashmir, India  
Email: parraywaseem.scholar@kashmiruniversity.net

**Suadat H. Wani**

Department of Economics, University of Kashmir, India  
Email: suadat.scholar@kashmiruniversity.net

**Effat Yasmin**

Department of Economics, University of Kashmir, India  
Email: fgulwani@gmail.com

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**Abstract:** The present study investigates trade balance determinants in post-liberalization India from 1991 to 2020. The main aim of this study is to test the validity of the J-curve and Marshal-Lerner condition and examine the impact of other related macroeconomic variables, including foreign income, exchange rate, domestic prices, and domestic demand on the country's trade balance. To achieve this objective, bounds tests and error correction model within asymmetric and symmetrical framework was used for estimation. In addition, variance decomposition analysis was applied to examine the dynamic interaction of selected variables. The results indicate the absence of the 'J-curve' effect and 'Marshall-Lerner' condition in India. Further, the results indicate that domestic prices, domestic demand, and money supply have negative signs, whereas exchange rate and world demand have positive signs in the long and short-run. The results from the variance decomposition indicate that as compared to other variables, the exchange rate highly contributes to forecasting error variance of trade balance in the case of India

**Keywords:** Trade balance; Exchange rate; J-curve; ARDL; NARDL.

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\* Corresponding author: Waseem A. Parray. E-mail: parraywaseem.scholar@kashmiruniversity.net

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## 1. Introduction

Trade has long been an essential engine of global economic growth and development. It is a key instrument for increasing the social and economic performance of emerging countries, particularly the developing ones (UNCTAD, 2005). The benefits can be seen in different ways like rapid economic growth, increasing employment opportunities, low inflation, and poverty reduction (Lotfalipoure, Montazeri & Sedighi, 2013; Karam & Zaki, 2015; Sakyi, Vilaverde & Maza, 2015). Nonetheless, it should be noted that whether or not a country reaps the advantages of international trade that may be seen in its trade balance position, which is frequently seen as favorable or unfavorable for the economy in surplus or deficit (Akoto & Sakyi, 2019). According to international trade theories, fluctuations in the exchange rate affect both imports and exports. A domestic currency devaluation increases exports and decreases imports which leads to improvement in the trade balance. Nevertheless, this improvement in the balance of trade is not instantaneous, as prior contracts or purchases remain unchanged following a depreciation whereas, price adjustment has an immediate effect. Hence, the value of export payment falls, and import payment rises. This brief worsening in the trade balance of a country followed by the long-run improvement is termed as the 'J-curve' effect (Sajad and Javed, 2020).

Theoretically, the exchange rate affects both imports and exports, which may be investigated using the 'Marshall-Lerner' (M-L) condition and the "J-curve" effect. According to trade theories, the beneficial effect of devaluation is contingent upon the export and import elasticities. The trade balance will improve following currency devaluation if the export and import elasticities are greater than one. Conversely, if the sum of export and import elasticities is less than one, then currency devaluation would deteriorate the trade balance. On the other hand, if the total of export and import elasticities is equal to one, the trade balance may remain unchanged during a currency depreciation.

The association between the balance of trade and the exchange rate has been the subject of much investigation over the last several decades, and much work has been done on both the empirical and theoretical sides of the issue. Nevertheless, no succinct conclusion has been reached. According to most of the research cited earlier, the association between the balance of trade and exchange rate has been considered symmetrical. That is, the response of trade balance to exchange rate fluctuations is considered to be identical for currencies depreciation and appreciation. When negative and positive deviations from equilibrium interact nonlinearly, asymmetry can develop at the point at which they revert to the mean or variation in the pace at which positive and negative departures from equilibrium revert to equilibrium (Arize and Malindretos, 2012). The symmetrical linear models have been used throughout the literature to assert that the adjustment path for

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movements in exchange rates and trade balances is equivalent in terms of adjustment speed.

A plethora of studies assumed a symmetric relationship between exchange rate volatility and the trade balance. However, questions have been raised regarding this symmetric relationship. Therefore, scholars have acknowledged the possibility of asymmetric links into an analytical and theoretical framework (Bahmani-Oskooee & Beak 2016; Arize et al. 2017). The scholars reported that currency devaluation impacts trade balance more than appreciation to the same extent.

Theoretical papers of (Dixit, 1989; Baldwin and Krugman, 1989) on hysteric behavior, or an effect that does not reverse when the source of the disruption is removed, provide the basis for the possibility of asymmetric trade balance movements and adjustments. Export enterprises must invest in order to sell their products in another country, and a greater commitment to export markets shows a greater intention to allocate human, managerial and financial resources to the export activity. Consequently, the creation of value-added services for customer gladness and loyalty is an example of a business-culture orientation toward exports. Research and development (product and process adaptations) and capital investment may be some of the investments made in these areas. If the company decides to discontinue exporting, the investment costs will not be recouped. While currency depreciation may make it more difficult for new export enterprises to depart the market or to recover the costs of their investment once the depreciation/devaluation is ended, it may also make it more difficult for existing firms to exit the market or recover the costs of their investment. If they stay in the market after the currency appreciates, their behavior shifts to the "Hold your breath and hope for better times soon".

