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The Impact of Foreign Exchange Rate Volatility on Exports in India

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Abstract:

In the year 1991, India has launched its policy reform agenda and implemented a host of liberalization reforms, primarily targeting the foreign exchange market and the tradable sectors which marked the beginning of an extensive regime shift. At the same time the annual growth rate of India's exports of goods and services has increased tremendously. Therefore, a study is conducted to find the relationship between Indian exports and foreign exchange rate (INR VS USD) and analyzed the impact of foreign exchange rate volatility on Indian exports. E-views software is used to analyze the relationship and impact of the exchange rate on exports by (Auto Regressive Data Lag) ARDL model, which showed that Average Exchange Rate of lag 1, Influenced the Exports of current period. The coefficient of determination (R^2) showed 31.97% explained relationship between the variables, the Average Exchange Rates and Exports.

Keywords: Foreign Exchange Rate, Exports, ARDL etc.

Introduction

The share of global trade in total world output has grown quite substantially and has almost tripled the level since the Second World War and over the past couple of decades, emerging markets have steadily become systematically important trading centers because of the growing role of global supply chains and high-technology exports.

Despite the steady growth of global trade, there are some recurring concerns about the impact of exchange rate movements on trade in general and on a country's export and import activities. For instance, in early 1970s, Bretton Woods system collapsed and discussions on exchange rate effects on trade were renewed after the Asian financial crisis in 1997 and global financial crisis in 2008.

The total trade activity of a country is an collective decisions of individual firms. Hence in order to understand exchange rate effect changes on trade balance, it is important to analyze the exchange rate fluctuations which affects the decisions of a wide range of individual firms. Such analysis provides understandings into heterogeneous responses across firms to exchange rate movements and the related policy implications of the central bank's effort in managing and stabilizing foreign exchange variations.

India is an interesting case study to explore the issue of impact of exchange rate fluctuations on exports. Before 1990s, India's exchange rate was more or less fixed. However, since 1991, India has launched its policy reform agenda and implemented a host of liberalization reforms, primarily targeting the foreign exchange market and the tradable sectors which marked the beginning of an extensive regime shift. By 1992-93, India shifted to a more market-oriented exchange rate system through devaluations and deregulations. Since then, the exchange rate has mostly been under a managed floating regime with the Reserve Bank of India intervening from time to time to stabilize the nominal exchange rate.

At the same time the annual growth rate of India's exports of goods and services increased from 16% in 1999-2000 to around 33% in 2010-2011. The share of exports in GDP has gone up significantly from 6% in 1990 to 12% in 2000, and to 23% in 2010. Simultaneously, India's overall share in total world trade (which includes trade in both merchandise and services sector) has increased from 0.5% in 1990 to about 1.4% in 2010. As a result, India has moved up to seven places between 1999 and 2009, to hold its rank as the fourteenth largest trading center worldwide.

During the period of 2000 to 2010, the growth of exports of commercial services has been faster than that of merchandise exports; the former registered an average growth rate of about 23% whereas the latter grew at a rate of about 18%. It is striking to note that the high export growth occurred despite the Indian Real Effective Exchange Rate (REER) appreciating by about 1.4% during the same period.

1.2 Literature Review

Ranajoy Bhattacharyya and Jayadeep Mukherjee (2011), in spite of several policy changes and twists, it is appropriate to interpret domain knowledge to be supportive of a single break for the real exchange rate correlating to the adoption of the liberalisation measures.

Sidheswar Panda, Ranjan kumar Mohnty (2015) discusses Effects of exchange rate volatility on exports: Evidence from India, analyzed that the empirical results indicate that a moderation in the exchange rate volatility can increase the exports in case of India.

Sarfaraz Ahmed Shaikh (2015) explored that Exchange Rate Volatility and Trade Flows: Evidence from China, Pakistan, and India was examined and revealed a short-term, negative, and significant link between exchange rate volatility and exports for each country. Although statistically modest, the volatility of the exchange rate has a favourable long-term link with China exports. Our findings lead us to the broad conclusion that while not all nations are affected negatively by exchange rate volatility, some countries are.

Vijay Gondaliya and Paresh Dave (2015) examined how exports and imports affected India's exchange rates. The development of a nation's export and import industries is significantly influenced by exchange rates, which are one of the key indications of an economy's global competitiveness. There is conflicting evidence in the empirical literature so far about the link between trade volume and exchange rate volatility. Analysis demonstrates that the shift in export will have a beneficial impact on the value of the Indian Rupee relative to the Euro, Pound, Dollar, and Yen. However, imports have little effect on the euro, dollar, pound, and yen exchange rates.

Mohsen Bahmani-Oskooee, Javed Iqbal, Muhammad Salam (2016), in their study on the short- and long-term effects of exchange rate volatility on commodity trade between Pakistan and Japan, found that the switch from fixed to floating exchange rates in 1973 sparked a debate among economists on both sides of the issue. The effect of exchange rate volatility or uncertainty on trade flows was one of the criticisms of floating exchange rates at the time.

