

Examining the Drivers of India's Trade Deficit: An ARDL Bounds and Causality Approach

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ABSTRACT

India's trade deficit has widened due to its dependence on imports and uncompetitive exports. An understanding of drivers influencing trade deficit deserves significant attention. This study examined the impact and causality of crude oil, USD/INR exchange rate and gold on trade deficit in India from the year 2004 to 2019. The study employed Auto Regressive Distributed Lag (ARDL) bound test approach and the Granger causality to empirically verify the results. The study found that USD/INR and crude oil prices have a negative and long run impact on trade deficit. The study also observed no impact of gold on trade deficit. Further, the Granger causality test revealed a unidirectional causality running from crude oil and USD/INR to trade deficit. The implication of the result is that Government of India and policymakers should aim at promoting a phenomenal growth of exports and reduce imports of crude oil and gold so as to maintain a sustainable trade balance.

Keywords: Trade deficit, Crude oil, Gold prices, Exchange rates, Autoregressive distributed lag, Granger causality

JEL classification: F14, F32, F62, F68

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INTRODUCTION

Before Independence, India had been following restrictive trade policies. However, the Indian economy began opening up since 1980s. Liberalisation was made in policies related to the entry of foreign capital and withdrawal of restrictions on imports. Data released by Indian Commerce Ministry show that for more than a decade, India's imports are higher than its exports, thus leading to a significant increase in its trade deficit. The year 2019 was also no different. With the

surge in prices of precious stones, crude oil has led to a higher import bill thus widening the deficit. In the year 2018–2019, India's trade deficit value was \$35 billion, which is 2.7% of GDP as compared to the previous year, which was 1.8% of the GDP (*Source:* RBI website). The value of imports of oil and gold are high because of the depreciation of the Indian rupees. High trade deficit is seen as a reflection of poor economic health. Hence, in order to ensure a balanced trade deficit, it is necessary to ensure that there is

stability in the exchange rate. Maintaining a balanced current account is one of the biggest challenges faced by many developing countries, specifically India. The major reason of India's current account deficit (CAD) is its dependence on other countries majorly for gold and crude oil. High trade deficit has also led to a significant increase in India's CAD. The widening balance of CAD is a cause of worry for any economy and the solution to reduce this widening balance depends upon finding the factors behind deficit. The deficit can also increase due to the movements of the exchange rate. Depreciation in rupee value vis-a-vis other currencies will raise exports and make imports dearer. When imports exceed the exports of a country, it leads to an increased outflow of currency resulting in a fall in the value of its currency, making it less valuable in foreign exchange markets. High-trade deficit results in a loss of confidence by foreign investors who in turn may withdraw their investment from the Indian market resulting in devaluation in its currency.

One of the most prominent reasons for trade deficit in developing countries like India is its dependence on crude oil. Oil imports account to almost one-third of the country's total import volume and India is the world's third largest importer of oil. High trade deficit in India has resulted in a rise in its CAD as well. If the oil prices increase, it results in a higher import bill and, therefore, the Government has to borrow from the Central Bank to finance their expenditures. There has been an upward periodic hike in the prices of crude oil by the oil exporting countries and India, being a major importing country becomes vulnerable to such a price hike. Also, increased prices lead to an increase in money supply and in turn, lead to depreciation in the domestic currency.

Figure 1 shows that the quantity of gold demanded in tonnes has remained more or less stable since the last decade while Figure 2 shows the import of crude oil by India has increased consistently since the year 2003. The quantity of gold imported went

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Figure 1: Depicts the total quantity demanded of gold in tonnes in India
Source: From researcher's data

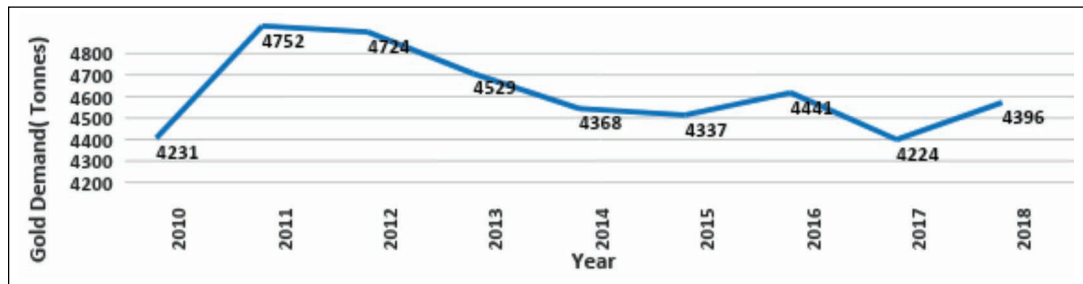
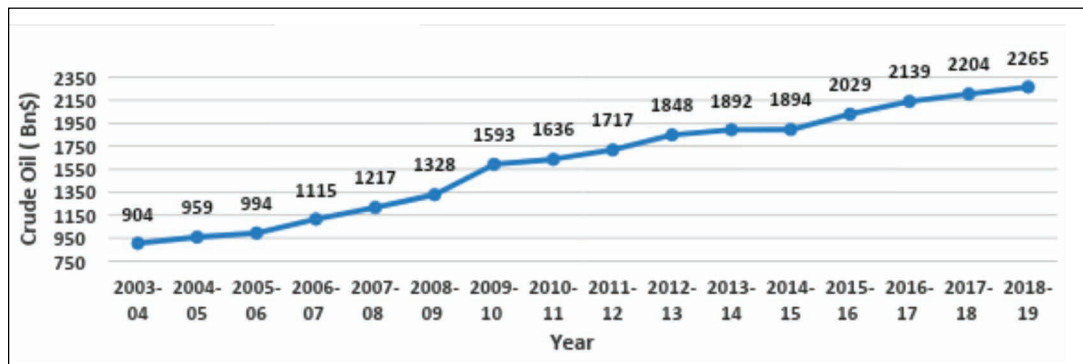