Price stickiness has been linked to nonlinearity and asymmetry. Pelzman (2000) argued that 'Prices go up more quickly than they go down. Firms hike their prices more quickly when their costs go up than when they go down. In another way, price changes are more erratic downwards than upwards. In accordance with Rhee and Rich (1995), prices are sticky. This means that producers modify product pricing more quickly in response to cost increases than they do in response to cost cuts.

In the context of asymmetric pricing-to-market behavior, asymmetric responses are feasible. Because pricing-to-market entails discrimination based on price by exporting enterprises across export targets, these firms consider the level of competition in overseas markets when adjusting their prices. When confronted with a currency devaluation, exporters typically retain their current prices and avoid attempting to increase earnings. This results in a decrease in their foreign currency exchange rates (that is, prices in the target market will go down), this increases sales volume and market share over time. As a result, export revenue or earnings may grow slightly, but not enough to cover outlays and profits. *Ceteris paribus*, this behavior outline results in exporter's gaining market share through price competition

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during currency depreciation, as lower prices imply reduced costs. Nonetheless, export earnings may not grow and prices may even rise as a result of currency depreciation in certain circumstances. The final result is an empirical matter.

On the other hand, exporters seeking to maintain as well as expand market share will strive to lower export prices. Exporters typically respond by decreasing the item's domestic currency prices they sell to avoid the equivalent foreign currency price from increasing and resulting in a loss of market share. Exporters think maintaining and not increasing overseas currency exchange rates is far preferable to losing sales volume and market share. As a result, decreased profit margins and diminished competitiveness are tolerated. This may help to explain why exporters frequently use market pricing to partially offset the loss of competitiveness caused by the appreciation of the currency. In summary, Exporters would establish a price according to market conditions and reduce their national prices in order to preserve market share. On the other hand, if the exchange rate appreciates much, it may become more difficult for exporters to reduce prices due to shrinking profit margins. India is a fascinating case study since it was one of the most closed economies in the 1960s and 1970s, with a nearly fixed exchange rate. However, the implementation of 1991 economic reforms, that is, LPG (Liberalisation, Privatisation, and Globalisation), signaled the beginning of a significant regime transition, with India intensifying and broadening its foreign integration. The country switched from a fixed exchange rate regime to a more deregulated regime in 1992-93 and has maintained a managed floating exchange rate regime since then, with RBI (Reserve Bank of India) intervening periodically to avoid excessive destabilization in the forex. The Republic of India has also struggled with a large deficit in the overall current account since the 1991 reform program. However, with rare exceptions, the absolute magnitude has decreased with time.

The rest of the paper is organized in the following manner. Section 2 discusses previously available literature along with the gap in the literature. Similarly, section 3 explains Methodology, Estimation strategy and data source. The empirical results are discussed in section 4, followed by the summary and conclusion in section 5.

## 2. Literature review

Bahmani-Oskooee (2001) has attempted to construct real and nominal exchange rate index using data from 1971(Q1) to 1994(Q4) to examine how depreciation affects trade performance of selected 11 middle east countries. The study concludes that depreciation has a beneficial long-run effect on these selected countries' trade balance.

Using annual data from 1960 to 1995, Singh (2002) estimates the trade balance model in the case of India. The findings show that real exchange rate and domestic income play a significant role, whereas world income has less role in a country's

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trade balance. However, the effect of the real exchange rate is more significant than the nominal exchange rate and the country needs to keep an eye on the real exchange rate rather than the nominal rate. The study suggests that to maintain domestic price stability and maximize the beneficial effect of currency fluctuations on the trade balance, a devaluation-based adjustment policy supplemented by stabilization policy needs to be adopted.

Applying cointegration, Granger causality test, generalized impulse response analysis, and vector error correction technique Onafowora and Owoye (2006) attempted to examine the link between budget deficit and trade balance in Nigeria during 1970-2001. The study found a positive relationship between budget deficit and trade balance in the long run. Further, there is a positive relationship between real exchange rate, money supply and the trade balance and negative relation between interest rate, domestic income and trade deficit in the long run.

Using the cointegration and error correction method, Aziz (2008) found j-curve phenomena in the case of Bangladesh. Similarly, Kim (2009) investigated the impact of macroeconomic determinants on the trade balance of South Korea with its trade partners, including Japan and the USA. The study concludes that currency depreciation improves the trade balance of South Korea, whereas the 'J-curve' effect was found in the case of trade with Japan. In contrast, in the case of Malaysia, Yusoff (2010) was not able to provide enough empirical data about the 'J-curve' effect.

Similarly, Kakar et al. (2010) have applied the ARDL approach to examine determinants of trade balance in the case of Pakistan for 1970-2005. The study finds evidence of a relationship between the balance of trade and world income, exchange rate, supply of domestic money and confirms that the depreciation/devaluation of currency is positively related to trade balance both in the short and long run.

According to Hall et al. (2010), the link between trade volume and exchange rate volatility varies between emerging and developed economies. Whereas, exchange rate volatility does not affect exports of emerging countries, it negatively influences exports of developing countries. The study suggests that, as compared to developing countries, more accessible capital markets may reduce the effect of an exchange rate change on emerging economies.

