To Study the Impact of Exports & Imports on Exchange Rates in India

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Abstract

This research investigates the relationship between exchange rates and imports and exports in India. The study employs panel co-relation analysis using annual data from 2018 to 2024. The findings reveal a co-integrated relationship between effective exchange rates and exports-imports in the long run. Regression analysis finds a positive correlation between the Kuwaiti Dinar and the US Dollar, and a negative correlation between the Japanese Yen and other currencies. An increase in the USD exchange rate is associated with an increase in imports and a decrease in exports. The Euro's impact is inverse. Overall, the study suggests intricate relationships between currency exchange rates and trade activities, highlighting the importance of exchange rates in understanding and predicting trade dynamics.

Introduction

The study investigates the relationship between exchange rates and imports and exports in emerging economies. Exchange rate policies significantly influence international trade dynamics. The research employs the panel co-relation by analyzing annual data from 2018 to 2024. The findings reveal a co-integrated relationship between effective exchange rates and exports-imports in the long run. As India, a developing nation, focuses on globalization, recent trends show rising goods exports, record-breaking poultry exports, and extended export duties on parboiled rice. Additionally, the Reserve Bank of India aims to reduce remittance costs at the World Trade Organization.

Literature Review

1. **(DR.G. JAYACHANDRAN, 2013)** This paper empirically investigates the impact of exchange rate volatility on real exports and Imports in India. The empirical analyses have been carried out using annual time series data for the period 1970 to 2011. The growth of the exchange rate, export, and import has seen successes through linear regression techniques. The study results confirm that real exports and imports are cointegrated with exchange rate volatility, real exchange rate, gross domestic product, and foreign economic activity.

2. **(Dr. Vijay Gondaliya and Mr. Paresh Dave 2015)** A study on the impact of exports and imports on exchange rates in India. The main goal of the paper was to examine whether the import or export affects the exchange rate (USD, EURO, POUND, and YEN) in India. The monthly exchange value of the euro, pound, dollar, and yen as well as exports and imports has been used for the study. The data period was from January 2006 to October 2015.

3. **(Dr. Mahjabin Banu Ms. Ruchika Malhotr 2021)** The Impact of Exports and Imports on Exchange Rates in India. The study's main goal was to analyse the impact of Indian Imports and Exports on Indian Exchange Rates. The advanced statistical technique correlation was applied. Tools used in this research are MS- excel to analyse and present.

4. Another 3 Latest LRs will be provided on Request.

Research Methodology

Studying the impact of export and import on Exchange rates in India revolves around the need to understand the various dependent variables that is exchange rates get affected by the independent variables that is import and export. This study employed a descriptive research design to investigate the impact of exports and imports on exchange rates in India. Secondary data was collected from publicly available sources including the Reserve Bank of India (RBI), the Ministry of External Affairs (MEA), past research papers, and relevant websites. The data covered six years from 2018 to 2024. Correlation, Linear, and Logistic regression analysis will examine the relationships between export/import levels and exchange rates.

Data Analysis

1. Correlation between Import, Export, and Currency Exchange Rate

	Import (In Lakh)	Export (In Lakh)	USD	YEN	EURO	POUND	Kuwaiti Dinar
Import (In Lakh)	1						
Export (In Lakh)	0.978830138	1					
USD	0.781208555	0.688927362	1				
YEN	-0.686605177	-0.632503726	-0.956212875	1			
EURO	0.169633147	0.033857166	0.575173791	-0.455614966	1		
POUND	0.197000142	0.111456511	0.659546464	-0.648490851	0.918026	1	
Kuwaiti Dinar	0.756852395	0.673551818	0.994361727	-0.963004827	0.614666	0.720038905	1

2. Linear Regression Analysis of import with exchange

Regression Statistics	
Multiple R	0.98876996
R Square	0.977666035
Adjusted R Square	0.888330174
Standard Error	35812927.34
Observations	6

3. Linear Regression Analysis of export with exchange rates

Regression Statistics	
Multiple R	0.999249684
R Square	0.998499931
Adjusted R Square	0.992499656
Standard Error	5470007.653
Observations	6