Figure 2: Import of crude oil (Bn\$)
Source: From researcher's data



down during the period 2013-2015 due to the restrictions imposed by the RBI and Government of India to curb gold imports so as to help reduce the trade deficit. Crude oil is an important input in transportation and different production processes in India, hence its dependence on crude oil/petroleum cannot be reduced to a great extent. An enhanced Trade deficit leads to weakening of a country's currency, which is depicted in Figure 3. Figure 4 clearly indicates that India's trade deficit to GDP ratio has gradually

decreased from 2013 to 2016, subsequently, an increase in the ratio has been observed after 2016–2017.

As per the data published by the Ministry of Commerce & Industry, India's overall trade deficit has increased from 84.45 billion US dollars in 2017–2018 to 103.63 billion US dollars in 2018–2019. In spite of the growth in exports, this deficit increased due to higher imports of crude oil and petroleum products,

Figure 3: USD/INR values and yearly change in USD/INR value (%)

Source: From researcher's data

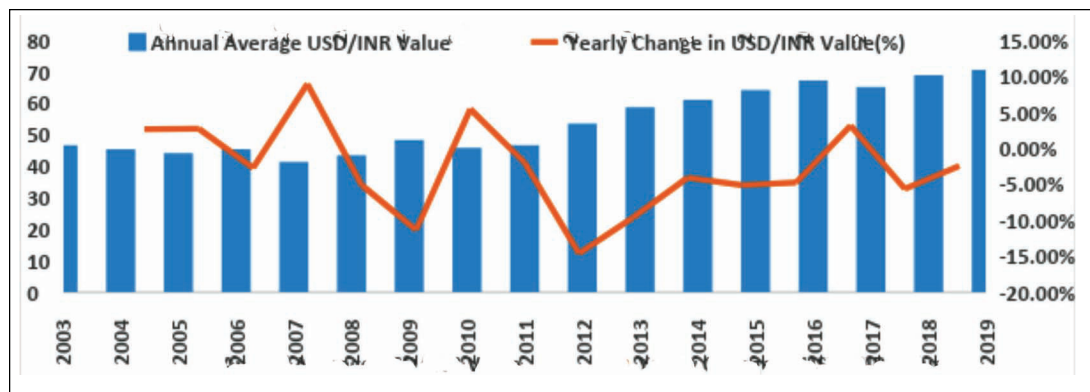
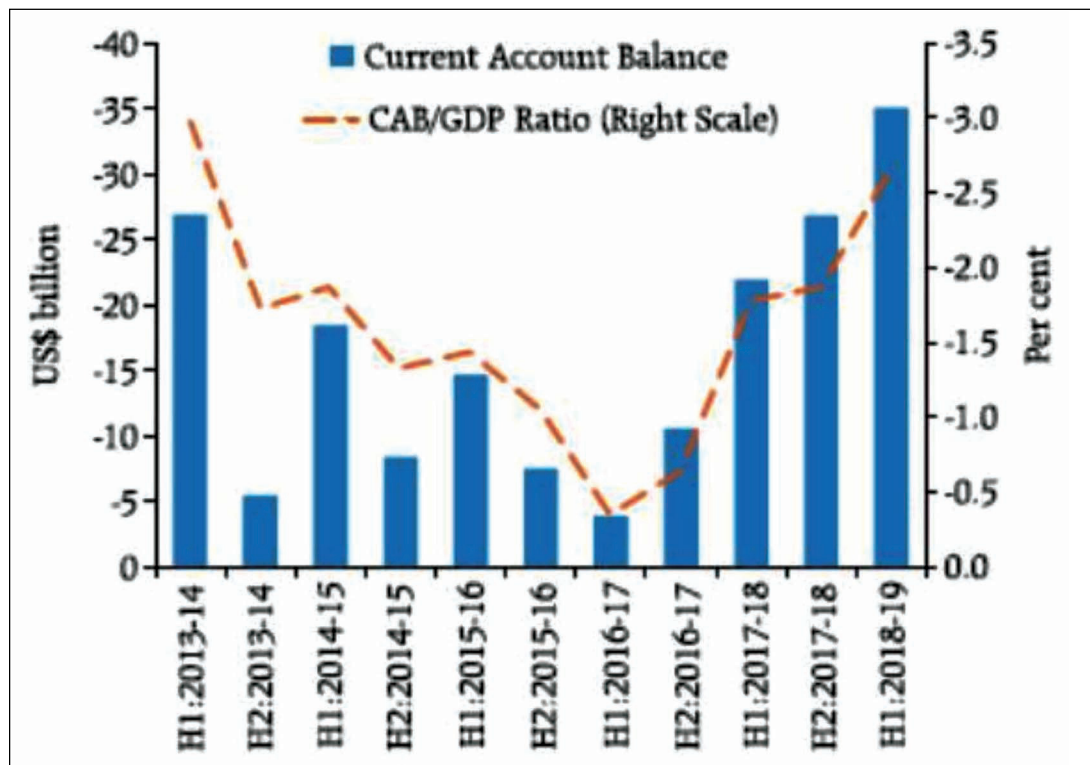


