RELATIONSHIP BETWEEN REAL EXCHANGE RATE AND ECONOMIC GROWTH IN INDIA

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ABSTRACT

This article studies a near relationship between the real exchange rate and economic growth in India, for the period from Q1 2005 to Q4 2017, by considering the variables such as Nominal Exchange Rate, Consumer Price Index, Balance of Payments, Exports, Foreign Exchange Reserves, Gross Domestic Product, Imports, Inflation, International Reserves and Money Supply. This study used the Johansen cointegration test, Granger Causality and ADF stationary tests, for the purpose of analysis. The study found that Real Exchange Rate did have a linear relationship with all the variables of Economic Growth, except Balance of Payments and Inflation. Granger Causality Test revealed that the Real Exchange Rate recorded unidirectional relationship with Exports, Foreign Exchange Reserves and Money Supply. There was long-run relationship between Real Exchange Rate and Economic Growth. Hence, the policy makers in India should pay special attention to these variables, in order to devise appropriate policy, for the economic growth of India in the long run.

KEYWORDS: Real Exchange Rate, Economic Growth, Causality, Cointegration, Imports and Exports.

JEL code: F31, F43, O11.

1. Introduction

The exchange rate is one among many macro-economic factors, which is considered as the most important factor for the economic growth of India. The exchange rate is influenced by factors like GDP, inflation rate, money supply and interest rate. The rate at which domestic currency is exchanged against a foreign currency is the rate of exchange. The decline in currency

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value is called depreciation. The emerging economies normally have confidence in import to meet their internal demand. At the same time, almost all the emerging economies trade across countries and this, in turn, has to consequence for the inclusive economy (**Janus, T., & Riera-Crichton, D. 2015**). In the dollar-pegged system, the majority of East Asian Currencies had witnessed this phenomenon in 1997. Those affected countries started worrying, about the extreme dependence on US currency (USD). However, in the majority of the Asian Countries, the production or distribution networks, particularly in machinery industries, have expanded robustly at the international level and they have recognized their implications for the Asian Currency Crisis. The exchange rate of one currency against the other currency is subjective, by various fundamental and technical factors. These factors include relative supply and demand of both currencies, economic performance, the outlook for inflation, interest rate differentials, capital inflows and outflows, technical support and resistance levels and so on (**Rodrik.D, 2008**).

The foreign exchange rate could greatly control the growth of the economy of any nation. Besides, the foreign exchange rate regimes were the main influencing factors when they experienced financial crises. The foreign exchange rate also becomes important for policymakers. There were numerous reasons for a financial emergency in countries where high-value losses resulted in the nominal rates as a result of the crises (**Walters and De Beer, 1999**).

The Reserve Bank of India has acted with timely interventions by exchanging dollars from time to time. However, in the crisis periods of global intensity, the investors have preferences for USD as a safe port. The RBI can reduce capital controls, by raising the ceiling level of FII on investment in government and corporate debt instruments and introduce higher limits in European Central Banks. The Government can generate a settled political and economic environment. But a lot hinges on the Global economic outlook and the future of Eurozone, which will determine the future of INR (**Hegwood, N. D., & Nath, H. K. 2014**).

The relationship between the exchange rate and the economic growth of an economy is critical. Some empirical studies have proved that the real exchange rate positively affected economic growth. Meanwhile, some studies asserted that the real exchange rate negatively affected economic growth. Nevertheless, in the India context, these findings were not confirmed. Against this background, this study attempts to find the relationship between Real Exchange Rate and Economic Growth in India.

2. Review of Literature

A summary of concise information related to real exchange rate and economic growth available in the extant literature is exhibited in the following **Table - 1**. A selected review is presented briefly.

Table – 1 A brief summary of Recent studies on Real Exchange Rate and Economic Growth