4. Regression Line

Import

$$Y = C + β_1x_1 + β_2x_2 + β_3x_3 + β_4x_4$$

Import = (-20595501383) + 195320332.9(USD) + 14795196160(YEN) + (-184929942) (EURO) + 125184103.8 (POUND)

Export

$$Y = C + β_1x_1 + β_2x_2 + β_3x_3 + β_4x_4$$

Export = (-12162515166) + 117236601.2 (USD) + 8864399566 (YEN) + (-184929942) (EURO) + 76760986.4 (POUND)

5. Descriptive Analysis of Import and Export Data

Year	Mean	Standard Deviation	Range	Minimum	Maximum	Sum
23-24 Import	8497386.064	44580471.45	420616600.8	4009.383	420620610.2	841241220.4
23-24 Export	5311799.167	26951549.35	262931095.3	2963.457	262934058.8	525868117.6
22-23 Import	11942931.14	63316315.92	591170137.2	4954.2	591175091.4	1182350183
22-23 Export	7524203.26	38312561.21	372445047.6	3013.805	372448061.4	744896122.8
21-22 Import	9734515.839	51105505	481855295.7	3238.32	481858534	963717068
21-22 Export	6700909.459	33795089.88	331693399.1	1619.16	331695018.2	663390036.5
20-21 Import	5891828.238	30522168.98	291644181.7	1316.132	291645497.8	583290995.6
20-21 Export	4358844.558	21816472.34	215760713.1	2092.502	215762805.6	431525611.2
19-20 Import	7106247.334	37309676.18	351755323.1	3919.89	351759243	703518486.1

19-20 Export	4690911.727	23614124.58	232197826	2304.51	232200130.5	464400261

6. *Logistic Regression Analysis of export with exchange rates*

Coefficients

Predictor	Estimate	Confidence Interval: Lower	Confidence Interval: Upper	Odds	Standard Error	Chi2-Statistic	P-Value
Intercept	5.987598	-728.985	740.96	398.4562067	374.9928	0.000255	0.987261
KWD	18.05272	-561.35	597.4555	69214473.1	295.6191	0.003729	0.951305
USD	-37.8322	-769.657	693.9931	3.71273E-17	373.3871	0.010266	0.919295
Euro	-16.8962	-613.73	579.9372	4.59289E-08	304.5124	0.003079	0.955751

Regression Summary

Metric	Value
# Iterations Used	**11**
Residual DF	**10**
Residual Deviance	**0.000256**
Multiple R2	**0.999986**

Metrics

Metric	Value
Accuracy (#correct)	**14**
Accuracy (%correct)	**100**
Specificity	**1**
Sensitivity (Recall)	**1**
Precision	**1**
F1 score	**1**
Success Class	**1**
Success Probability	**0.5**

Logistic Regression Analysis line (Export)

$$Y = C + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

Export = (5.987598) + 18.05272 (KWD) + -37.8322 (USD) + (-16.8962) (EURO)

7. *Logistic Regression Analysis of import with exchange rates*

Coefficients

Predictor	Estimate	Confidence Interval: Lower	Confidence Interval: Upper	Odds	Standard Error	Chi2-Statistic	P-Value
Intercept	-5.9876	-740.96	728.9848	0.002509686	374.9928	0.000255	0.987261
KWD	-18.0527	-597.455	561.3501	1.44478E-08	295.6191	0.003729	0.951305
USD	37.83218	-693.993	769.6574	2.69344E+16	373.3871	0.010266	0.919295
Euro	16.89617	-579.937	613.7295	21772785.39	304.5124	0.003079	0.955751

Regression Summary   Metrics

Metric	Value
# Iterations Used	11
Residual DF	10
Residual Deviance	0.000256
Multiple R2	0.999986

Metric	Value
Accuracy	14
Accuracy	100
Specificity	1
Sensitivity (Recall)	1
Precision	1
F1 score	1
Success Class	1
Success Probability	0.5

Logistic Regression Analysis line (Import)

$$Y = C + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

Import = (-5.9876) + -18.0527 (KWD) + 37.83218 (USD) + (16.89617) (EURO)

Findings

Correlation between Import, Export, and Currency Exchange Rate

The correlation between the Kuwaiti Dinar (KWD) and the US Dollar (USD) is very strong and positive (0.994). This means that the value of the Kuwaiti Dinar tends to move in the same direction as the US Dollar. The correlation between the Japanese Yen (JPY) and all other currencies is negative. This means that there is a tendency for the Yen to weaken when the other currencies strengthen, and vice versa. The correlation between the Euro (EUR) and the Pound Sterling (GBP) is positive but weak (0.575). This means that there is a slight tendency for the Euro and Pound to move in the same direction.