Khaled Alotaibi (2016), in his study examined how Exchange Rate Influence a Country's Import and Export. The values of currencies fluctuate in response to changes in supply and demand. Imports appear less expensive when the U.S. dollar is strong, which raises demand for them and the money required to buy them. Additionally, demand for the foreign currency increases as people buy it to invest in the securities of the other country when interest rates there are higher than those in the U.S. It goes without saying that a dropping exchange rate reduces

the buying power of income and capital gains from any returns. Consequently, a high dollar has the effect of creating a trade deficit.

Ranajoy Bhattacharyya, Bipradas Rit (2018) studied the relationship between nominal exchange rate and export demand in India, analyzed there is no direct evidence that the NER or its volatility influences exports.

The Impact of Exchange Rate Volatility on Exports in Vietnam: A Bounds Testing Approach by Vinh Nguyen Thi Thuy and Duong Trinh Thi Thuy (2019) examined the co-integration relationship between real foreign income, real exports, nominal exchange rate volatility and real effective exchange rate,. The outcome demonstrates that over time, exchange rate volatility will have an effect on export performance. The number of exports will decrease significantly by around 0.11 percent for every one percent increase in exchange rate volatility.

1.3 Research Gap

According to the literature reviewed, there is no uniformity in the results achieved by various researchers, leading to a gap in the existing literature. This gap is due to the different approaches employed by these scholars and different methods, statistical tools, assumptions, and theoretical frameworks designed by each of them. Also, there are differences arising due to the varying time periods of the studies in which the variables have been taken into consideration. The previous studies have been conducted by taking a period of 10 years or lesser to analyze the Impact of exchange rate on exports. The Methodology corresponding to this study and selection of the variables have been done after due consideration to literature review.

1.5 Objectives

1. To study the relationship between Indian exports and foreign exchange rate (INR VS USD).
2. To analyse the effect of foreign exchange rate on Indian exports.

1.6 Scope: There are so many factors influencing exports in India. This study focuses on Foreign Exchange rate as one of the factors influencing exports in India and is limited to 10 years study.

1.7 Limitations: Secondary data is taken from the RBI website and world bank. They are two different sources. All secondary data has got its own limitations. Hence, the same limitations applicable to this study.

1.8 Methodology

In this study, time series data was used from secondary sources. The required data was collected from reliable sources such as RBI. This study was conducted for the period 2008 to 2018 year wise and results were anticipated using OLS method/Autoregressive data lag method, as per the results obtained after data analysis whichever is applicable. The original data collected was non-stationarity and was converted into stationarity by applying unit root test by using E-views software (version11).

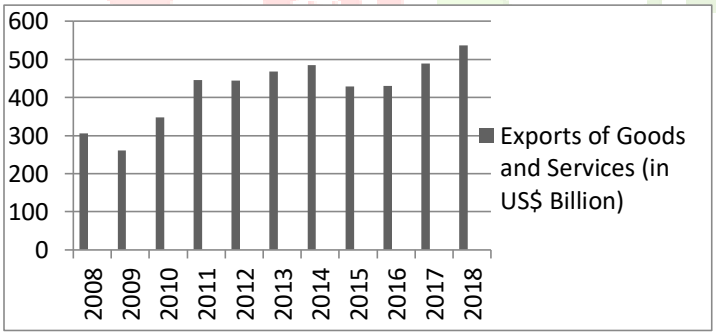
India's Export Trends From 2008 to 2018:

Table1: Growth of India's Exports

Year	Exports of goods and services (US $ Billion)	Annual growth rate of Exports of Goods and Services (%)	Export of Goods and Services (% of GDP)
2008	305.12	14.8	24.1
2009	260.85	-4.8	20.4
2010	348.03	19.5	22.4
2011	446.37	15.5	24.5
2012	443.84	6.8	24.5
2013	468.27	7.8	25.4
2014	485.58	1.8	23.0
2015	428.63	-5.6	19.8
2016	430.43	5.0	19.2
2017	489.40	5.6	18.8
2018	537.04	12.3	19.9

Source: databank.worldbank.org, wits.worldbank.org

Graph 1: Exports of Goods and Services (in US$ Billion) from 2008 to 2018

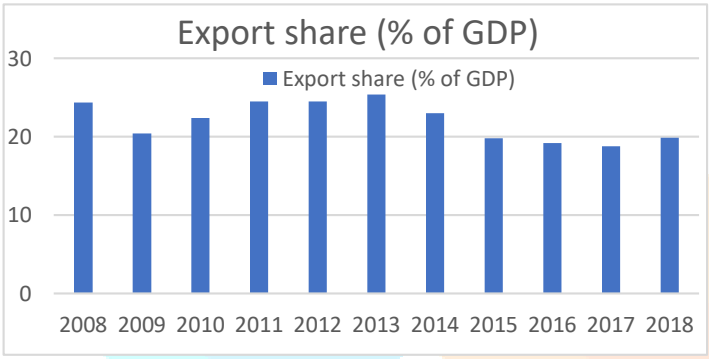


The exports of goods and services increased from 2008 to 2018.