Name of Author(s) (date)	Variables used	Country, coverage, and method	Findings
Aurangzeb, A et. al., (2005)	Export volumes, domestic export price index and bilateral exchange rate	Pakistan with Canada, France, Germany, Italy, Japan, Netherland, Singapore, Spain, UK and USA; Annual data (1985 - 2001); Unit root test, Co-integration, Error Correction Model	There was no causality from exchange rate volatility to exports in all sample countries.
Haykawa, K. et. al., (2009)	Export, Imports, Gross Domestic Product and Exchange Rate	60 sample countries from all over the world; Annual Data (1992 – 2005); Robustness Test, Regression.	Trading by East Asian Countries with other regions, was encouraged more than Intra – East Asian Trade. Discouragement of Intra East trade raised due to Distance – the related cost of East Asia.
Suna Korkmaz (2013)	Exchange Rate, Gross Domestic Product,	France, Germany, Greece, Hungary, Italy, Spain, Turkey, Poland and United Kingdom; Annual Data (2002 – 2011); Unit Root Test, Granger Causality Test and Cointegration Test	Presence of Causality Relationship between Exchange Rate and Economic Growth for all nine sample European Countries. The existence of long-run relationship was revealed with evidence of Cointegration test with the statistic value that was higher than 1.96.
Dimitrios Serenis (2013)	Exports, Gross Domestic Products and Exchange Rate	Croatia and Cyprus; Quarterly data (1990:q1-2012: q1); Vector Error Correction Model	This study examines the impact of exchange rate volatility for Croatia and Cyprus on Exports. The study found that there was a link between Exchange Rate Volatility and Exports.
Alessandro Nicita (2013)	Real Effective Exchange Rate, Export and Gross Domestic Product	Malawi, Morocco and South Africa; Quarterly Data (1973: q1 – 1990 q1); Unit Root Test, Vector Autoregressive Model.	The study found the impact of exchange rate volatility that was not in a furious concern when it was in the short run.
Khairul Alom (2015)	Exchange Rate, Gross Domestic Product, Trade Openness, FDI	Bangladesh; annual data (1985 – 2012); Descriptive Statistics, Unit Root Test, Granger Causality and	There was a unidirectional causal relationship between Exchange Rate and Gross Domestic Product and Exchange Rate and Trade Openness. There was long-run

	Inflow, Portfolio Equity	Johansen's Cointegration	relationship between Exchange Rate and Economic Growth in Bangladesh.
Ghulam Mujtaba Chaudhary, et al., (2016)	Exchange Rate, Import and Export	Pakistan, India, Sri Lanka, Bangladesh, Malaysia, Indonesia, Singapore and Thailand; (1979 – 2010) Diagnostic Test, Regression, (1995 – Cointegration, Error Correction Model,	The study reveals that significant long-run relationship did exist between exchange rate and export in most of the sample countries except Malaysia, Singapore and Thailand.
Dimitrios Asteriou et al., (2016)	Exchange Rate, Imports and Exports	Mexico, Indonesia, Nigeria and Turkey; (1925 – 2012) Unit Root Test, ARIMA Model, GARCH, Granger Causality and ARDL model.	There was a positive long-run relationship between the exchange rate with export and import demand for the only country Turkey.
Mohamed Aslam (2016)	Gross Domestic Product, Exchange Rate, Inflation Rate, and Interest Rate	Srilanka; Annual Data (1970 - 2015); ADF test and Multiple Regression	GDP was stationary at both levels; Inflation and Interest Rate were stationary at First difference and Exchange Rate had not attained stationarity at any levels.
Mohsen Bahmani Oskooee, et al., (2017)	Export, Imports, National Income and Real Effective Exchange Rate	Burundi, Egypt, Ethiopia, Kenya, Lesotho, Mauritius, Morocco, Nigeria, Sierra Leone, South Africa, Tanzania and Tunisia; Annual Data (1971 – 2005) Bounds Testing Approach	Most of the sample countries earned a significant relationship between exports and imports with exchange rate volatility in the short run; Exchange rate with exports shown negative effects in the countries like Nigeria and Sierra Leon;
Abdullahi Ahmed Jibrin et. al., (2017)	Exchange Rate, Gross Domestic Product, Inflation, Money Supply, Interest rates	Benin Republic, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, others are Nigeria and Sierra Leone; annual data (1990 – 2014); Classical Linear Regression Model	Benin, Liberia and Sierra Leone did have a significant relationship between GDP and Inflation. Ghana recorded the relationship between Gross Domestic Product and Interest rates. Exchange Rate and Gross Domestic Product showed their significant relationship in four countries namely Benin, Guinea Bissau, Liberia and Nigeria.
Ukwuoma Chidi Okonkwo et.al., (2017)	Exchange Rate, Gross Domestic Product, Oil Revenue, Government Expenditure,	Nigeria; Annual Data (1970-2010); Granger Causality, Vector Error Correction Model, Impulse response test	The weak impact on the Nigerian economy influenced the causality relationship between Sample Variables. There was a bidirectional relationship between Gross Domestic Product and External Reserve.

	Inflation and External Reserve		
Chandan Sharma et.al., (2018)	Exports, Imports and Nominal Exchange Rate of India, U.S, Germany, Japan and China	Annual Data, (2009- 2016) Unit Root Test, GARCH type Model, Granger Causality Test, NARDL model	In both long run and short run effect, nominal exchange rate volatility had a positive impact on Japan's export performance with respect to import performance.
Cengiz Tune, et.al., (2018)	Gross Domestic Product, Consumer Price Index and Exchange Rate	98 destination countries (1997 to 2014), Regression	This study found a positive impact of external exchange rate risk on exports.

