Indian Journal of Economics & Business, Vol. 18, No.2 (2019) : 457-466

DYNAMICS OF INDIA'S EXCHANGE RATE AND TRADE BALANCE - THE J CURVE HYPOTHESIS

[1]ANU PAUL & [2]RASANANDA PANDA

Abstract: *The J curve hypothesis defines the interrelationship between exchange rate and trade balance of an economy. This hypothesis suggests a J shaped like curve, and establishes as one of the possible relationship between the two variables. Describing the pattern of the curve, the hypothesis states that when the economy undergoes a depreciation, the trade balance experiences a downfall. However, with time the trade balance improves resulting in a J shaped like curve. Hence, to understand whether this pattern subsist in India, this study analysis the relationship between exchange rate and trade balance during the period 1998-2018. This study employs monthly data extracted from the Reserve bank of India compiled by the Ministry of Commerce. The paper incorporates Unit root tests in the beginning of the analysis to understand the stationarity of the data. In addition, the study applies Granger causality, Johansen Cointegration tests and vector error correction model (VECM) to understand the long and short-term equation respectively. The results from the study display a long-term relationship between the variables but not in the short- run.*

Keywords: *Marshal–Lerner condition, J-curve hypothesis, Trade balance, Exchange rate, Cointegration, Vector error correction model*

JEL Classification: *F10, F31, F41, C50*

INTRODUCTION

For any economy, to maintain economic stability the trend of the exchange rate plays a very pivotal role. Fluctuations in exchange rate affects the functioning of the economy mainly concerning the financial flows. When looked historically, the pairing of the rupee with her various trading partners has witnessed many outcomes which pertain to exchange rate and trade balance .Rupee was initially pegged to the pound sterling, followed by pairing it with 14 currencies and subsequently it was linked to 5 currencies which were India's major trading partners. But with time, the requirement of exchange rate management became quite criti-

[1]Corresponding Author, Research Assistant, Business Management Area, MICA-The school of Ideas, Ahmedabad – 380058, India, Email: anu.paul@micamail.in

[2]Co-Author, Professor, and Registrar, Business Management Area, MICA-The school of Ideas, Ahmedabad – 380058, India Email: rasananda.panda@micamail.in

cal due to external payments crisis of 1991. In response to the crises, to maintain overall stability, the devaluation of rupee took place the twice by a rate of 18 percent with reference to the U.S dollar.

Currently, the unsteadiness in exchange rate has gained quite an attention in the Indian economy. Considering just the past five years, India's exchange rate has taken a big leap from 60 $ to 72$. The informed fluctuations is taken into analysis by studying the equation between trade balance and exchange rate of India. The theories of Marshall-Lerner and the J curve hypothesis acts as a foundation behind the analysis of the study.

The theory of Marshall-Lerner condition is a long-term aspect. It revolves around the idea of how current account balance affects the price elasticity of net exports. When a currency depreciates the imports becomes expensive and the exports becomes cheaper. Hence, this leads to an increase in the demand of exports resulting in revenue generation The model states that if the absolute aggregate value of price elasticity of import and price elasticity of export is greater than unity, will lead to an improvement of the current account balance. Contrary to this, if the aggregate value of the price elasticity of import and export is less than unitary will lead to the worsening of the current account balance.

The J curve hypothesis explains the impact of depreciation in an economy on the trade balance of the country. Initially, the price elasticity of net exports is inelastic in nature leading to a total revenue loss. Hence, a current account undergoes deficit in the initial stage of devaluation. With time, the import demand and the export demand respond to each other leading to the substitution of goods and services. This change exercises some pressure on the trade balance leading to positive magnitude. Hence, the trade deficit goes up and then comes onto a more positive magnitude. This results in a pattern forming a J-curve wherein the effect from this curve aims to curtail the current account deficit through devaluation.

The rest of the paper is structured as follows. Section II gives a brief explanation of the review of literature based on the J curve analysis. Section III explains the data analysis and its results drawn from the econometric analysis. Section IV describes the results of our research study.

LITERATURE REVIEW

The essence of J curve hypothesis in Pakistan by Hafeez Ur Rehman and Muhammad Afzal aims to display using ARDL, OLS, 2SLS, and 3SLS techniques. The study concludes that the depreciation of Pak Rupee is not favorable to the economy in the end but the economy witnesses the presence of J curve (Rehman & Afzal, 2003). Examining the relationship between the trade balance and the real exchange rate, Anil K Lal and Thomas C Lowinger employs various tools like Cointegration techniques, error correction model and impulse response function

and studies the existence of J curve in the entire East Asian countries (Indonesia, Japan, Korea, Malaysia, Philippines, Singapore and Thailand). The study claims that the formation of the J curve varies across countries for multiple reasons, among the many, they highlight the different trade and exchange rate regimes across countries. It features that, the liberalization of trade and exchange rate will diminish the J curve effect. (Lal & Lowinger, 2002)