Graph 2: Annual Growth rate of Exports of Goods and Services from 2008 to 2018

It can be depicted from the above graph that the annual growth rate of exports of goods and services started declining from 2010 and were negative in 2015. From 2016 onwards, it depicted increasing trend.

Graph 3: Export of Goods and Services (% of GDP) from 2008 to 2018



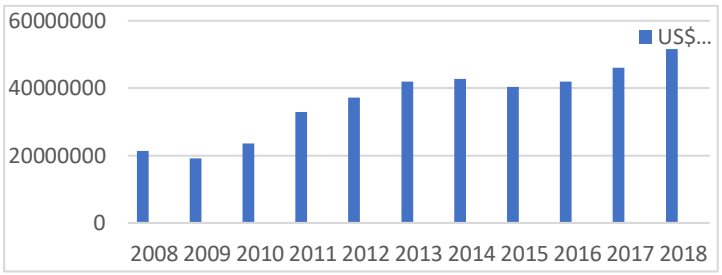
From the above graph it is been observed that in the decade, from 2009 to 2013 the percentage share of exports in the GDP was increased while from 2014 there is a decline in share of exports as a % of GDP which continued till 2017.

Table 2: Growth in India's Merchandise Exports from 2008 to 2018:

Year	Merchandise Export (in US$ Billion)	Annual Growth Rate of India's Merchandise Exports
2008	194.83	
2009	164.91	-15.4
2010	226.35	37.3
2011	302.91	33.8
2012	296.83	-2.0
2013	314.85	6.1
2014	322.69	2.5
2015	267.44	-17.1
2016	264.14	-1.2
2017	298.38	8.9
2018	324.78	-5.7

Source: databank.worldbank.org

Graph 4: Merchandise Exports (in US$ Billion) from 2008 to 2018



As seen in graph the merchandise exports fell sharply from US$ 194.83 billion in 2018 to US$ 164.91 billion in 2019 due to financial crisis happened in 2018.However it could revive in the next year i.e., in 2010 to US$ 226.35 billion by giving an annual growth rate of 37.3%. Throughout the decade there was fluctuation in the value of merchandise exports.

Graph 5: Annual Growth Rate of India's Merchandise Exports from 2008 to 2018

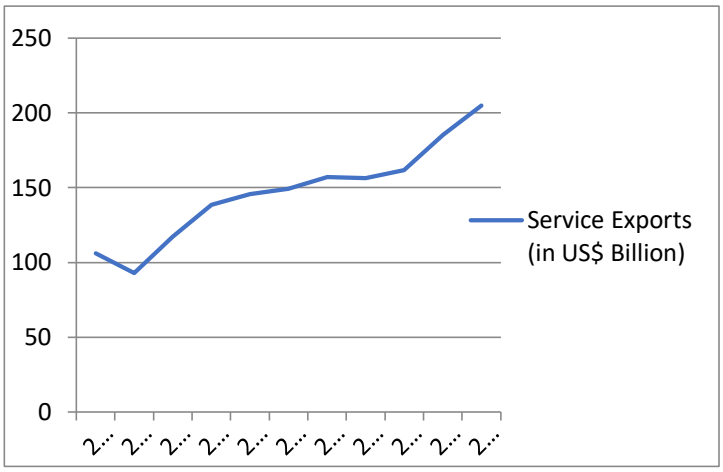
We can see in the graph that the growth rate in exports was improved from -15.4% in 2009 to 37.3% in 2010 and there was no trend of either increase of decrease in the growth rate of exports as there was a fluctuation in value of merchandise exports year after year.

Table 3: Growth in Service Exports from 2008 to 2018

Year	Service Exports (in US$ Billion)	Annual Growth Rate of India's Service Exports
2008	106.05	
2009	92.89	-12.4
2010	117.07	26.0
2011	138.53	18.3
2012	145.53	5.0
2013	149.16	2.5
2014	157.20	5.4
2015	156.28	-0.6
2016	161.82	3.5
2017	185.29	14.5
2018	204.96	10.6

Source: data.worldbank.org

Graph 6: Service Exports (in US$ Billion) from 2008 to 2018



From the graph, we can observe that from 2010 to 2014 there was an increase in the value of service exports. In 2015, there was a slight decrease in the value which gave a negative rate of -0.6%, after which there was an increase in the value of exports in 2016 which continued till 2018.