The above studies provided an overview of the relationship between Real Exchange Rate and Economic Growth of Asia – Pacific Countries. Various approaches were reviewed. But this study purposes to examine the relationship between Real Exchange Rate and Economic Growth. Therefore, this study would provide the evidence to understand the relationship between the Real Exchange rate and Economic Growth of Asia – Pacific Countries.

3. Objectives, Methodology and Variables used

3.1. The objective of the Study

The main objective of this study was to **examine the relationship between Real Exchange Rate and Economic Growth in India.**

3.2 Hypotheses of the Study

To fulfill the objective of this study, five null hypotheses were developed and tested in this study.

NH_1: There is no normal distribution in the Real Exchange Rate and Economic Growth in India

NH_2: There is no stationarity in the Real Exchange Rate and Economic Growth in India

NH_3: There is no linear relationship between the Real Exchange Rate and Economic Growth in India

NH_4: There is no causal relationship between the Real Exchange Rate and Economic Growth in India

NH_5: There is no long-run relationship between the Real Exchange Rate and Economic Growth in India

3.3 VARIABLES ADOPTED AND ESTIMATION TECHNIQUES

3.3.1. Sample Variables

To test the objectives, the quarterly frequency data of sample variables from 2005 to 2017 ($RER_{AUD/USD} = NER_{AUD/USD} \times (CPI_{USA} / CPI_{Australia})$) were collected from Euromonitor database. The Real Exchange Rate was considered as the dependent variable and the economic

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growth variables (Balance of Payments, Exports, Foreign Exchange Reserves, Gross Domestic Product, Imports, Inflation, International Reserves and Money Supply) were employed as independent variables.

The relationship between the variables is defined as follows:

$$RER_t = f(BOP_t, EXP_t, FER_t, GDP_t, IMP_t, INF_t, IRS_t, MSP_t) \ldots\ldots\ldots\ldots (1)$$

$$RER_t = \beta_0 + \beta_1 BOP_t + \beta_2 EXP_t, + \beta_3 FER_t + \beta_4 GDP_t + \beta_5 IMP_t + \beta_6 INF_t + \beta_7 IRS_t + \beta_8 MSP_t + \varepsilon_t \ldots\ldots\ldots\ldots (2)$$

Where:

RER_t: Real Exchange Rate, BOP_t: Balance of Payments, EXP_t: Exports, FER_t: Foreign Exchange Reserves, GDP_t: Gross Domestic Product, IMP_t: Imports, INF_t: Inflation, IRS_t: International Reserves, MSP_t: Money Supply, β: Coefficients, ε_t: Error term

3.3.3 Estimation Techniques

. The following tools were used for the analysis.

➢ **Descriptive Statistics** (to find out the normal distribution between Real Exchange Rate and Economic Growth)

➢ **Unit Root Test** (to find out the stationarity to the Real Exchange Rate and Economic Growth)

➢ **Correlation** (to examine the relationship between Real Exchange Rate and Economic Growth)

➢ **Regression** (to examine the impact of Real Exchange Rate on Economic Growth)

➢ **Granger Causality** (to examine the causal relationship between Real Exchange Rate and Economic Growth)

➢ **Co-integration** (to examine the long run relationship between Real Exchange Rate and Economic Growth.

3.4 Limitations of the Study

This research study suffered from the following limitations.

• This study was based on secondary data, collected from Euromonitor.

• This study was restricted to only one country covering a period of only thirteen years.

• All the limitations, associated with various tools like Descriptive Statistics, Unit Root Test, Correlation, Regression, Granger Causality and Cointegration, are applicable to this study also.

4. Results

4.1 Normality of Real Exchange Rate and Economic Growth in INDIA

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From **Table - 2**, that the mean (average) returns for all sample variables, except Inflation (-0.987) and Real Exchange Rate (-0.019), were positive in India during the study period. It is significant that the mean return of Balance Payments in India (0.450) scored higher than that of other sample variables considered for this study. The analysis of Standard Deviation indicated that the Balance of Payments (2.343) recorded high volatility due to risk in the Indian Economy, followed by Inflation, with the value of 1.891, Imports with the value of 0.116, Exports with the value of 0.096, Money Supply with the value of 0.091, Gross Domestic Product with the value of 0.070, Foreign Exchange Reserves with value of 0.053, International Reserves with the value of 0.052 and Real Exchange Rate with the value of 0.043, during the study period. The values of skewness, for all the sample variables, relating to Real Exchange Rate and Economic Growth in India, were between -3 to +3, due to more positive values of skewness. It is to be noted from the **Table – 2** that data for sample variables were skewed right and the right tail was long relative to the left tail. The values of Kurtosis, for all the sample variables, were more than three, except Gross Domestic Product (2.833) and Inflation (2.397), during the sample period. It indicated that the data series of sample variables did follow the peak of the distribution during the study period.