Regression Analysis of import with exchange rate

An R^2 value in Regression Analysis of import with exchange is 0.9984 is very high, which means that nearly all of the variance in the dependent variable is explained by the independent variable(s). However, it's important to note that a high R-squared doesn't necessarily mean a good model. The coefficient for the USD Exchange Rate is 117236601.2, the coefficient for the YEN Exchange Rate is 8864399566, the coefficient for the POUND Exchange Rate is 76760986.4, and the coefficient for the EURO Exchange Rate is -114786728.7. This means that for every unit increase in the USD exchange rate (holding other variables constant), Exports are estimated to increase by 117236601.2 units. If the USD exchange rate increases by 1 unit, imports are predicted to increase by 117236601.2 units and the coefficient for EURO Exchange Rate is -114786728.7. A negative coefficient indicates an inverse relationship. For every unit increase in the EURO exchange rate (holding other variables constant), Exports are estimated to decrease by 114786728.7 units

Regression Analysis of export with exchange rate

A value of 0.9984 is very high, which means that nearly all of the variance in the dependent variable is explained by the independent variable(s). However, it's important to note that a high R-squared doesn't necessarily mean a good model. The coefficient for the USD Exchange Rate is 117236601.2, the coefficient for the YEN Exchange Rate is 8864399566, the coefficient for the POUND Exchange Rate is 76760986.4, the coefficient for the POUND Exchange Rate is 76760986.4 and the coefficient for EURO Exchange Rate is -114786728.7. This means if the USD exchange rate increases by 1 unit, imports are predicted to increase by 117236601.2 units, and Exports are estimated to decrease by 114786728.7 units. If the EURO exchange rate increases by 1 unit, imports are predicted to decrease by 114786728.7 units.

Descriptive Analysis of Import and Export Data

The standard deviation for both import and export values tends to increase from earlier to later years, suggesting an increase in the variability of trade volumes during these periods. The varying range values over the years indicate an expansion in the scope of trade activities, with larger differences between the highest and lowest trade volumes. Here, a consistent upward trend in both the minimum and maximum values for both import and export figures over the years, indicating overall growth in trade activities. The increasing sum values over the years reflect the cumulative effect of rising trade volumes, emphasizing the overall growth and expansion of trade activities over the analyzed period.

Logistic Regression Analysis of export with exchange rates

The odds value for KWD is 69,214,473.1. This means that for every one-unit increase in KWD, the odds of the event (whatever you're predicting) increase by this factor. Such a high odds value suggests a strong association between KWD and the outcome. The odds value for USD is approximately 3.711×10^{-17}. This extremely small value indicates that the odds of the event happening decrease significantly with each unit increase in USD. It's practically negligible. The odds value for the Euro is approximately 4.59×10^{-8}. Similar to USD, this value is very small, suggesting a negative impact on the odds of the event. The p-value for KWD (0.9513) is greater than 0.05, indicating that the relationship between the number of keyword referrals needed and the number received is likely not statistically significant at the 5% level. Similarly, the p-value for USD (0.9193) is also higher than 0.05, suggesting that the relationship between the USD amount needed and received is not statistically significant.

The p-value for the Euro (0.9558) is again greater than 0.05, implying a lack of statistically significant association between the Euro amount needed and received. Metric represents the proportion of correct predictions made by the model (100% in this case). It's important to note that accuracy can be misleading, especially for imbalanced datasets. This metric reflects the proportion of negative cases that were correctly predicted as negative (100% here). Metric represents the proportion of positive cases that were correctly predicted as positive (100% here). Metric reflects the proportion of predicted positive cases that were positive (100% here) and also metric is a harmonic mean of precision and recall, providing a balanced view of model performance (100% here).