Graph 7: Annual Growth Rate in Service Exports from 2008 to 2018

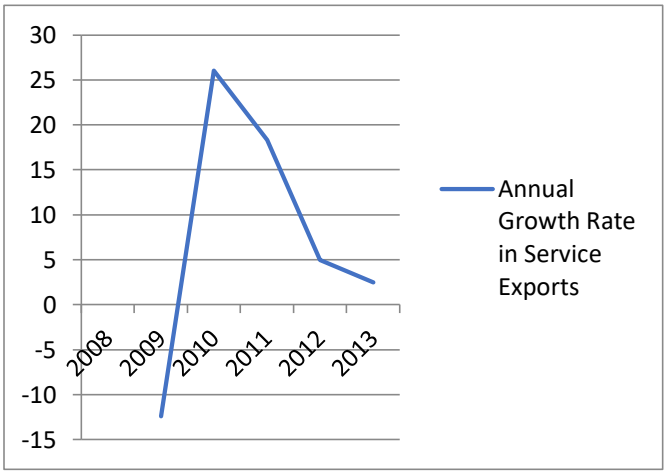
It can be depicted from the graph that the annual growth rate for the year 2009 fell sharply thereby giving a negative rate of 12.4% because of the financial crisis which took place in 2008.However, it could revive in 2010 with growth rate of 26%.From 2011 there was a decline in the rate of service exports and went till 2.5 % in 2013,after which there were fluctuations in the rate of service exports.

Table4: India Export in thousand US$ for all products United States between 2008 & 2018

Year	US$ thousand
2008	21407124.6
2009	19128199.8
2010	23587441.7
2011	32919043.5
2012	37170685.9
2013	41956732.2
2014	42684739.9
2015	40312702.9
2016	41992468.4
2017	46018076.6
2018	51628587.4

Source: wits.worldbank.org

Graph 8 : India's Exports to United States from 2008 to 2018



In the decade, from 2010 to 2014 the exports from India to US increased and in 2015 there was decline in the value of the exports after which there was a rise in the value of exports till 2018.

Overview of India's exports for the year 2018: In 2018 India was the number 7 economy in the world in terms of GDP (current US$), the number 16 in total exports, the number 11 in total imports, and the number 45 most complex economy according to the Economic Complexity Index (ECI). In 2018, India exported $326 Billion and imported $492Billion, resulting in a negative trade balance of -$166 Billion. In 2018, India's exports per capita were $241 and its imports per capita were $364. In 2018, India's has 222 as their export partners with 4450 number of products being exported.

Table 5: India's Top Export Partners In 2018

Country	US$ (in Million)	Percentage
United States	51,629	16.02
United Arab Emirates	28,523	8.85
China	16,366	5.08
Hong Kong, China	13,132	4.07
Singapore	10,444	3.24

Source: wits.worldbank.org

Top five countries to which India exported in 2018 are below, along with the percent of total exports that went to that country:

- India exports to United States worth US$ 51,629 million, with a partner share of 16.02 percent.
- India exports to United Arab Emirates worth US$ 28,523 million, with a partner share of 8.85%.
- India exports to China worth US$ 16,366 million, with a partner share of 5.08%.
- India exports to Hong Kong, China worth US$ 13,132 million, with a partner share of 4.07%.
- India exports to Singapore worth US$ 10,444 million, with a partner share of 3.24%.

Table 6: India's Top 5 Export products for the year 2018

Rank	Product	US$ million
1	Petroleum oils	47,053,748.01
2	Diamonds non-industrial nes excluding	24,188,847.81
3	Art. of jewelry and pts thereof of/o prec mtl	11,578,033.04
4	Other medicaments of mixed or unmixed products	10,755,582.48
5	Semi-milled or wholly milled rice	6,822,771.89

Source: wits.worldbank.org

3.1.1 Unit Root Test

H_o: P = 1 Unit Root (Variable is not Stationary)

H_1: P < 1 No Unit Root (Variable is Stationary)

If the P value is lesser than 0.05, then we can reject the H_0.

3.1.2 Ordinary Least Square (OLS) Method

When the original data was run in the software, the conditions of heteroscedacity and auto correlation were not satisfied. Therefore, the variables were converted into log variables. The same were tested. But even log variables data could not satisfy the conditions. The log variables were then converted into stationarity and then OLS method test was used.

(1) OLS (Original Values) After attaining stationarity

→ Exports = f (Average Exchange Rate)

(2) OLS (with log values) After attaining stationarity

→ Log (Exports) = f [log (Average exchange rate)]

3.1.3 Auto Regressive Distributed Lag (ARDL)

Auto regressive Distributed Lag Models **(ARDL)** model plays a vital role when comes a need to analyze an economic scenario. In an economy, change in any economic variables may bring change in another economic variables beyond the time. This change in a variable is not what reflects immediately, but it distributes over future periods.

→ Exports = f [Exports (-1), Exports (-2), Exports (-3), Exports (-4), AER, AER (-1), AER (-2), AER (-3), AER (-4)]

The data in this study has satisfied all the conditions described in the methodology such as the residual normality test, Auto Correlation and Heteroskedasticity test, hence the same are shown in the output sheets.