It is noted from **Table – 2** that the values of Jarque Bera, for all the sample variables, except Balance of Payments (140.514), Money Supply (80.825) and Real Exchange Rate (9.327) earned a value less than five during the study period. The probability values of the descriptive statistics were at 0.000 (for Balance of payments), 0.676 (for Exports), 0.593 (for Foreign Exchange Reserves), 0.582 (for Gross Domestic Product), 0.119 (for Imports), 0.479 (for Inflation), 0.566 (for International Reserves), 0.000 (for Money Supply) and 0.009 (for Real Exchange Rate) during the study period. It is to be noted that out of nine sample variables, the values of four variables, namely, Balance of Payments, Money Supply and Real Exchange Rate were below 0.05 (significant value). But the data of other six sample variables (Exports, Foreign Exchange Reserves, Gross Domestic Product, Imports, Inflation and International Reserves) were not normally distributed during the sample period. Hence the null hypothesis (NH$_1$) – **There is no normal distribution in the Real Exchange Rate and Economic Growth in India,** was accepted.

The overall analysis of **Table – 2** reveals that the mean values, in respect of sample variables in India, ranged from -0.987 to 0.450 during the study period. The Balance of Payments recorded a high mean value of 0.450, followed by Imports (0.033) and Exports (0.029). It is to be noted that Inflation recorded the least and the negative mean value (-0.987). From this, it is clear that sample variables like Real Exchange Rate and Economic Growth except for Inflation and

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Real Exchange Rate, were significant factors for the growth of India, especially to render a stable economy. Hence it is suggested that international investors may consider these factors before investing their hard-earned money in India, and get better returns from the trading of FOREX in India.

4.2 Stationarity of Real Exchange Rate and Economic Growth in INDIA

According to the findings of ADF as given in **Table - 3** Test, the statistical values, for all the nine sample variables, were at -6.895 (for Balance of Payments), -7.571 (for Exports), -4.456 (for Foreign Exchange Reserves), -8.249 (for Gross Domestic Product), -6.556 (for Imports), -11.017 (for Inflation), -3.738 (for International Reserves), -9.470 (for Money Supply) and -5.758 (for Real Exchange Rate) during the study period. The statistical values, for all the sample variables, were less than that of critical test value at 1% (-3.56), 5% (-2.92) and 10% (-2.59) significance levels.

The results of the PP Test, given in the Table, indicated that the statistical values, for all the nine sample variables of India, were at -6.894 (for Balance of Payments), -7.539 (for Exports), -4.542 (for Foreign Exchange Reserves), -9.463 (for Gross Domestic Product), 6.540 (Imports), -15.457 (for Inflation), -4.409 (for International Reserves), -10.205 (for Money Supply) and -5.758 (for Real Exchange Rate) and the critical values for these variables, at 1%, 5% and 10% levels of significance, were higher than that of statistical test.

According to the results of the ADF Test and PP Test, the returns, for all the nine sample variables of India, attained stationarity at the level {I(0)}. In the ADF Test, a variable, namely, International Reserves (-3.738) earned a value higher than that of other statistical values for remaining sample variables. sThe analysis of the Durbin Watson Statistic showed the statistical values of all the nine sample variables, which were closer to the value of two. The values of the Durbin Watson Test Statistic were at 2.012 (for Balance of Payments), 0.539 (for Exports), 1.887 (for Foreign Exchange Reserves), 1.826 (for Gross Domestic Product), 1.984 (for Imports), 2.238 (for Inflation), 1.842 (for International Reserves), 2.018 (for Money Supply) and 1.996 (for Real Exchange Rate). In other words, returns of all the nine sample variables of India attained stationarity during the period from Q1 2005 to Q4 2017.

A variable, namely, Inflation recorded the highest value under Durbin Watson Statistic (2.238) while Exports recorded the highest R-Squared value (1.812), under both ADF and PP Test during the sample period. Hence the null hypothesis (NH$_2$) namely, **There is no stationarity in the Real Exchange Rate and Economic Growth in India,** was rejected.

It is to be noted that the traders, in the above scenario may not earn abnormal returns and hence traders are advised to be cautious when they take an investment decision.