Using quarterly data from 1980 to 2006, Shahbaz et al. (2012) have applied the ARDL method to investigate the relation between the trade balance and real exchange rate in Pakistan. The study concludes that the J-curve relation does not support Pakistan's case and argues that a conservative approach needs to be adopted to correct fundamental disequilibrium in the balance of payments.

Similarly, using annual data from 1980 to 2012, Turkay (2014) attempted to examine Turkey's 'Marshall-Lerner' condition by applying the Johansen cointegration test and error correction model. The findings indicate that import and export demand elasticity is higher than one, which supports the Marshall-Lerner condition.

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However, a statistically significant relationship could not be found between the selected variables in the short run. Thus, the study concludes that currency adjustment may be effective only in the long run in reducing the current account deficit.

Applying both linear and nonlinear adjustment process for the period, 1971(1) to 2013(3), Bahmani-Oskooee and Fariditavana, (2015) has examined the J-curve effect for China, Canada, Japan and USA. The study found that J-curve is supported for Canada and USA only when a linear adjustment process is used. However, China is also added to the list when the nonlinear approach is adopted. Besides nonlinear approach indicates that the effect of exchange rate changes on the trade balance is asymmetric for all four countries. The study concludes that in the future, attention needs to be diverted towards testing symmetric versus asymmetric effects using aggregate data between one country and the rest of the world.

In a related study, Tutueanu (2015) has used the ARDL method to examine the link between forest product exports of Romania and the exchange rate during the period 1991-2013. The study could not find enough evidence of the 'J-curve' effect for the country's forest products. Similarly, the exchange rate was found to be insignificant in its impact on forest products in the long run. Thus, the study concludes that the country's trade balance remains unchanged regardless of exchange rate fluctuations. Further, Asteriou et al. (2016) have investigated the impact of exchange rate fluctuations on trade relations of Indonesia, Mexico, Nigeria, and Turkey for 1995-2012 using monthly data and applying GARCH and ARDL techniques for short-run and long-run, respectively. The empirical analysis indicates no linkage between volatility in the exchange rate and trade relations in the long run in the case of selected countries except for Turkey. However, for Indonesia and Mexico, a strong causal association between volatility and trade relations is observed in the short run, but for Nigeria, one-way causality from export demand to volatility is detected.

Similarly, applying several nonlinear estimation techniques, Arize et al. (2017) view that in an asymmetric model, when the depreciation and appreciation effects are split, it significantly impacts the balance of trade. The findings reveal that a long-run relationship exists between the balance of trade and the real effective exchange rate in selected nations. Thus, the study concludes that in the case of selected countries, the Marshall-Lerner condition holds in the long run.

In a related study, employing the VECM model, Doojav (2018) examines the effect of exchange rate on t Mongolia's trade balance. The findings support the Marshall-Lerner condition by revealing that depreciation/devaluation of currency may improve the balance of trade in the case of Mongolia both in the short and long run. The study suggests that exchange rate risk and current account deficits can be effectively managed by adopting a flexible exchange rate.

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Similarly, Buba et al., (2018) employ the asymmetric cointegration adjustment model to examine long-run exchange rate pass-through into trade balance in the case of Thailand. Using the monthly data of fifteen years from M1:200 to M2:2014, the study indicates an asymmetric cointegration relationship between exchange rate and balance of trade. Besides, the results indicate that change in the real exchange rate has contributed to the country's deficit trade balance during the analysis period.

Further, applying the GMM technique, Chiu and Ren. (2019) have examined linear and nonlinear relations between the balance of trade, saving rate and exchange rate of china with 102 trade partners for 1995-2014. The results show that the currency devaluation of China has a different effect on the trade balance of the country depending on the trade partner. Moreover, the saving rate has a nonlinear effect on China's bilateral trade balance. The analysis suggests that currency devaluation may not be a viable policy instrument to improve trade with individual trading partners. In line with the available literature, the present study analyzes the relationship between exchange rate and balance of trade in both symmetric and an asymmetric framework.

### 3. Methodology

Following (Rose & Yellen 1989,1991; Wilson & Tat 2001; Narayan 2004), the baseline model takes the following functional form:

$$TB = f(ER, Y, Y^*) \tag{1}$$

'TB' signifies trade balance; 'ER' denotes the exchange rate; 'Y' and Y\* represent the domestic and foreign income, respectively. The equation (1) is transformed in two ways following the prior research.

The first alteration is prompted by recognizing that different components of aggregate demand (government and household expenditures) have varying effects on the trade balance. The second adjustment is to account for the effect of some critical variables (i.e., domestic prices and money supply) found in the literature (Saruni, 2007; Duasa, 2007; Mohammad, 2010; Waliullah et al. 2010; Kayhan et al. 2013; Shawaa & Shen, 2013) on TB. According to the monetary approach, the money supply can influence a country's trade balance. If the money supply in the domestic economy increases without a rise in the money demand, the trade balance deteriorates. Because individuals with large cash balances can influence both the demand for local and imported goods, they can significantly influence the market. After these two modifications, equation (1) is restated as follows:

Equation (1) is re-specified as follows, including these two modifications:

$$TB = f(ER, CP, FE, WG, MS) \tag{2}$$

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ER represents exchange rate, CP represents domestic price level, FE represents final expenditure (both household expenditure and government expenditure), WG represents foreign demand, and MS represents domestic money supply. All the variables are expressed in log form to interpret coefficients in terms of elasticity. The estimable form of the equation can be written as:

$$LTB_t = \alpha_0 + \alpha_1 LER_t + \alpha_2 LCP_t + \alpha_3 LFE_t + \alpha_4 LWG_t + \alpha_5 LMS_t + \mu_t \quad (3)$$

Where L represents the natural logarithm,  $\alpha_i$  ( $i = 1, 2, \dots, 5$ ) are the estimable parameters, t represents the time, and  $\mu$  is the disturbance term.