3.1.4 Normality Test

This test is again very important to find out whether the error term follows Normal Distribution and the hypotheses are stated as follows:

H_o: Residuals are normally distributed

H_1: Residuals are not normally distributed.

Again, if the Probability value > 0.05 then we can accept H_0.

3.1.5 Serial Correlation LM Test

The presence of serial correlation is examined by Breusch – Godfrey serial correlation LM test.

H_o: No Auto Correlation

H_1: Auto Correlation

If the Probability value > 0.05 then we can accept H_o. Hence, no auto correlation was found.

3.1.6 Heteroskedasticity test

This test is important to confirm the robustness of the OLS output since the results cannot be reliable in the presence of Heteroskedasticity.

H_o: No Heteroskedasticity

H_1: Heteroskedasticity

If the Probability Value is > 0.05 then we can accept the H_0. Hence, no heteroskedasticity was found.

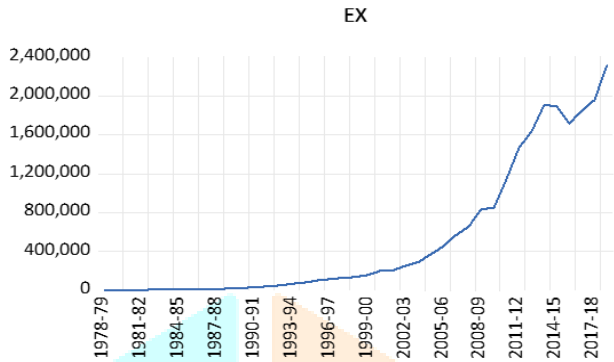
3.2 RESULTS

3.2.1 Table 7: Summary of Unit Root Test of Original Values of Variables

Variable	At level	At First Difference	At Second Difference
Ex	0.9882	0.0049	-
AER	0.9811	0.0001	-

- When the unit root test conducted the original data was non-stationarity the probability values were almost nearer to one.
- Therefore, First Difference was applied and again unit root test repeated for exports and average exchange rates and stationarity was attained, representing the probability values less than 5%.

Figure 1: Descriptive statistics of the original data was shown below



- From the above table, it is observed that the values of mean and median are having big difference. Skewness in not equal to Zero. Indicating that the data is a skewed data.
- Range (difference between maximum & minimum) is show higher value indicating the variations in the data.
- Skewness values indicates that there is a Positive variation in exports and negative variations in average exchange rates. Also, kurtosis values both exports and Average Exchange Rates are showing a platy kurtic curves.

Particulars	EX	AER
Mean	528358.2	35.51568
Median	139753.1	40.26070
Maximum	2307726.	70.40000
Minimum	5726.100	7.909200
Std. Dev.	712348.8	19.23170
Skewness	1.230395	-0.007062
Kurtosis	2.986436	1.852635

Graph 9 : Graphical Presentation of Original values of the Variables.

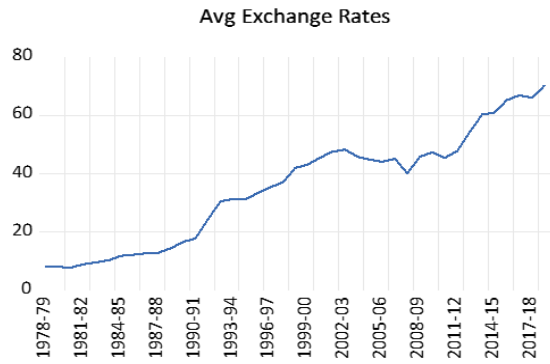
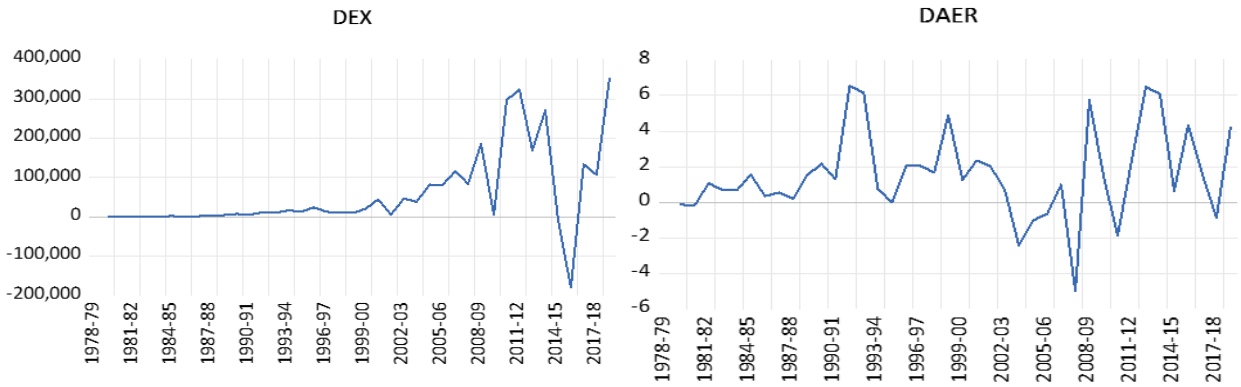