Figure 4: India's current account balance to its GDP ratio

Source: RBI website



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which altogether comprise 70% of the overall imports volume. Behera and Yadav (2019) suggested that trade deficit can be curbed by promoting high-value product exports. Similarly, Sharif and Ali (2016) suggested Government authorities to implement policies that support export of goods from the country and limiting of imports by restricting trade policies. The major determinants of trade deficit such as exchange rate, crude oil and gold prices have been studied widely in theoretical and empirical literature but mostly the research on these three important variables remained separate.

An investigation of determinants of trade deficit covering all the three variables seems a less explored avenue for research. This article is an attempt to study the impact of these variables on the trade deficit since a widened balance of trade deficit affects the GDP of an economy adversely. There are a plethora of studies focusing on the relationship between trade deficit and macroeconomic variables in developed countries but literature focusing upon all the macroeconomic indicators used in the study in the Indian context seems

to be scanty. The period of the research from the year 2004 to 2019 seemed appropriate to cover the run-up period to the global financial recession and its subsequent recovery. Reducing the trade deficit is viewed as an important goal that policymakers aim at.

Figures 5–8 shows the prices of USD/INR, Crude, gold and also trade deficit for the study period. An increasing trend is observed in all the variables under study.

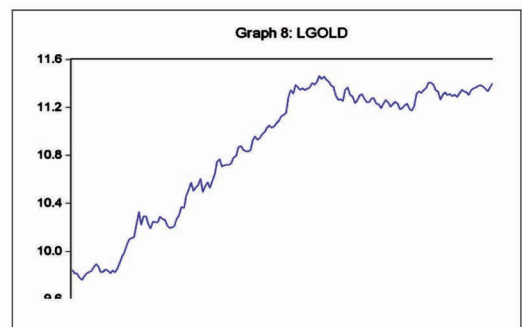
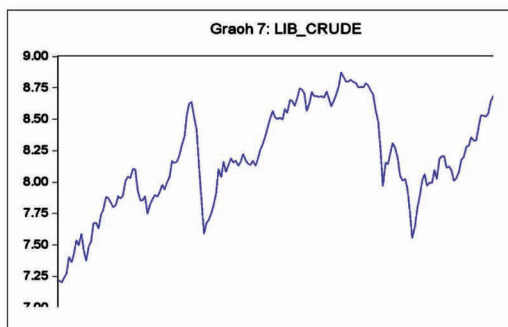
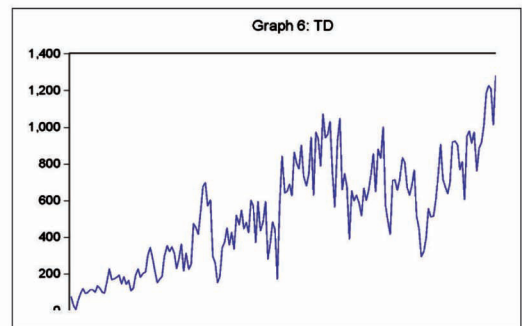
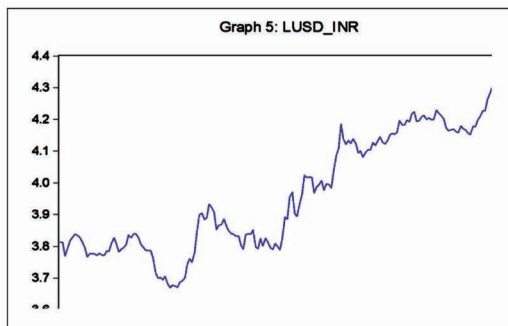
The next section of the research paper outlines the related conceptual and empirical literature, objectives, rationale of the study followed by a description of the data and research methodology. At the end, the key results are presented with policy implications and conclusions of the research.