The NARDL model developed by Shin et al., (2014) is a tool to examine short and long-run dynamics. The bounds test provides reliable results even when the sample size is small (Granger & Yoon, 2002; Narayan & Narayan, 2005; Pesaran et al., 2001). The order of integration should not be greater than one. As per the authors' knowledge, all trade balance modeling studies follow a linear framework. This study is conducted in a non-linear framework, and the focus is the asymmetry of the exchange rate. Researchers (Sajad and Javed, 2020; Akoto & Sakyi, 2019; Bahmanii-Oskooee & Fariditavanaa, 2015; and Bahmanii-Oskooee & Bahmanii, 2015) proposed that the link between exchange rate and trade balance appears to be asymmetric rather than symmetric. If this is the case, the specification is given in equation (3) cannot fully reflect the relationship between trade balance and exchange rate. The non-linear functional form is given as:

$$LTB = F(LER^+, LER^-, LCP, LFE, LWG, LMS)$$

Therefore, considering the asymmetric impact of ER on TB. in India, our model will be:

$$LTB_t = \beta_0 + \beta_1 LER_t^+ + \beta_2 LER_t^- + \beta_3 LCP_t + \beta_4 LFE_t + \beta_5 LWG_t + \beta_6 LMS_t$$

Where  $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$  and  $\beta_6$  are the long-run parameters. The asymmetric effects of ER are incorporated by positive change  $LER_t^+$ , and negative change  $LER_t^-$ , respectively. Where  $LER_t^+$  and  $LER_t^-$  denote the partial sum of the positive and negative changes in LER respectively. To extract the short-run effect, we can re-specify Equation 1 as:



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$$\begin{aligned}
 LTB_t = & \delta_0 + \sum_{k=1}^N \delta_{1k} \Delta LTB_{t-k} + \sum_{k=1}^N \delta_{2k} \Delta LER_{t-k} + \sum_{k=1}^N \delta_{3k} \Delta CP_{t-k} \\
 & + \sum_{k=1}^N \delta_{4k} LFE_{t-k} + \sum_{k=1}^N \delta_{5k} LWG_{t-k} + \sum_{k=1}^N \delta_{6k} LMS_{t-k} \\
 & + \theta_1 LTB_{t-1} + \theta_2 LER_{t-1} + \theta_3 LCP_{t-1} + \theta_4 LFE_{t-1} + \theta_5 LWG_{t-1} \\
 & + \theta_6 LMS_{t-1} + \mu_t \tag{4}
 \end{aligned}$$

Equation (4) combines both short and long-run coefficients.  $\Delta$  represents the short-run coefficient while  $\theta_1, \theta_2, \theta_3, \theta_4, \theta_5,$  and  $\theta_6$  are the long-run coefficients. The non-linear cointegrating regression is specified as:

$$Y_t = \alpha^+ ER_t^+ + \alpha^- ER_t^-$$

where  $ER_t$  are the long-run parameters of the  $K \times 1$  vector of regressors decomposed as,

$$ER_t = ER_t^+ + ER_t^-$$

Where  $ER_t^+$  and  $ER_t^-$  are independent variables. Which are decomposed into partial positive and negative sums as:

$$\begin{aligned}
 POS_t = LER_t^+ &= \sum_{j=1}^k \Delta LER_j^+ = \sum_{j=1}^k \max(\Delta LER_j, 0) \\
 NEG_t = LER_t^- &= \sum_{j=1}^k \Delta LER_j^- = \sum_{j=1}^k \min(\Delta LER_j, 0)
 \end{aligned}$$

Replacing LER in equation (2) by  $LER^+$  and  $LER^-$  gives us the non-linear model as:

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$$\begin{aligned}
 LTB_t = & \gamma_0 + \sum_{k=1}^N \gamma_{1k} \Delta LTB_{t-k} + \sum_{k=1}^N \gamma_{2k} \Delta LER_{t-k}^+ + \sum_{k=1}^N \gamma_{3k} \Delta LER_{t-k}^- \\
 & + \sum_{k=1}^N \gamma_{4k} \Delta CP_{t-k} + \sum_{k=1}^N \gamma_{5k} LFE_{t-k} + \sum_{k=1}^N \gamma_{6k} LWG_{t-k} \\
 & + \sum_{k=1}^N \gamma_{7k} LMS_{t-k} + \beta_1 LTB_{t-1} + \beta_2 LER_{t-1}^+ + \beta_3 LER_{t-1}^- \\
 & + \beta_4 LCP_{t-1} + \beta_5 LFE_{t-1} + \beta_6 LWG_{t-1} + \beta_7 LMS_{t-1} + \mu_t \quad (5)
 \end{aligned}$$

To generate asymmetric representations of the estimable model, we substitute  $POS_t$  (positives) and  $POS_t$  (negatives) in equation (3), and this represents an asymmetric version of ARDL. Doing so enables us to ascertain whether exchange rate fluctuations impacted the trade balance symmetrically or asymmetrically. When the coefficients of the two partial sums are the same in sign and magnitude, the effect is symmetric; otherwise, it is asymmetric.