Figure 2: Descriptive statistics after attaining stationarity

	DAER	DEX
Mean	1.554333	57550.00
Median	1.277850	11974.00
Maximum	6.530900	351211.7
Minimum	-4.988800	-180061.1
Std. Dev.	2.490391	104080.8
Skewness	0.231777	1.265050
Kurtosis	3.410336	4.843213

Skewness is showing, variations in the data are in the positive directions. However the Average Exchange rates data showed a very negligible skewness when compared to Exports. i.e., Data curve shows longtail as the right side. Also the kurtosis results indicates as LeptoKurtic in Nature for both Exports and Average Exchange Rates.

Graph 10: Graphical Representation of DEX and DEAR:



The OLS Model was applied.

Exports = f (Average Exchange Rate)

Dependent Variable: DEX				
Method: Least Squares				
Date: 07/18/20 Time: 08:15				
Sample (adjusted): 2 41				
Included observations: 40 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	49830.10	19583.19	2.544534	0.0151
DAER	4966.697	6731.670	0.737811	0.4652
R-squared	0.014123	Mean dependent var		57550.00
Adjusted R-squared	-0.011821	S.D. dependent var		104080.8
S.E. of regression	104694.2	Akaike info criterion		26.00418
Sum squared resid	4.17E+11	Schwarz criterion		26.08863
Log likelihood	-518.0836	Hannan-Quinn criter.		26.03471
F-statistic	0.544364	Durbin-Watson stat		1.027433
Prob(F-statistic)	0.465162			

Figure3: Least Squares Method

EX= 49830.10 + 4966.696 (DAER)

Probability value is 0.4652 I.e., 46.52 > 5%.

Hence, there is no significant influence of Average Exchange Rate on Exports in India. Hence OLS model is not a fit model.

3.2.2 OLS (with log values)

Table 8: Summary of Unit Root Rest of Log Values of Variables

Variable	At level	At First Difference	At Second Difference
Lex	0.79640	0.0030	-
Laer	0.4587	0.0006	-

Interpretation: The Original values at Stationary failed to give the results in OLS model. Hence the Variables were converted into Log (Variables). And checked such values for stationarity but failed at level. Then their first differences were taken and checked for stationarity and satisfied.

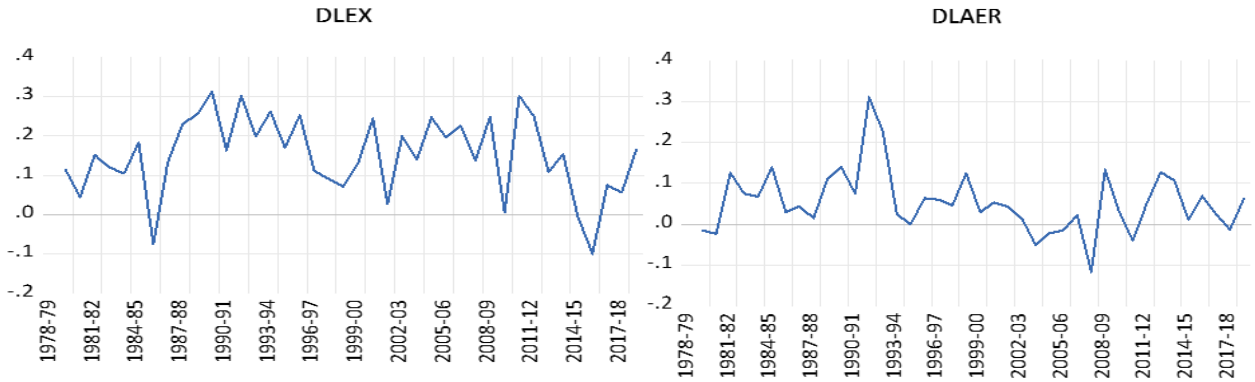
Figure4: Descriptive statistics of stationary data after converting original data into log values

	DLEX	DLAER
Mean	0.149975	0.053670
Median	0.152219	0.044640
Maximum	0.312689	0.310410
Minimum	-0.099761	-0.116816
Std. Dev.	0.098899	0.076229
Skewness	-0.512455	0.931481
Kurtosis	2.907766	5.183042

Interpretation: After the data attained the Stationary at first difference, the descriptive statistics were obtained. The results have shown that the Exports data is positively skewed whereas the Average exchange rates has showed a negatively skewed.

Also, the Exports data is Platy Kurtic in nature whereas the Average Exchange rates have shown Lepto Kurtic in nature.

Graph 11: Graphical presentation of stationary data after the original data converted into log values.



The OLS Model was applied and the Results are shown below.