REVIEW OF LITERATURE

Theoretically, the relationship between the exchange rate and trade balance is well known from the literature. The argument is a result of depreciation of the home

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Figures 5–8: The movement of the variables under study
Source: Prepared by the authors



currency making exports cheaper and imports dearer. A study conducted in Thailand by Kyophilavong *et al.* (2018) on the effect of currency devaluation on Thai trade balance found that exchange rates play a significant role in the trade balance of Laos. A similar study conducted by Islam *et al.* (2017) proved a positive impact of depreciation of rupee against the US dollar on India's trade balance. Previous studies have confirmed that the exchange rate fluctuations have a negative impact on the balance of trade (Sharma and Tiwari, 2015; Dada and Olomola, 2017; Kurihara, 2013; Dhasmana, 2017; Immaculate and Kwado, 2017). However, a few studies by Weerasinghe and Perera (2019) in the Sri Lankan context and Tarlok (2004) in the Indian context find that the exchange rate has no impact on the balance of trade. Research conducted by Tufail *et al.* (2014) and Shah and Majeed (2014) proved that exchange rate had a negative effect on trade balance whereas another set of studies carried by Ahmad *et al.* (2014), Kennedy *et al.* (2013) and Irhan *et al.* (2011) found a positive effect of exchange rate on trade balance.

Due to India's dependence on oil imports, inflation increases, exports become weaker and GDP is also affected. A majority of the researchers (Yaylali and Lebe, 2015; Yalcin *et al.*, 2014) has proved the impact of rising oil prices on the economic growth of a country. While stable oil prices contribute positively to a country's economic growth, rising prices negatively impact its economic performance. Ozlale and Pekkurnaz (2010) observed that the oil price shocks increase the CAD in the Turkish context. Rasmussen and Roitman (2011) reported a positive correlation between real export rates of Turkey and oil prices. Another study in Turkey conducted by Çulha *et al.* (2015) proved that there is a limited influence of the changes in oil prices on the exports. Due to an unprecedented rate of rise in the global crude oil prices, India's import bill has also increased. Few other studies (Lafer *et al.*, 1978; OECD, 2004; Kilian *et al.*, 2009;

Bodenstein *et al.*, 2011; Le *et al.*, 2013) recognise the importance of crude oil price fluctuations on a country's trade balance and also on its stock market performance. Research by Pandey (2013) and Tufail (2014) conclude that the balance of trade of a country improves if the country experiences an increase in its economic growth or aggregate production. Hassan and Zaman (2012) concluded a negative relationship among oil prices, trade balance and exchange rate in the context of Pakistan and the results of the Granger causality indicated a bidirectional causality between oil prices and exchange rates. Similarly, Tiwari and Olayeni (2013) also found an inverse relationship between real oil price and real trade balance in the Indian context. Afsar (2006) reported that an increase in oil prices were influential in CAD, especially for developing countries. Olayungbo (2019) found that the oil prices do not impact exchange rate and trade balance of Nigeria.

As discussed earlier, India is a major consumer of gold but is able to produce a negligible amount of gold. It has to depend upon imports to meet its consumption requirements. Thus, the major reason for India's trade deficit is due to heavy import of gold and crude oil. In the Indian context, gold is considered as an investment tool, hedge against inflation, tool for financial protection as well as a status symbol. The foreign exchange gets drained due to import of goods. The import price of gold has accelerated manifold since the last 5 years. As per a report published by the World Gold Council in 2014, curbing of imports of gold would be the most effective way to reduce the trade deficit in the Indian economy. There are various studies examining the utility of gold either for hedging (Narayan *et al.*, 2010; Hood and Malik, 2013; Shakil *et al.*, 2018) or for diversification of portfolio (Conover *et al.*, 2009; Hoang *et al.*, 2015; Soja, 2019) or as a safe haven during adverse market fluctuations (Shakil *et al.*, 2018; Baur *et al.*, 2010; Baur *et al.*, 2016). Sessaiah *et al.* (2017) conducted a study in the Indian context and found that oil prices, exchange

rate, trade deficit and fiscal deficit were found to have a long run relationship. Gold prices and trade deficit contributes in bringing variance in exchange rates as well as crude oil prices. Similarly, Sudheer *et al.* (2015) found that the CAD is caused by gold and crude oil rather than currency fluctuations.

Eric *et al.* (2018) suggests that the Government that the Government should make continuous efforts to move towards other alternative energy sources, like solar energy, rather than relying solely on crude oil. This would help in reducing India's trade deficit to a large extent.

OBJECTIVES

India's trade deficit has widened due to its dependence on imports and uncompetitive exports since the last decade and an increased balance of trade deficit impacts the GDP of a nation adversely. An understanding of determinants impacting trade deficit deserves significant attention. The main objective of this study is to examine the impact and causality of crude oil, USD/INR exchange rate and gold on trade deficit of India. We apply Granger causality and ARDL Bounds test approach to validate the results empirically.

RATIONALE OF THE STUDY

Summarising from the empirical literature, the results show different evidence regarding the influence of oil prices, gold prices and exchange rates individually on trade deficit. Many previous studies have attempted to examine the relationships among trade balance, oil prices and exchange rates, but the findings of the study shows mixed results. An investigation of determinants of trade deficit covering all the three variables seems a less explored avenue for research. However, studies covering the impact of all these three significant variables on trade deficit in the Indian context have been quite scanty. The current research is an attempt

to bridge this gap in the existing literature. This research contributes towards examining the factors that impact trade deficit by using advanced econometric tools. It is a known fact that trade deficit is a significant macroeconomic indicator of the economic performance of any country. Also, when imports exceed the exports of a country, it leads to an increased outflow of currency resulting in a fall in the value of its currency. The value of imports of oil and gold are high because of the depreciation of Indian rupee. Hence in order to ensure reduction in the trade deficit, it is necessary to ensure that there is stability in the exchange rate. The choice of these variables has been made keeping in view the interdependence of these variables upon each other.