The advantage of the NARDL model is that it can be applied whether variables are either I(0) or I(1) or a mixture of both. Pesaran et al.'s (2001) bounds testing approach applies to model 5.

### 3.1 Estimation strategy

In this study, the Autoregressive distributed lag model (ARDL) framework developed by Shin et al., (2001) has been used. There are several considerations behind the choice of this technique. The approach produces consistent findings regardless of the order in which variables are integrated. but not orders greater than one, either I(0) or I(1) or a mix of both. It produces unbiased estimates and consistent t-statistics in the long run, but some regressors may be potentially endogenous. In studies with relatively small samples, such as this one, the estimation technique ARDL is quite effective. This technique also allows optimum lags of dependent and explanatory variables to be established and means that different variables can have optimum adjustment speed to balance. The general ARDL model is represented as follows:

$$\Delta E = \delta_0 + \beta_1 t + \beta_2 E_{t-1} + \beta_3 K_{t-1} + \sum_{t=1}^n \gamma_i \Delta E_{t-1} + \sum_{t=1}^n \delta_i \Delta K_{t-1} + \mu_t \quad (6)$$

Where E is the explained variable, K is the vector of independent variables, t represents the time and  $\mu_t$  is the disturbance term. Now to check the long-run relationship between the variables under study F-test statistics is used. The null hypothesis for the absence of cointegration between the variables is denoted by

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$H_0: \beta_1 = \beta_2 = \beta_3 = 0$  against  $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$ . The test entails using the critical value bounds test, which is dependent on the order in which variables are integrated. As a thumb rule, if 'F-statistics' is more than the upper bounds critical value, the  $H_0$  is rejected. It can be concluded then that the series is co-integrated, implying a long-run relationship between the variables and otherwise if the 'F-statistics' is below the lower bound critical value. However, if the testing statistics lay between the critical value of lower and upper bounds, a decisive inference cannot be made. When the variables are determined to be co-integrated, the parameters that characterize the long-run equilibrium link between trade balance and its explanatory variables must be estimated. The next stage in the estimating method entails the error correction model (ECM), which estimates short-run and long-run relationships between parameters inside the ARDL framework.

### 3.2 Data description

The present study uses annual time series data spanning the years from 1991 to 2020. This time was chosen because the current study's objective is to investigate India's trade balance in the post-liberalization era. All the variables included in this study are extracted from world development indicators (WDI) except the exchange rate variable which is extracted from the international monetary fund (IMF). Following (Bahmani-Oskooee, 1991, 2001; Akoto & Sakyi, 2019), the export and import ratio is taken to measure the trade balance. The available literature provides two explanations for this measure. (a) This ratio is independent of the unit of measurement. (b) This could be interpreted as a real or nominal balance of trade. The study uses domestic currency per US dollar for the exchange rate. Following (Duasa, 2007; Shawa & Shen 2013) money supply and consumer price index are used to measure domestic money supply and price level. To obtain foreign income, average GDP per capita (annual percentage growth) of top ten trading partners [1] have been selected given close cooperation between India and these countries. Similarly, following (Saruni, 2007; Nienga, 2010), final consumption expenditure (annual percentage growth) includes household and government consumption expenditure.

## 4. Results and Discussions

### *Stationarity tests*

To check for the stationarity of the variables used in the present study, both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used. Table 1 clearly indicates that all the variables are stationary at  $I(0)$  and  $I(1)$ , which justifies the use of the ARDL approach for the present study.

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**Table 1 Unit Root Test, ADF and PP Test**

ADF Test			PP Test	
Variables	t-statistics	p-value	t-statistics	p-value
LnTB	-1.58	0.47	-1.56	0.48
DLnTB	-7.34	0.00*	-7.31	0.00*
LnMS11	-1.34	0.34	-2.16	0.10
DLnMS11	-9.61	0.00*	-9.61	0.00*
LnFE1	-2.94	0.05**	-3.71	0.00*
DLnFE1	-10.67	0.00*	-10.67	0.00*
LnER	-3.15	0.03**	-3.15	0.03**
DLnER	-8.22	0.00*	-7.69	0.00*
LnCP	-0.44	0.88	-1.55	0.49
DLnCP	-5.97	0.00*	-3.06	0.04**
LnWG	-1.08	0.71	-1.08	0.71
DLnWG	-3.83	0.00*	-3.91	0.00*

Source: Author's calculation

Note: D denoted the first difference. Significance at \*1%, \*\*5%.

*Cointegration test*

The ARDL and NARDL model selection of (1,2,1,2,3,0) and (1,1,1,1,1,2,2) for model 1 and model 2 respectively is based on AIC (Akaike Info Criterion). The bounds test results from Table 2 indicate a long-run relationship between variables selected in the model.