4.3 Linear Relationship between Real Exchange Rate and Economic Growth in India

It is clear from **Table – 4** that the Real Exchange Rate and sample variables of Economic Growth, except Balance of Payments (-0.002) and Inflation (-0.156), were correlated with each other. A variable, namely, Exports was correlated with sample variables of Economic Growth, except Balance of Payments (-0.191) and Inflation (-0.106). A high degree of correlation was reported between International Reserves and Foreign Exchange Reserves (0.991) of India, followed by Real Exchange Rate and International Reserves (0.570) of India, Real Exchange Rate and Foreign Exchange Reserves (0.566) of India and Real Exchange Rate and Imports of India with the value of 0.491.

According to the results of correlation, the linear relationship between Real Exchange Rate and Economic Growth was not significant during the study period but there was a low correlation between Real Exchange Rate and Economic Growth of India. A variable set, namely Exports and Balance of Payments, had recorded the lowest correlation, with the value of -0.191, followed by Gross Domestic Product and Balance of Payments of India, with the value of -0.151. There were only lesser degrees of the interrelationship between Real Exchange Rate and Economic Growth of India. Hence, the null hypothesis (NH$_3$) namely, **there is no linear relationship between Real Exchange Rate and Economic Growth in India,** was accepted.

From the overall analysis of the Table, a variable, namely, Real Exchange Rate did have a relationship with Economic Growth Variables (except Balance of Payments and Inflation). In short, international traders should study all the variables such as Trade Balance, Gross Domestic Product, Money Supply and Reserves before taking trading decisions. Besides, they also can invest their hard working money in India to get better returns from their trading.

4.4 Impact of Real Exchange Rate on Economic Growth in INDIA

The analysis of the **Table - 5** reveals that out of eight variables, four variables (Balance of Payments, Exports, Imports and International Reserves) earned negative t-values, with Real Exchange Rate, during the study period. Those four variables, namely, Foreign Exchange Reserves, Gross Domestic Product, Imports and Money Supply recorded t-values (standardized coefficients) of 0.828, 0.915, 3.968 and 2.410 respectively during the study period. In the case of Standardized Coefficients, Imports (3.968) earned the highest value. The significant value of Imports was 0.000. However, Imports (0.000) and Money Supply (0.020) were statically significant with Real Exchange Rate at 95% confidence interval. It is to be noted that other six

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independent variables (Balance of Payments, Exports, Foreign Exchange Reserves, Gross Domestic Product, Inflation and International Reserves) were not significant, with Real Exchange Rate, during the study period.

The analysis of ANOVA and model summary indicated that there were inter-linkages between eight independent variables with Real Exchange Rate. From the overall analysis of the model summary, it is clear that the R-value (0.781), Adjusted R-square value (0.537) and Durbin Watson test (2.072) recorded a significant impact. However, the F-test value was also less than 0.05 (0.000). The analysis of these values clearly revealed that the regression model was perfectly fit. Hence, the null hypothesis (NH$_4$) namely "**There is no impact of Real Exchange Rate on Economic Growth in India**", was rejected.

4.5 Causal Relationship between Real Exchange Rate and Economic Growth in INDIA

The analysis of F-Statistic on Real Exchange Rate with Economic Growth as given in **Table – 6** revealed that three sample variables (Imports, Inflation and International Reserves) reported unidirectional '←' and '→' or one-way linkage. The other four sample variables (Balance of Payments, Exports, Foreign Exchange Reserves and Money Supply) recorded no casualty linkage (---). The remaining variable namely Gross Domestic Product as bidirectional or two-way linkage (<-->) of India.

Hence, the null hypothesis NH$_5$ - **there is no Casual relationship between Real Exchange Rate and Economic Growth** was partially rejected. In short, four sample variables (Balance of Payments, Exports, Foreign Exchange Reserves and Money Supply) recorded no causal linkages (--) period from Q1 2005 to Q4 2017. The investors or traders, who wish to trade in India, may note this information before investing their hard working money in India to get better returns.

Figure - 1 reveals the graphical expression showing three forms of linkages, namely, unidirectional, bidirectional and no causal linkages were reported for eight sample variables of Economic growth with the real exchange rate, during the period from Q1 2005 to Q4 2017. It is evident from the picture that variables such as Imports, Inflation and International Reserves had experienced unidirectional or one-way linkage with Real Exchange Rate. A variable, namely, Gross Domestic Product reported two bidirectional or two-way linkage. There was no causal linkage between three sample variables of Economic Growth, namely, Balance of Payments, Exports, Foreign Exchange Reserves and Money Supply, with Real Exchange Rate.