Examining the determinants of trade deficit would not only be useful for the Indian economy but also for developing countries that are more dependent on imports for meeting their resource requirements. The time period of the research from the year 2004 to 2019 also seemed appropriate to cover the run-up period to the global financial recession and its subsequent recovery. Reducing the trade deficit is viewed as an important goal that policymakers aim at.

RESEARCH METHODOLOGY

Data and Sources of Data

The study collected the monthly values of USD/INR Exchange Rates (USD_INR), Trade deficit (TD), Indian basket of crude oil prices (IB_Crude) and Gold prices (GOLD) for the period of 186 months from January 2004 to June 2019. Table 1 describes the variables under study and the source of data.

Analytical Tools

Unit Root Test

Augmented Dickey–Fuller (ADF) test and Phillip–Perron (PP) test has been employed to verify whether variables are stationary or not.

Table 1: Description of Variables and Data Sources

Variable	Description	Source
GOLD	Gold prices	World Gold Council
USD_INR	USD/INR exchange rates	Reserve Bank of India (RBI) Website
TD	Trade deficit	RBI Website
IB_CRUDE	Indian basket of crude oil prices	Petroleum Planning and Analysis Cell (PPAC)

Source: Compiled by the authors

Autoregressive Distributive Lag Model (ARDL)

ARDL model is generally used for modelling of nonstationary time-series data, particularly the ‘Bounds Test’ which is used to assess the long run relationship a group of time series variables, which are integrated at ‘zero’ order or integrated at ‘zero’ order or integrated at order ‘one’.

The general ARDL (p, q) model (Eq(1)) indicates that the current values of dependent variables (Y) are regressed with its own lagged values, current values and lagged values of independent variables (X) while τ_0 , Π and γ are parameters to be estimated. j and k are the optimum lag length to be used and e_t represents the error term or white noise disturbance.

A general ARDL (p, q) model is given as follow:

$$Y_t = \tau_0 + \sum_{i=1}^j \Pi_i Y_{t-i} + \sum_{i=0}^k \gamma_i X_{t-i} + e_t \dots(1)$$

Model (2) represents the standard model to test the linear relationship of time series data. Model (3) represents the long run model and Model (4) is to test the short-run relationship using ARDL estimated equation.

$$\ln(TD_t) = \alpha_0 + \alpha_1 \ln(USD_INR_t) + \alpha_2 (IB_CRUDE_t) + \alpha_3 (\ln GOLD_t) + e_t \dots(2)$$

$$\begin{aligned} \Delta \ln(TD_t) &= \theta_0 + \theta_1 (\ln USD_INR_{t-i}) + \theta_2 (IB_CRUDE_{t-i}) + \theta_3 (\ln GOLD_{t-i}) \\ &+ \sum_{i=1}^m \delta_i \Delta \ln(USD_INR_{t-i}) + \sum_{i=0}^n \beta_i \Delta \ln(IB_CRUDE_{t-i}) \\ &+ \sum_{i=0}^p \psi_i \Delta \ln(GOLD_{t-i}) + e_t \dots(3) \end{aligned}$$

$$\begin{aligned} \Delta \ln(TD_t) &= \beta_1 + \sum_{i=1}^m \delta_i \Delta \ln(USD_INR_{t-i}) + \sum_{i=0}^n \beta_i \Delta \ln(IB_CRUDE_{t-i}) \\ &+ \sum_{i=0}^p \psi_i \Delta \ln(GOLD_{t-i}) + \lambda ecm_{t-1} \dots(4) \end{aligned}$$

$$ECM_t = \ln(TD_t) - \theta_1 \ln(USD_INR_t) - (IB_CRUDE_t) - \theta_3 \ln(GOLD_t) + \theta_0 \dots(5)$$

The regression using non-stationary variables leads to spurious regression model. It can be resolved by differencing the data. The resolved regression model represents only short-run relationship. The long-term relationship model can be established by incorporating the concept of cointegration and ECM and thus the study can analyse both long-run and short-run relationships. Equation (4) represents the long-run cointegration relationship among the variables and then it produces the error correction representation. The error correction model indicates the speed of adjustment of disequilibrium back to long-run equilibrium.

The functional model specification is presented in the below equation.

$$\ln(TD_t) = f [\ln(USD_INR_t), \ln(IB_Crude_t), \ln(GOLD_t)]$$

Where, $\ln(TD_t)$, Trade Deficit; $\ln(USD_INR_t)$, USD/INR Exchange Rates; (IB_CRUDE_t) , Indian Basket of crude oil Prices, $\ln(GOLD_t)$, Gold prices

where the symbol λ represents the magnitude of the speed of adjustment. The symbol Δ represents sign of differencing and (e_t) is the error term or white noise disturbance. ECM is an error correction term obtained from the estimation of ARDL Equation (5). The lagged error correction term (residual) (ecm_{t-1}) denotes the disequilibrium in a long-run cointegration relationship.