DLEX = f (DLAER)

Dependent Variable: DLEX				
Method: Least Squares				
Date: 07/18/20 Time: 08:36				
Sample (adjusted): 2 41				
Included observations: 40 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.133566	0.018908	7.063811	0.0000
DLAER	0.305732	0.204537	1.494750	0.1432
R-squared	0.055532	Mean dependent var		0.149975
Adjusted R-squared	0.030677	S.D. dependent var		0.098899
S.E. of regression	0.097370	Akaike info criterion		-1.771888
Sum squared resid	0.360276	Schwarz criterion		-1.687444
Log likelihood	37.43777	Hannan-Quinn criter.		-1.741356
F-statistic	2.234277	Durbin-Watson stat		1.560790
Prob(F-statistic)	0.143238			

DLEX = 0.133566 + 0.305732 (DLAER)

But the probability value is 14.32, which is greater than 5%, hence it can be concluded that the average exchange rates is not influencing exports in India, even after using logarithm values.

As the model failed, diagnostic tests were not checked. Now the same data is used for Auto Regressive Distributed Lag (ARDL) Model is applied to check the relationship between the Exports and Average Exchange rates.

3.2.3 ARDL (Including Diagnostic tests)				
Dependent Variable: DLEX			Sample (adjusted): 6 41	
Method: ARDL		Date: 07/17/20 Time: 23:44		
Included observations: 36 after adjustments				
Dependent lags: 4 (Fixed)			Fixed regressors: C	
Dynamic regressors (4 lags, fixed): DLAER				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DLEX(-1)	0.298689	0.187706	1.591258	0.1236
DLEX(-2)	0.136455	0.208402	0.654766	0.5184
DLEX(-3)	0.109647	0.193101	0.567823	0.5750
DLEX(-4)	-0.274047	0.196882	-1.391938	0.1757
DLAER	0.356329	0.249159	1.430124	0.1646
DLAER(-1)	-0.607932	0.265959	-2.285813	0.0307
DLAER(-2)	0.488416	0.266455	1.833013	0.0783
DLAER(-3)	-0.316863	0.279376	-1.134181	0.2671
DLAER(-4)	0.275021	0.255338	1.077086	0.2913
C	0.102884	0.046686	2.203761	0.0366
R-squared	0.319773	Mean dependent var		0.154691
Adjusted R-squared	0.084309	S.D. dependent var		0.102452
S.E. of regression	0.098038	Akaike info criterion		-1.576797
Sum squared resid	**0.249896**	**Schwarz criterion**		**-1.136931**
Log likelihood	38.38235	Hannan-Quinn criter.		-1.423272
F-statistic	1.358057	Durbin-Watson stat		1.929592
Prob(F-statistic)	0.256881			
Figure 6 : ARDL Test				
*Note: p-values and any subsequent tests do not account for model				

D [Log (Exports)] = f [DLEX (-1), DLEX (-2), DLEX (-3), DLEX (-4), LAER, DLAER (-1), DLAER (-2), DLAER (-3), DLAER (-4)]

Interpretation:

1. The Coefficient of Determination (R^2) showed the relationship between Exports & Average Exchange Rates to an extent of 31.97%.

2. Auto Regressive Distributed Lag (ARDL)

Exports = f [Exports (-1), Exports (-2), Exports (-3), Exports(-4), AER, AER (-1), AER (-2), AER (-3), AER (-4)]

D [Log (Exports)] = f [DLEX (-1), DLEX (-2), DLEX (-3), DLEX (-4), DLAER, DLAER (-1), DLAER (-2), DLAER (-3), DLAER (-4)].

DLEX = 0.102884 - 0.607932[DLAER (-1)]

For every one-unit change in Average Exchange Rate of Lag 1, there is a 0.607932 change in Exports in opposite direction.

i.e., there is inverse relationship between Average Exchange Rate (AER) of Lag 1 & Exports (EX). i.e., If AER (-1) ↓ Ex ↑

If AER (-1) ↑ Ex ↓

Graph 12: Normality Test

Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:				
Null hypothesis: No serial correlation at up to 2 lags				
F-statistic	0.180164	Prob. F(2,24)		0.8363
Obs*R-squared	0.532496	Prob. Chi-Square(2)		0.7662
Test Equation:		Included observations: 36		
Dependent Variable: RESID				
Method: ARDL		Date: 07/17/20	Time: 23:45	Sample: 6 41
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLEX(-1)	-0.333665	0.673318	-0.495552	0.6247
DLEX(-2)	-0.183811	0.604339	-0.304152	0.7636
DLEX(-3)	0.107036	0.270745	0.395339	0.6961
DLEX(-4)	0.071610	0.248312	0.288386	0.7755
DLAER	0.024990	0.263435	0.094861	0.9252
DLAER(-1)	0.112353	0.350110	0.320907	0.7511
DLAER(-2)	-0.093914	0.416235	-0.225626	0.8234