4.6 Cointegration Test for Real Exchange Rate and Economic Growth in INDIA

It is to be noted from **Table – 7,** that intercept and trend were not present in the cointegration equation. From the trace statistics, the probability value (0.000) (461.278) was below 5% or 0.05 (significant value) and trace statistic value was greater than the critical value (197.371). In the Maximum Eigen Statistic, the p-value (0.000) (144.728) was below 5% or 0.05 (significant value) and it was greater than the critical value (58.434). In the case of Maximum Statistic p-value, all the cointegrating vectors obtained the value below 0.05. Both the Trace Statistic value and the Maximum Eigen Value statistics revealed that there were six cointegrating vectors between India's Real Exchange Rate and Economic Growth. Hence, the Null Hypothesis (NH_6) – **there is no long-run relationship between Real Exchange Rate and Economic Growth** was rejected.

5. Conclusion

This study mainly tested the relationship between Real Exchange Rate and Economic Growth in India. There was no linear relationship between Real Exchange Rate and Economic Growth in India. The GDP and RER recorded a unidirectional relationship during the study period. According to linear regression, only two dependent variables namely, Imports and Money Supply, affected Real Exchange Rate. Johansen Cointegration test proved the long run relationship between Real Exchange Rate and Economic Growth, at the level itself. Therefore, the result confirmed that the high exchange rate promotes the economic growth of countries. Not only RER but also imports and exports would control economic growth. It also found that exports and imports were crucial for upgrading the growth of the economy.

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TABLES AND FIGURE

Table 2: Normality of Real Exchange Rate and Economic Growth for India from Q1 2005 to Q4 2017

	BOP	EXP	FER	GDP	IMP	INF	IRS	MSP	RER
Mean	0.450	0.029	0.023	0.027	0.033	-0.987	0.023	0.023	-0.019
Median	-0.018	0.021	0.020	0.024	0.028	-1.100	0.020	0.038	-0.014
Maximum	9.938	0.259	0.164	0.186	0.320	3.500	0.161	0.389	0.080
Minimum	-2.172	-0.265	-0.111	-0.112	-0.285	-4.500	-0.106	-0.305	-0.146
Std. Dev.	2.343	0.096	0.053	0.070	0.116	1.891	0.052	0.091	0.043
Skewness	2.463	-0.076	0.282	0.343	-0.163	0.281	0.290	0.258	-0.837
Kurtosis	9.370	3.581	3.406	2.833	4.364	2.397	3.434	9.086	4.227
Jarque-Bera	140.514	0.782	1.044	1.081	4.264	1.473	1.137	80.825	9.327
Probability	0.000	0.676	0.593	0.582	0.119	0.479	0.566	0.000	0.009

Source: Euromonitor database and computed by using E-views

Note: BOP – Balance of Payments, EXP – Exports, FER – Foreign Exchange Reserves, GDP – Gross Domestic Product, IMP – Imports, INF – Inflation, IRS – International Reserves, MSP – Money Supply

Table 3: Stationarity of Real Exchange Rate and Economic Growth for India from Q1 2005 to Q4 2017

Variable	LOS	ADF Test		PP Test		Critical Value	Durbin Watson Test Statistic	R-squared
		Statistical Value	P-value	Statistical Value	P-value			
BOP	1%	-6.895	0.000	-6.894	0.000	-3.565	2.012	0.492
	5%	-6.895	0.000	-6.894	0.000	-2.920		
	10%	-6.895	0.000	-6.894	0.000	-2.598		
EXP	1%	-7.571	0.000	-7.539	0.000	-3.565	0.539	1.812
	5%	-7.571	0.000	-7.539	0.000	-2.920		
	10%	-7.571	0.000	-7.539	0.000	-2.598		
FER	1%	-4.456	0.001	-4.542	0.001	-3.565	1.887	0.288
	5%	-4.456	0.001	-4.542	0.001	-2.920		
	10%	-4.456	0.001	-4.542	0.001	-2.598		
GDP	1%	-8.249	0.000	-9.463	0.000	-3.568	1.826	0.451
	5%	-8.249	0.000	-9.463	0.000	-2.921		
	10%	-8.249	0.000	-9.463	0.000	-2.599		
IMP	1%	-6.556	0.000	-6.540	0.000	-3.565	1.984	0.467
	5%	-6.556	0.000	-6.540	0.000	-2.920		
	10%	-6.556	0.000	-6.540	0.000	-2.598		
INF	1%	-11.017	0.000	-15.457	0.000	-3.571	2.238	0.593
	5%	-11.017	0.000	-15.457	0.000	-2.922		