VAR Granger Causality/Block Exogeneity Wald Test (GC Test)

The Granger causality test can be used for the variables which are stationary at level, that is, $I(0)$. Equation (6) and (7) represents Granger causality models. The GC test is used to assess whether lagged variables M_1 provides any statistically significant information on M_2 in the presence of lagged M_2 . Then M_1 does Granger cause M_2 otherwise M_1 does not Granger cause M_2 . The study also used robust Wald test statistics to verify the null hypothesis that all non-intercept coefficients are equal to zero.

$$M_{1,t} = a_0 + \sum_{i=1}^p a_i M_{1,t-i} + \sum_{j=1}^q \beta_j M_{2,t-j} + \varepsilon_t \dots(6)$$

$$M_{2,t} = a'_0 + \sum_{i=1}^p a'_i M_{2,t-i} + \sum_{j=1}^q \beta'_j M_{1,t-j} + \varepsilon'_t \dots(7)$$

ε_t and ε'_t are disturbances assumed to be uncorrelated.

ANALYSIS AND DISCUSSION

Table 2 clearly shows that the mean value of the variables are 3.965, 6.456, 8.187 and 10.869, respectively. Jarque–Bera test results clearly indicate that, except Indian basket of crude oil, rest of the macroeconomic variables are not normally distributed. Further, TD has more standard deviation (0.71), followed by GOLD (0.55), IB_Crude (0.39) and USD_INR (0.18).

Table 3 shows the unit root test results of the individual variable. The study used ADF and PP test to analyse the stationarity of given time series variable. The results clearly depict that all the variables are stationary at first-order difference ($I[1]$) at intercept and trend, except Trade Deficit which is stationary at a level using PP test. Further, the results depict that none of the variable are $I(2)$ or above, which ensures the existence of long run relationship among the variables.

Table 4 shows the results of optimum lag length in order to execute the best ARDL model under VAR environment. Akaike Information Criterion (AIC) is preferred over other model specification. According to the AIC criteria, maximum two lag lengths are to be used to analyse the data.

Table 2: The Descriptive Statistics of USD/INR Exchange Rate, Trade Deficit, Indian Basket of Crude Oil and Gold

	LUSD_INR	LIB_CRUDE	LGOLD	LTD
Mean	3.9658	8.1878	10.8694	6.4563
Median	3.9034	8.1666	11.1824	6.5655
Maximum	4.3035	8.8714	11.4623	7.1495
Minimum	3.6685	7.2006	9.7602	0.0023
Std. Dev.	0.1853	0.3963	0.5528	0.7166
Skewness	0.1801	-0.2914	-0.7318	-4.5351
Kurtosis	1.5201	2.4205	2.0419	37.8503
Jarque–Bera	17.8804	5.2067	23.5903	9996.29
Probability	0.0001	0.0740	0.000008	0.000000
Observations	186	186	186	186

Source: Calculated by the authors

Table 3: Results of Unit Root Test

Variables	ADF		PP		Decision
	Level	First difference	Level	First difference	
	Intercept and trend		Intercept and trend		
LUSD_INR	-3.2216	-3.4800 ***	-2.6143	-11.8795***	I[1]
	(0.0835)	(0.0448)	(0.2745)	(0.0000)	
LTD	-1.9987	-6.9118***	-5.9784***	-	I[1]
	(0.5975)	(0.0000)	(0.0000)	-	
LIB_CRUDE	-2.8149	-9.9259***	-2.8149	-9.7359***	I[1]
	(0.1938)	(0.0000)	(0.1938)	(0.0000)	
LGOLD	-0.9280	-12.7850***	-0.9461	-12.7856***	I[1]
	(0.9496)	(0.0000)	(0.9474)	(0.0000)	

Source: Calculated by the authors

Table 4: Shows the VAR Lag Order Selection Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-149.2596	NA	6.64e-05	1.731747	1.803524	1.760857
1	798.6341	1842.234	1.77e-09	-8.798125	-8.439238*	-8.652574
2	827.5149	54.82469*	1.53e-09*	-8.943671*	-8.297675	-8.681680*

Source: Calculated by the authors

Table 5: Results of the Bounds Test

Null hypothesis: No long-run relationships exist		
Test statistic	Value	K
F-statistic	7.261037	3
Critical value bounds		
Significance	I0 Bound	I1 Bound
5%	2.79	3.67
1%	3.65	4.66

Source: Calculated by the authors

Table 5 represents the results of the Bounds test. It clearly depicts that the *F*-statistic test value (7.2610) is larger than I (0) and I (1) bound values at 1% and 5% level of significance. Thus, it suggests that there is a strong long-run relationship among Trade Deficit, USD/INR exchange rate and Indian basket of crude oil and gold prices. This clearly indicates that cointegration relationship exists among the variables.

Table 6 shows the results of short- and long-run cointegration coefficients. The study used ARDL (2, 1, 1, 1) model based on the AIC criteria. The long-run coefficient results show that USD/INR Exchange Rates (LUSD_INR) and Indian basket of crude oil prices (LIB_Crude) have negative significant long run impact on Trade deficit (TD). The ARDL results found that LUSD_INR and LIB_crude have an inverse relationship with LTD. Thus, 1% decrease in USD_INR value leads to a 2.361% increase in TD value and vice versa. Further 15% decrease in LIB_Crude oil prices lead to 1.0729% increase in TD values.