DLAER(-3)	-0.007277	0.418563	-0.017386	0.9863
DLAER(-4)	-0.000271	0.315951	-0.000859	0.9993
C	0.050086	0.096376	0.519694	0.6080
RESID(-1)	0.350363	0.698034	0.501928	0.6203
RESID(-2)	0.299031	0.656751	0.455318	0.6530
R-squared	0.014792	Mean dependent var		-2.06E-17
Adjusted R-squared	-0.436762	S.D. dependent var		0.084498
S.E. of regression	0.101283	Akaike info criterion		-1.480588
Sum squared resid	0.246200	Schwarz criterion		-0.952748
Log likelihood	38.65059	Hannan-Quinn criter.		-1.296358
F-statistic	0.032757	Durbin-Watson stat		1.945171
Prob(F-statistic)	0.999999			

Figure 7: Serial Correlation Test

Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
Null hypothesis: Homoskedasticity				
F-statistic	0.480745	Prob. F(9,26)		0.8742
Obs*R-squared	5.136116	Prob. Chi-Square(9)		0.8223
Scaled explained SS	2.456379	Prob. Chi-Square(9)		0.9820
Test Equation:		Date: 07/17/20	Time: 23:46	Sample: 6 41
Dependent Variable: RESID^2			Method: Least Squares	
Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006370	0.004877	1.306023	0.2030
DLEX(-1)	-0.011732	0.019609	-0.598277	0.5548
DLEX(-2)	-0.009141	0.021771	-0.419860	0.6780
DLEX(-3)	-0.012732	0.020173	-0.631154	0.5334
DLEX(-4)	0.023864	0.020568	1.160285	0.2565
DLAER	-0.011232	0.026029	-0.431511	0.6697
DLAER(-1)	0.026952	0.027784	0.970056	0.3410
DLAER(-2)	-0.000605	0.027836	-0.021724	0.9828
DLAER(-3)	0.020019	0.029185	0.685914	0.4988
DLAER(-4)	-0.001338	0.026674	-0.050157	0.9604
R-squared	0.142670	Mean dependent var		0.006942

Adjusted R-squared	-0.154098	S.D. dependent var	0.009533
S.E. of regression	0.010242	Akaike info criterion	-6.094576
Sum squared resid	0.002727	Schwarz criterion	-5.654710
Log likelihood	119.7024	Hannan-Quinn criter.	-5.941051
F-statistic	0.480745	Durbin-Watson stat	2.658582
Prob(F-statistic)	0.874198		

- **ARDL** Model was observed to be a fit model for this study.
- It has been checked the diagnostic tests also. I.e., Normality Test, serial correlation Test and Heteroscedasticity Test.

4.1 Findings of this study are as follows:

i. Current Period Average Exchange Rate does not influence the current period Exports.

ii. In this study, OLS method was applied to check whether Average Exchange Rate influencing the current period Exports, It was noticed that there is no significant influence of Average Exchange Rate on Exports.

iii. The variables Exports & Average Exchange Rates were converted into log values. It was noticed that there is unit root problem. I.e., the log values were non – stationary.

iv. Then the log values of the variables were converted to stationary by taking first difference.

v. OLS Method was applied and results showed that the DLAER is not influencing the DLAEX i.e., Average Exchange Rates is not influencing Exports.

vi. Auto Regressive Distributed Lag (ARDL) Model was used to check the influence of Average Exchange Rates on Exports, by using a lag 4.

vii. When ARDL model was applied by taking lag period 4, the results showed that Average Exchange Rate of lag 1, Influenced the Exports of current period.

Viii. The coefficient of determination (R^2) between the variables, the Average Exchange Rates and Exports showed that 31.97%.

ix. Auto Regressive Distributed Lag (ARDL)

- Exports=f[Exports(-1),Exports(-2),Exports(-3),Exports(-4),AER, AER (-1), AER (-2), AER (-3), AER (-4)]
- D[Log(Exports)]=f[DLEX(-1),DLEX(-2),DLEX(-3),DLEX(-4),DLAER,DLAER(-1), DLAER (-2), DLAER (-3), DLAER (-4)].
- DLEX = 0.102884 - 0.607932[DLAER (-1)]

For every one-unit change in Average Exchange Rate there is a 0.607932 change in Exports in opposite direction. i.e., there is inverse relationship between Average Exchange Rate (AER) of Lag 1 & Exports (EX).

i.e., If AER (-1) ↓ Ex ↑

If AER (-1) ↑ Ex ↓

4.3 Conclusion:

- The Coefficient of Determination (R^2) shows that there is 31.97% relationship between Exports & Average Exchange Rates.
- DLEX = 0.102884 - 0.607932[DLAER (-1)].

It can be concluded that there is a inverse relationship between Exports (EX) in the current period and Average Exchange Rate (AER) of lag 1. i.e., If AER (-1) Increases by Rupee 1 then there is a decrease in current year Exports by Rupee 0.607932 Or i.e., If AER (-1) decrease by Rupee 1 then the Current Period Exports will increase by Rupee 0.607932.

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