	10%	-11.017	0.000	-15.457	0.000	-2.599		
IRS	1%	-3.738	0.006	-4.409	0.001	-3.568		
	5%	-3.738	0.006	-4.409	0.001	-2.921	1.842	0.281
	10%	-3.738	0.006	-4.409	0.001	-2.599		
MSP	1%	-9.470	0.000	-10.205	0.000	-3.565		
	5%	-9.470	0.000	-10.205	0.000	-2.920	2.018	0.647
	10%	-9.470	0.000	-10.205	0.000	-2.598		
RER	1%	-5.758	0.000	-5.758	0.000	-3.565		
	5%	-5.758	0.000	-5.758	0.000	-2.920	1.996	0.404
	10%	-5.758	0.000	-5.758	0.000	-2.598		

Source: Euromonitor database and computed by using E-views
Note: BOP – Balance of Payments, EXP – Exports, FER – Foreign Exchange Reserves, GDP – Gross Domestic Product, IMP – Imports, INF – Inflation, IRS – International Reserves, MSP – Money Supply, RER – Real Exchange Rate and LOS – Level of Significance

Table 4: Linear Relationship between Real Exchange Rate and Economic Growth for India from Q1 2005 to Q4 2017

		BOP	EXP	FER	GDP	IMP	INF	IRS	MSP	RER
BOP	Pearson Correlation	1.000								
	Sig. (2-tailed)									
EXP	Pearson Correlation	-0.191	1.000							
	Sig. (2-tailed)	0.176								
FER	Pearson Correlation	-0.045	.363**	1.000						
	Sig. (2-tailed)	0.753	0.008							
GDP	Pearson Correlation	-0.151	.466**	0.259	1.000					
	Sig. (2-tailed)	0.286	0.001	0.064						
IMP	Pearson Correlation	0.229	.470**	0.209	0.081	1.000				
	Sig. (2-tailed)	0.103	0.000	0.137	0.567					
INF	Pearson Correlation	.277*	-0.106	0.095	-.478**	0.123	1.000			
	Sig. (2-tailed)	0.047	0.454	0.505	0.000	0.386				
IRS	Pearson	-0.049	.392**	.991**	.287*	0.229	0.094	1.000		

	Correlation								
	Sig. (2-tailed)	0.728	0.004	0.000	0.039	0.103	0.506		
MSP	Pearson Correlation	-0.060	.340*	.421**	.437**	-0.021	-0.108	.421**	1.000
	Sig. (2-tailed)	0.673	0.014	0.002	0.001	0.882	0.447	0.002	
RER	Pearson Correlation	-0.002	.446**	.566**	.415**	.491**	-0.156	.570**	.468**	1.000
	Sig. (2-tailed)	0.987	0.001	0.000	0.002	0.000	0.271	0.000	0.000	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
Source: Euromonitor database and computed by using E-views
Note: BOP – Balance of Payments, EXP – Exports, FER – Foreign Exchange Reserves, GDP – Gross Domestic Product, IMP – Imports, INF – Inflation, IRS – International Reserves, MSP – Money Supply and RER – Real Exchange Rate

Table 5: Impact of Real Exchange Rate on Economic Growth for India from Q1 2005 to Q4 2017 ANNOVA for Real Exchange Rate on Economic Growth

Model	Sum of Square	df	Mean Square	F	Sig
Regression	0.056	8	0.007	8.387	0.000[b]
Residual	0.036	43	0.001		
Total	0.093	51			

a. Dependent Variable: RER, b. Predictors: (Constant), MSP, INF, EXP, IR, BOP, IMP, GDP, FER

Coefficients[a] for Real Exchange Rate on Economic Growth

Model	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B	
	B	SE	Beta	t	Sig	LB	UP
Constant	-0.038	0.005		-7.272	0.000	-0.049	-0.028
BOP	-0.001	0.002	-0.034	-0.313	0.756	-0.005	0.003
EXP	-0.034	0.060	-0.078	-0.570	0.572	-0.156	0.087
FER	0.505	0.610	0.625	0.828	0.412	-0.725	1.736
GDP	0.075	0.082	0.124	0.915	0.365	-0.090	0.241
IMP	0.178	0.045	0.482	3.968	0.000	0.087	0.268
INF	-0.004	0.003	-0.157	-1.333	0.190	-0.009	0.002
IRS	-0.223	0.631	-0.271	-0.353	0.725	-1.496	1.050
MSP	0.132	0.055	0.282	2.410	0.020	0.022	0.242

a. Dependent Variable: RER

Model Summary for Real Exchange Rate on Economic Growth

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	0.781[a]	0.609	0.537	0.028990	0.609	8.387	8	43	0.000	2.072

a. Predictors: (Constant), MSP, INF, EXP, IR, BOP, IMP, GDP, FER
b. Dependent Variable: RER
Source: Euromonitor database and computed using SPSS (version – 20)

Note: BOP – Balance of Payments, EXP – Exports, FER – Foreign Exchange Reserves, GDP – Gross Domestic Product, IMP – Imports, INF – Inflation, IRS – International Reserves, MSP – Money Supply and RER – Real Exchange Rate