**Table 2 Result of Cointegration Relationship**

	ARDL	NARDL
F-statistics	5.831*	4.411*

Source: Author's calculation

Notes\*Indicates acceptance of alternative hypothesis at the 10%, 5%, and 1% significant levels.

*Long-run and short-run relationship*

The next step after checking for cointegration is to discuss the estimates in both the short run and long run that characterize the response of trade balance to change in selected variables. Tables 3 and 4 present both short-run and long-run coefficients of these variables. The results related to both ARDL and NARDL are reported in each table.

The ARDL model indicates that the exchange rate and trade balance have a positive but statistically insignificant relationship in the long run. From the results, it is clear that though the exchange rate has the expected sign, its insignificance is in contrast to the theoretical explanation, according to which improvement in the trade balance

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is associated with real exchange rate depreciation. Thus, from the results, it can be concluded that the M-L condition according to which depreciation in a nation's currency improves its trade balance does not hold in the case of India. On the other hand, the short-run exchange rate coefficient is positive and significant, indicating that trade balance improves with an increase in the exchange rate. Thus, the results don't support the 'J-curve' effect in India.

NARDL results from table 3 indicate that the effect of exchange rate positive (depreciation) is more than exchange rate negative (appreciation), although the exchange rate negative is statistically insignificant. From the table, it is clear that with 1 percent depreciation, trade balance improves by around 1.21 percent and appreciation of equal extent leads to deterioration in the balance of trade by around 0.38 percent. Thus, the relationship between these two variables has an asymmetric relationship as both sign and size is different for the coefficients of positive and negative exchange rates. Besides, asymmetry is reported in the short-run, as depicted from table 4 (NARDL) panel. The results show that the exchange rate positively impacts the balance of trade more than the exchange rate negatively, implying that currency depreciation impacts the balance of trade more than currency appreciation to the same extent. The results clearly refute the 'J-curve' phenomena in India's case.

**Table 3 Long-run Coefficient Estimation**

Variables	ARDL	NARDL
LnMS	-0.34* (0.05)	-0.21** (0.07)
LnCP	-0.82** (0.35)	-1.39** (0.59)
LnFE	-0.14** (0.05)	-0.08 (0.06)
LnWG	0.68 (0.45)	0.35 (0.38)
LnER	0.43 (0.29)	
LnER_POS		1.21*** (0.68)
LnER-NEG		-0.38 (0.41)
Constant	-4.03 (4.01)	1.52 (2.83)

Source: Author's Calculation

Note: \*, represent 1% \*\* 5%, and \*\*\* represent 10% significance levels.

Figures in Parenthesis are standard errors.

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**Table 4 Short-run Error Correction Estimation**

Variables	ARDL	NARDL
LnMS	-0.12* (0.03)	-0.07** (0.02)
DLnMS(-1))	0.05*** (0.03)	
LnCP		-1.87* (0.25)
LnFE	-0.07* (0.01)	-0.02*** (0.01)
LnWG	0.37** (0.16)	0.42** (0.17)
D(LnWG(-1))	-0.84* (0.15)	-0.69* (0.14)
LnER	0.31* (0.08)	
DLnER(-1))	0.21** (0.09)	
LnER_POS		0.73* (0.14)
LnER-NEG		-0.04 (0.28)
DLnER-NEG(-1))		1.02* (0.14)
CointEq(-1)	-1.09* (0.13)	-0.95* (0.12)

Source: Author's Calculation

Note: \*, represent 1% \*\* 5%, and \*\*\* represent 10% significance levels.

Figures in Parenthesis are standard errors.

The next step is to discuss the long-run and short-run effects of other variables, which include FE (final expenditure), MS (Supply of money),  $Y^*$  (Foreign income) and CP (Domestic price) on the trade balance in both the models. Domestic prices are found to significantly impact the trade balance in both the short and long run. The findings suggest that in the case of India, domestic prices are an important predictor of the trade balance. These results are not surprising as one expects that an increase in domestic prices makes both domestic and exported goods expensive compared to imports. Subsequently, this results in a reduction in demand for exports and an increase in demand for imports. These negative income and substitution effects of high domestic prices reinforce each other, which continuously deteriorates the country's trade balance. Thus, it is essential to mention here that domestic prices have continuously increased in the study period.

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Similarly, in both the model's money supply is found to have a significant and negative effect on the country's trade balance in both the short and long run in both the models. The monetarist balance of payment approach describes how changes in money demand and supply in a domestic economy affect a country's balance of payment. Thus, at a given exchange rate, an increase in the money supply without an increase in money demand will have a negative effect on the trade balance of a country. The results both in the short and long run indicate that the money supply is inversely related to the trade balance in the case of India.

It is expected that when foreign income increases, demand for exports will enhance, which in turn would improve the balance of payment. The results in Tables 3 and 4 indicate that the foreign income has an expected positive sign and is statistically significant in Table 4. This shows that enhancing income in leading trade partners would enhance the demand for exports from India. According to UNCTAD (1999), an acceleration in the growth rate of industrial countries has improved the balance of trade in most emerging countries.