Logistic Regression Analysis line

$$Y = C + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

Export = (5.987598) + 18.05272 (KWD) + -37.8322 (USD) + (-16.8962) (EURO)

A higher Keyword Density (KWD) is associated with a greater probability of the event. This is because the coefficient for KWD is positive (18.05272). A higher USD amount is associated with a lower probability of the event. This is because the coefficient for USD is negative (-37.8322). A higher EURO amount is associated with a lower probability of the event. This is because the coefficient for EURO is negative (-16.8962). It is important to note that the logistic regression line is not a perfect predictor of the outcome variable. The model only estimates the probability of the event occurring based on the independent variables.

Logistic Regression Analysis of import with exchange rates

The odds value for KWD is 69,214,473.1. This means that for every one-unit increase in KWD, the odds of the event (whatever you're predicting) increase by this factor. Such a high odds value suggests a strong association between KWD and the outcome. The odds value for USD is approximately 3.711×10^{-17}. This extremely small value indicates that the odds of the event happening decrease significantly with each unit increase in USD. It's practically negligible. The odds value for the Euro is approximately 4.59×10^{-8}. Similar to USD, this value is very small, suggesting a negative impact on the odds of the event.

This value represents the statistical significance of the corresponding coefficient. p-value less than a chosen significance level (usually 0.05) implies that the relationship between the predictor and the target variable is statistically significant. The p-value for KWD (0.9513) is greater than 0.05, indicating that the relationship between the number of keyword referrals needed and the number received is likely not statistically significant at the 5% level. Similarly, the p-value for USD (0.9193) is also higher than 0.05, suggesting that the relationship between the USD amount needed and received is not statistically significant. The p-value for the Euro (0.9558) is again greater than 0.05, implying a lack of statistically significant association between the

Euro amount needed and received. Metric represents the proportion of correct predictions made by the model (100% in this case). It's important to note that accuracy can be misleading, especially for imbalanced datasets. This metric reflects the proportion of negative cases that were correctly predicted as negative (100% here). Metric represents the proportion of positive cases that were correctly predicted as positive (100% here). Metric reflects the proportion of predicted positive cases that were positive (100% here) and also metric is a harmonic mean of precision and recall, providing a balanced view of model performance (100% here).

Logistic Regression Analysis line

$Y = C + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$

Import = (-5.9876) + -18.0527 (KWD) + 37.83218 (USD) + (16.89617) (EURO)

The equation is the formula for a logistic regression model. It shows the predicted probability (Y) of an event occurring, based on the independent variables X1, X2, X3, and X4. A higher Keyword Density (KWD) is associated with a greater probability of the event. This is because the coefficient for KWD is positive (18.05272). A higher USD amount is associated with a lower probability of the event. This is because the coefficient for USD is negative (-37.8322). A higher EURO amount is associated with a lower probability of the event. This is because the coefficient for EURO is negative (-16.8962).

__Detailed and Table-wise Interpretations can be made available on request.__

Conclusion

Based on the analysis conducted, several key findings emerge regarding the relationship between currency exchange rates and import/export activities. Firstly, it's evident that the Kuwaiti Dinar (KWD) shows a strong positive correlation with the US Dollar (USD), indicating that when one strengthens, the other tends to follow suit. Conversely, the Japanese Yen (JPY) exhibits a negative correlation with other currencies, suggesting a tendency to weaken when others strengthen.

In terms of regression analysis, the high R-squared values indicate that a significant portion of the variance in both import and export volumes can be explained by changes in exchange rates. Notably, an increase in the USD exchange rate is associated with an increase in imports and a decrease in exports, while the Euro's impact is inverse, with increases associated with decreases in both imports and exports.

The logistic regression analyses further reinforce these relationships. For exports, a higher Keyword Density (KWD) is linked to increased probability, while higher USD and Euro amounts are associated with decreased probabilities. Similarly, for imports, higher KWD amounts increase the probability, while higher USD and Euro amounts decrease it.

Overall, these findings suggest intricate relationships between currency exchange rates and trade activities. While certain currencies move in tandem, others exhibit inverse relationships, influencing import/export volumes in complex ways. Additionally, the statistical significance of these relationships underscores their importance in understanding and predicting trade dynamics.

Data Used for Analysis

Monthly data of Import, export, and Currency rate (Used for Logistic Regression)

Summarised data for Import, Export, and Exchange rate (Used for Liner Regression and Co-relation)