The ARDL short-run results clearly show that only two-period lagged values of TD have an impact on the current values of TD. Further, the error correction term (CointEq(-1)) represents the speed of adjustment and is found to be negatively significant at 1% level

Table 6: Shows ARDL Cointegrating Long and Short Run Results

Dependent variable: LTD					
Short-run coefficients			Long-run coefficients		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
D(LTD(-1))	-0.30243***	0	LUSD_INR	-2.3618***	0.0012
D(LUSD_INR)	-2.8049	0.0832	LIB_CRUDE	-1.0729***	0.0014
D(LIB_CRUDE)	-0.76887	0.0719	LGOLD	0.42391	0.2083
D(LGOLD)	1.355854	0.1531	C	19.9882***	0
CointEq(-1)	-0.464***	0			

$$\text{Cointeq} = \text{LTD} - (-2.3618 \times \text{LUSD_INR} - 1.0729 \times \text{LIB_CRUDE} + 0.4239 \times \text{LGOLD} + 19.9882)$$

***Significant at 1% level

Source: Calculated by the authors

significance. It is expected to have a negative sign and indicates the speed at which the variables adjust to equilibrium. The coefficient value (0.464) indicates that 46.4% of disequilibrium is adjusted back to equilibrium with accelerated speed of adjustment.

Theory says that depreciation of exchange rate leads to decline in the volume of imports, increase in the demand for exports and results in an improved trade balance. The result of this study supports the theoretical literature. The results are also consistent with previous researchers. Lan Huong Hoang (2016) studied Vietnam's economy and found negative relationship with exchange rate and trade balance. Akorli and Edem (2017) documented that the exchange rate has a negative impact on the country's trade balance in the long run. Ogutu (2014), Bahmani-Oskooee and Ratha (2008) documented that devaluation of currency can improve the trade balance. Tufail *et al.* (2014) and Shah and Majeed (2014) documented that an exchange rate has negative and significant relationship with trade deficit.

Hassan and Zaman (2012) studied Pakistan's economy and found a significant negative relationship between oil prices and trade balance both in the long run and short run. Velde (2007) and Tsen (2009) suggested that higher oil prices lead to reduction in the import

of oil thereby reducing the trade deficit. Akpan (2007), Mohammad (2010) and Sanchez (2011) documented negative impact of oil prices on trade balance. The overall results of the study are also consistent with the studies of Lan Huong Hoang (2016); Akorli and Edem (2017); Tufail *et al.* (2014); Shah and Majeed (2014); Tiwari and Olayeni (2013) & Hassan and Zaman (2012).

Table 7 depicts the diagnostic test results. The study conducted various diagnostic tests to verify the stability of the ARDL model. Heteroscedasticity and Serial Correlation LM test results clearly indicate that residuals of the model do not have heteroscedasticity and autocorrelation. Further Ramsey's test results indicate that the model is most stable. These results confirm the stability of the long relationship of TD, USD_INR, LIB_CRUDE and GOLD.

Table 7: Diagnostic Test Results of ARDL Model

Heteroscedasticity test: ARCH			
Obs R^2	1.521964	Prob. chi-square (2)	0.4672
Breusch-Godfrey serial correlation LM test			
Obs R^2	0.894606	Prob. chi-square (2)	0.6394
Ramsey RESET test			
F-statistic	0.526772	Prob	0.4689

Source: Calculated by the authors

Table 8: Shows VAR Granger Causality/Block Exogeneity Wald Tests

Independent Variables	Dependent variables							
	D(LTD)		D(LGOLD)		D(LIB_CRUDE)		D(LUSD_INR)	
	Chi-square	Prob	Chi-square	Prob	Chi-square	Prob	Chi-square	Prob
D(LTD)	–	–	0.7223	0.6969	1.6961	0.4282	5.3810	0.0678
D(LGOLD)	2.5174	0.2840	–	–	0.1648	0.9209	2.9460	0.2292
D(LIB_CRUDE)	14.5561***	0.0007	2.5080	0.2854	–	–	0.3931	0.8215
D(LUSD_INR)	6.5371**	0.0381	1.7616	0.4144	10.8424***	0.0044	–	–
All	27.5430***	0.0001	5.0176	0.5416	13.1209**	0.0412	9.0126	0.1729

***, **Significant at 1% and 5% level of significance level, respectively; *Source:* Calculated by the authors

Table 9: Shows Consolidated VAR Granger Causality/Block Exogeneity Wald Tests Results (Unidirectional and Bidirectional Causality Test Results)

Uni directional causality			
D(LTD)	D(LGOLD)	D(LIB_CRUDE)	D(LUSD_INR)
D(LIB_CRUDE)	–	D(LUSD_INR)	–
D(LUSD_INR)			
Bidirectional causality			
–	–	–	–