Finally, financial expenditure consisting of household consumption and government consumption spending is found to have a negative impact on a country's trade balance. In both models, the variable has expected negative signs and is significant in the short and long run. The results are in line with a theoretical background of the variables selected. As household consumption includes both domestic and imported goods, an increase in domestic consumption increases demand for both types of goods, which impacts the trade balance of a country. Similarly, government spending consists of expenditure both on foreign and domestic goods, and an increase in such expenditure has a negative effect on the trade balance. The error correction term (-1.09) and (-0.95) is negative and statistically significant, suggesting that disequilibrium is corrected by 109% and 95% per year in ARDL and NARDL models, respectively.

**Table 5 Diagnostic Tests**

Tests	ARDL	NARDL
Serial Correlation LM Test	2.11 (0.17)	2.79 (0.11)
Heteroskedasticity Test	2.19 (0.08)	1.67 (0.19)
Normality	0.32 (0.85)	0.38 (0.82)
Ramsey RESET Test	1.12 (0.31)	0.04 (0.84)

Source: Author's Calculation

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**4.1 Variance Decomposition Result**

Following (Koop et al. 1996; Pesaran & Shin, 1998), generalized VDC within unrestricted VAR model was conducted and presented at 2, 4, 6, 8 and 10 periods as presented in Table 6.

The results show that the trade balance forecast error variance is the product of its own shocks. In the second period, 86.71 percent trade balance forecast error variance is attributed to its own shocks, but the contribution continuously falls with the passage of time. In terms of other explanatory variables, the exchange rate has a greater impact on the forecast error variance of the trade balance than other variables included in the present study. Similarly, the contribution of other variables like world income, final expenditure, money supply and domestic income enhance sequentially to explain trade balance forecast error variance in the selected time period. The fluctuations in the exchange rate explain 13.19 percent of forecast error variance in trade balance after ten years. Domestic prices explain 1.74 percent, while shocks in final expenditure, money supply and world income explain 2.51 percent, 1.95 percent and 5.54 percent respectively in the selected time period.

**Table 6 Results of the Variance Decomposition**

Variance Decomposition of LNTB						
Percent of forecast variance explained by innovations in						
Horizon	LNTB	LNER	LNCP	LNFE1	LNMS11	LNWG
2	86.71	5.29	1.25	1.80	3.85	1.08
4	78.52	10.45	1.49	2.73	2.52	4.27
6	75.52	12.74	1.65	2.67	2.18	5.24
8	75.29	12.98	1.69	2.54	2.02	5.46
10	75.06	13.19	1.74	2.51	1.95	5.54

Source: Author's Calculation

The VDC substantiates the important role of the exchange rate, domestic price level, final expenditure, money supply, and world income in explaining the fluctuations in forecast error variance of trade balance in the case of India during the study period. Compared to other selected variables, the domestic price level explains relatively little of the forecast error variance of the trade balance. Thus, domestic price level or inflation contributes little to trade balance fluctuation during this period. However, the portion of trade balance fluctuation explained by selected variables increases continuously over the years of which the exchange rate maintains for higher percentage compared to other variables. This shows that India's change in the trade balance is highly attributed to exchange rate fluctuations compared to other variables.



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## 5. Conclusions

The present study attempts to identify different determinants of India's trade balance. To fulfill this objective, the presence or absence of the 'J-curve' effect and the 'Marshall-Lerner' condition was tested to identify trade balance response to exchange rate. This process was performed in two steps, first, the exchange rate was included in the model, and second, by decomposing the positive and negative exchange rate in the model. Besides, the impact of other macroeconomic variables, including money supply, final expenditure, domestic price, and foreign income on traded balance, was also examined. In addition, how innovation in independent variables and shocks in dependent variables contribute to forecast error variance of trade balance was also investigated. To check for symmetric and asymmetric specifications, bounds testing approach to cointegration and error correction model within ARDL and NARDL framework was used. In addition, variance decomposition analysis was employed to examine dynamic interaction among variables. The results indicate both long-run and short-run dynamics among the variables included in the study. However, the results clearly indicate the absence of India's 'J-curve' effect and 'Marshall-Lerner' condition. Besides, variance decomposition analysis indicates that the exchange rate contributes highly to forecast error variance of trade balance in the country.

From the results discussed it can be concluded that urgent steps need to be taken to improve the trade balance position to enhance economic development in the country. However, it is essential to note that currency depreciation is not an appropriate tool to improve the trade balance, unlike industrialized countries. Besides, the government needs to adopt policies that would help domestic producers produce at low prices and control inflation, which can help enhance exports and improve trade balance in the long run. Also make in India initiative need to be strengthened further to divert household and government demand towards domestic goods.

Though the present study attempts to examine different determinants of trade balance with the symmetric and asymmetric framework, many macro and micro variables that were not included in the present study can be examined in future studies.

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### Author Contributions

The authors contributed equally to this work.

### Disclosure Statement

The authors have not any competing financial, professional, or personal interests from other parties.