Table 6: Causal Relationship between Real Exchange Rate and Economic Growth for India from Q1 2005 to Q4 2017

Null Hypothesis	F-Statistic	p-value	Results		Null Hypothesis	F-Statistic	p-value	Results	
RER does not cause BOP	1.076	0.350	Accept	---	RER does not cause EXP	0.860	0.430	Accept	---
BOP does not cause RER	1.472	0.240	Accept		EXP does not cause RER	1.074	0.350	Accept	
RER does not cause FER	0.668	0.518	Accept	---	RER does not cause GDP	8.045	0.001	Reject	↔
FER does not cause RER	2.482	0.095	Accept		GDP does not cause RER	5.245	0.009	Reject	
RER does not cause IMP	3.709	0.032	Reject	→	RER does not cause INF	2.800	0.072	Accept	←
IMP does not cause RER	1.963	0.152	Accept		INF does not cause RER	3.669	0.033	Reject	
RER does not cause IRS	0.556	0.578	Accept	←	RER does not cause MSP	1.938	0.156	Accept	---
IRS does not cause RER	2.537	0.090	Reject		MSP does not cause RER	1.124	0.334	Accept	

Sources: Euromonitor Database, Computed using E-views
Note: 1) Rejection of Null Hypothesis when the Probability value was less than or equal to 0.05.
 2) BOP – Balance of Payments, EXP – Exports, FER – Foreign Exchange Reserves, GDP – Gross Domestic Product, IMP – Imports, INF – Inflation, IRS – International Reserves, MSP – Money Supply, RER – Real Exchange Rate.
 3) "→" and "←" indicates unidirectional causality, "↔" indicates bidirectional causality and "---" indicates no causality

Table 7: Long run relationship between Real Exchange Rate and Economic Growth for India from Q1 2005 to Q4 2017

Null Hypothesis	Alternative Hypothesis	Statistics	0.05 Critical Value	Probability Value **
Trace Statistic				
r=0	r=1	461.278*	197.371	0.000
r=1	r=2	316.550*	159.530	0.000
r=2	r=3	234.047*	125.615	0.000
r=3	r=4	157.404*	95.754	0.000
r=4	r=5	104.858*	69.819	0.000
r=5	r=6	67.795*	47.856	0.000
Maximum Eigenvalue Statistic				
r=0	r>0	144.728*	58.434	0.000
r≤1	r>1	82.503*	52.363	0.000
r≤2	r>2	76.644*	46.231	0.000
r≤3	r>3	52.546*	40.078	0.001
r≤4	r>4	37.063*	33.877	0.020
r≤5	r>5	29.114*	27.584	0.032

* denotes rejection of the hypothesis at the level 0.05, **Mackinnon -Haug-Michelis (1999) p-values, r denotes no. of co-integrating vectors
Source: Euromonitor & Computed using E-views

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Figure 1: The Linkages between Real Exchange Rate and Economic Growth of India
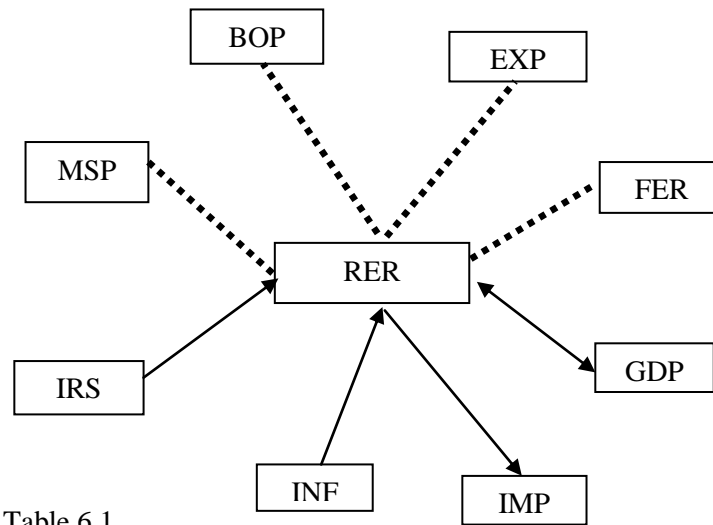
Source: The results of Table 6.1
Note:

Two Way or Bidirectional Causality
One Way or Unidirectional Causality
No Causality relationship

BOP – Balance of Payments, EXP – Exports, FER – Foreign Exchange Reserves, GDP – Gross Domestic Product, IMP – Imports, INF – Inflation, IRS – International Reserves, MSP – Money Supply and RER – Real Exchange Rate