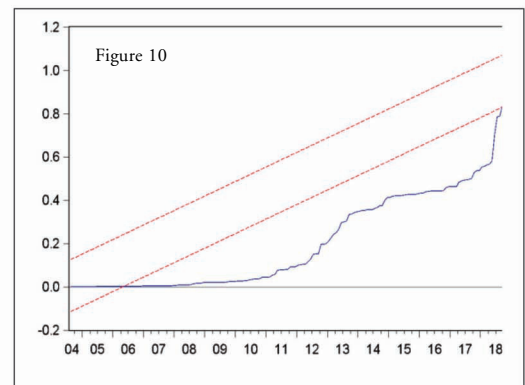
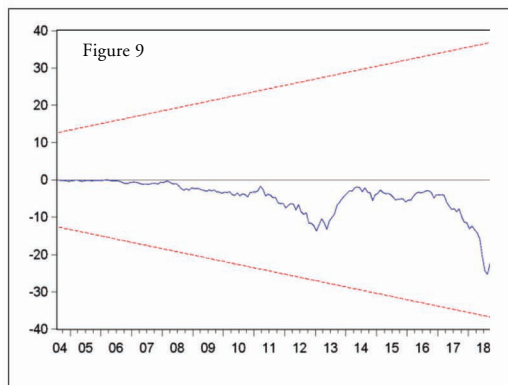
Source: Compiled by the authors

Tables 8 and 9 shows individual and consolidated results of VAR Granger Causality/Block Exogeneity Wald test results, respectively. The results clearly indicate that unidirectional causality runs from LIB_CRUDE to LTD and LUSD_INR to LTD. The results indicate no causal relationship running from gold to TD. However, these results are consistent with ARDL results, where it is found that no short-run and long-run relationship exists between gold and TD.

Figures 9 and 10 show the stability test results of the model. The study used CUSUM and CUSUM of Squares Test to verify the stability of all the coefficients of the selected ARDL model. The CUSUM test figure clearly shows CUSUM (the blue line) is well within critical region at a 5% level of significance. Thus, it indicates that the coefficients of the model are stable, CUSUM of squares indicates that the coefficients of the model are not stable and shows some structural

Figures 9 and 10: The Plot of CUSUM (Stability Test)

Source: Prepared by the authors



breaks in the data. The Indian Macroeconomical data may witness the structural breaks during the sample period, which constitutes pre-global recession period (2004–2007), Great Recession period (2007–2009) and Global recession Period 2 that became imperative during the early 2010s which kicked momentum across the globe in 2011 becoming the second-worst recession of all times since the Great Depression and the and the subsequent economic slowdowns in India. The GDP growth of the Indian Economy has touched 25-quarter low in the first quarter of 2019–2020 due to weak private consumption and investment.

CONCLUSION

The study examined the impact and causality of crude oil, gold and exchange rate on trade deficit in India from the year 2004 to 2019. The study employed ARDL model and Granger causality test to analyse the possible short term and long term effects among the variables under study. After performing the tests, the study found that USD/INR and crude oil prices have a negative and long-run impact on trade deficit. The study also observed no impact of gold on trade deficit. Further, Granger causality test revealed a unidirectional causality running from crude oil and USD/INR to trade deficit. The absence of long-term impact and causal relationship effect of gold on trade deficit suggest that gold prices do not have any significant effect on India's trade balance. The study fosters global market participants and policymakers to consider a balanced mechanism to regulate the exchange rate of the country and accelerate their efforts towards reducing the nation's dependence on the import of crude oil and gold by encouraging alternative options.

POLICY IMPLICATIONS

Successfully addressing India's trade deficit challenge is a difficult but an important task. The policymakers

must accelerate their efforts towards reducing the nation's dependence on the import of crude oil and gold. Further, it is important to develop alternative energy sources like solar energy, wind power as a substitute of crude oil. It becomes essential to reanalyse the domestic and non-conventional sources of oil supply as a substitute for existing foreign country oil sources to meet the country's energy needs. The Government should promote FDI as it would help in accelerating the volume of exports. The Government of India has encouraged encouraged the use of electric vehicles which will further reduce the requirement of fuel imports. The study suggests that the Reserve Bank of India (RBI) and monetary authorities can consider the paramount role of country's Exchange rate and oil price in monetary policy analysis. These variables have a significant long-term effect on the economic growth of the country. Since India practices managed floating exchange rate system, India has the advantage of promoting its export growth because an undervalued exchange rate boosts the competitiveness of its exports. Despite the depreciation of Indian Rupee as compared to the US dollar, India is not taking advantage of promoting its exports. Thus, the competitiveness of exports in the Indian context is certainly required. The negative significant impact of exchange rate on the trade deficit clearly indicates that monetary authorities can participate in the markets and depreciate the value of the Indian Rupee in order to improve the trade balance of the country. Theory proves that when currency of a country depreciates, it results in an increase in the volume of its exports and reduction in its imports. The continuous effort of policymakers should be on diversifying away from oil-based activities to alternative activities that would generate foreign reserves for India. India can take the advantage of its young skilled population to produce more high-value exports instead of low-value products.

LIMITATIONS AND FUTURE RESEARCH

The study has been conducted in the Indian context and it can be extended to Asia and other regions of the world. Further study can be carried out by considering other relevant determinants of the trade deficit.

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