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**Notes:**

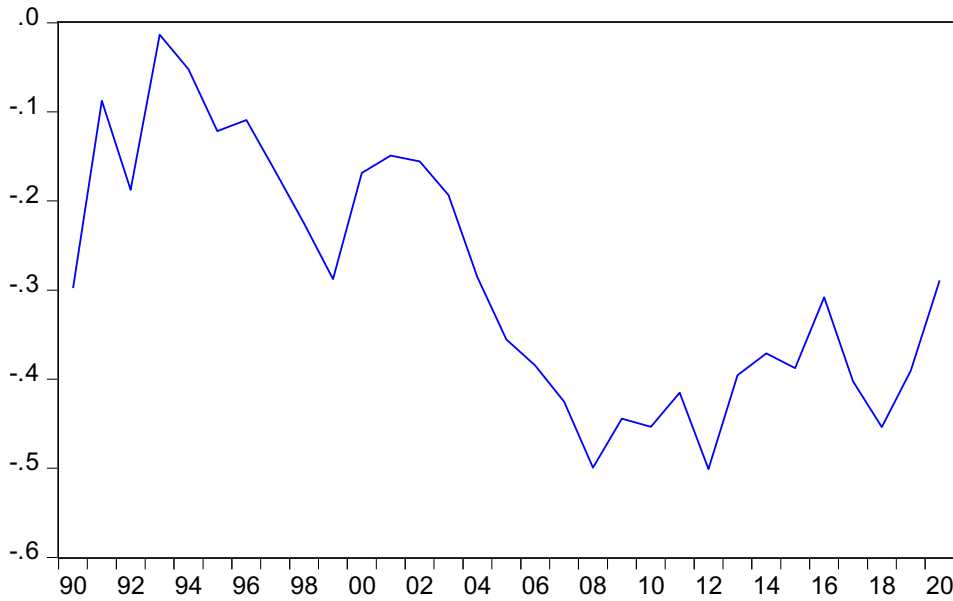
[1] These countries include the USA, UAE, China, Hong Kong, Singapore, Saudi Arabia, Iraq, Switzerland, Germany and Indonesia.

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**Appendix 1. Trend of India's Trade Balance**

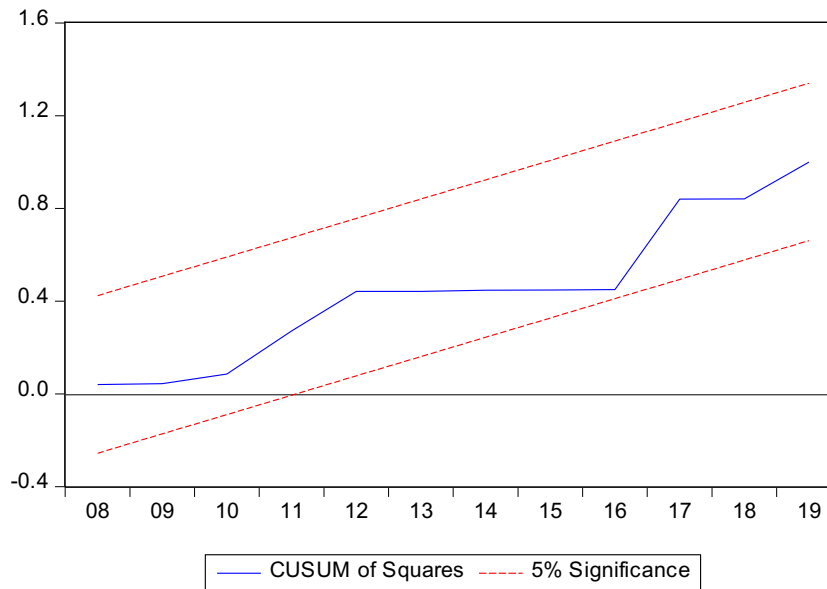
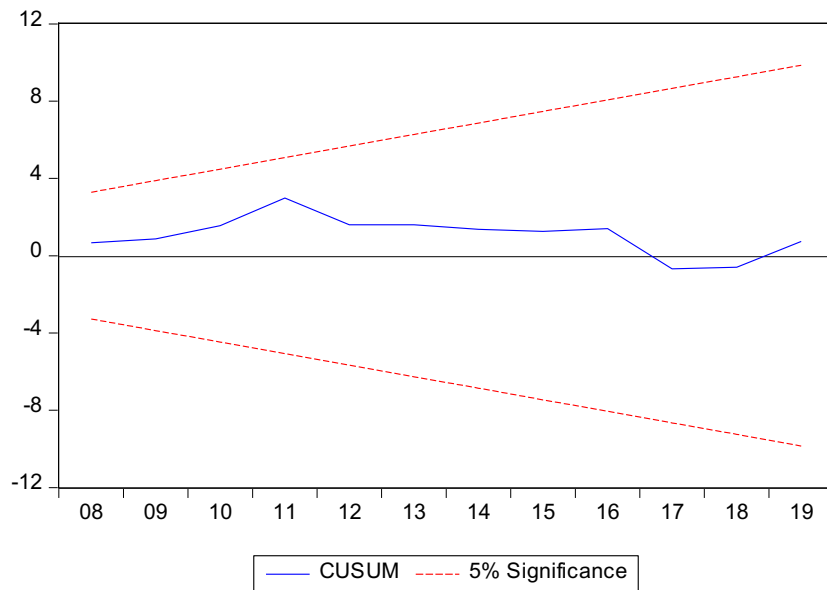
LnTB



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**Appendix 2. Stability Test (ARDL)**



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**Appendix 3. Stability test (NARDL)**