Marcus Noland in his paper, estimates the generalized gamma-distributed lag model of Japanese trade. The analysis confirms the existence of lags on the price change responses. Further, the study uses these estimates to construct a J curve, which yields that the results were not satisfying the Marshall Lerner condition. However, the paper highlights the facts that the policymakers should target the trade balance for an effective economic activity rather than targeting on the exchange rate (Noland, 1989). Further, Mohsen Bahmani-Oskooee and Hanafiah Harvey investigates the short-run as well as the long-run impact on the exchange rate and trade balance between Indonesia with each of its trading partners. This analysis executes Vector Error Correction Model and ARDL. The study witnesses the presence of J curve only in 5 countries amongst the 13 trading partners (Bahmani-Oskooee, 1985).

Techniques like Generalized impulse response and Error Correction Model is applied by Elif Akbostanci where the study explores the presence of a J-curve in the Turkish data during the period 1987-2000 (quarterly data). The paper concludes that the existence of, the J curve is not achieved. (Akbostanci, 2004). Rabeya Khatoon and Mohammad Mahbubur Rahman studies the depreciation of Taka on the trade balance. The analysis uses techniques like Autoregressive Distributed Lag Model, Engel Granger Two-step model, and granger causality test. Here, the analysis is done both in the short run and the long run. The paper confirms that there is the J curve exists in the economy of Bangladesh. (Rahaman & Rabeya, 2009)

Nsama Musawa in his study examines the impact of the change in the exchange rate on the trade balance, the change in impact was studied both in the timeline of short and the long run. The techniques used to study the relationship, were Cointegration analysis and the Vector Error Correction model where the period of the study in this paper was 2000-2010, this study concludes that in the short run, the exchange rate has negligible impact on trade balance but it has its influence in the long-run for the Zambia economy (Musawa, 2014).

In the paper "The Relationship between the real exchange rate and the trade balance: An Empirical Reassessment" by Hassan Shirvani and Barry Wilbrate studies, the relationship between exchange rate and trade balance between U.S and other G7 countries. The study concludes, the trade balance is not reactive to exchange rate immediately but experience the impact in a span of two years. In addition, the existence of Marshall-Lerner condition proves to conclude that devaluation improves the balance of trade in the economy.

In most of the studies, linearity approach analysis the equation between Trade balance and Exchange rate. However, in a study by Salah Nusair, non-linearity fashion is performed to understand its results concerning the J-curve hypothesis. The authors test whether the introduction of Non-Linearity would elucidate the study of the J curve. The paper confirms that the introduction of asymmetric effects gives a clear understanding in studying the J curve analysis (Nusair, 2017). Also in the study by Horrace and Sickles (2014), the situations of short-run and long run, execution of partial sum decomposition of the explanatory variables results in nonlinearities. The paper also highlights on the fact that working on linearity does not completely portray the existence of the J-curve phenomenon. The assumption proves to be accurate as the linearity model failed to prove the presence of the J curve. However, with the application of Non-linearity the existence of J-curve exists in 12 out of 16 countries. Henceforth, suggesting that implying nonlinearity in the adjustment process is significant while studying the J-curve phenomenon.

The analysis of J curve analysis has been tested in most of the major Economies. The available literature on the J curve analysis applies the techniques ARDL model, OLS, 2SLS and 3SLS. Also, to check the long term and short term dynamics of the J curve, Cointegration technique and Granger Causality test and Vector Error Correction Model have been incorporated in many works. Most of the studies been interpreted where the variables are examined linearly, however few studies introducing the asymmetric relationship between the variables has inferred that the analysis of the J curve is done in much depth. This paper attempts to understand the existence of the J curve in the Indian Economy, from the period August 1998 to August 2018. This specific period has been chosen, as there has been a radical change in India's Exchange rate in just five years. Studying from the available literature, techniques like Johansen Cointegration, Granger Causality and Vector Error correction Model has been applied in this paper.

DATA, RESULTS, AND DISCUSSION

The data on the exchange rate and trade balance is extracted from the Reserve Bank of India compiled by Ministry Of Commerce. The data is compiled of monthly frequency for twenty years ranging from 1998 to 2018.

- **Unit root tests**

Unit root tests analyses the stationarity of data. The presence of variance in a time series data confirms that the series is Non-Stationary. The results of unit root using ADF and KPSS are presented in Table 1 (a) and (b) respectively. The results in table 1(a) shows that at level there is a presence of unit root, as the t-value of the exchange rate and trade balance is higher than 1%level of significance, also the p-value is not statistically significant. In consequence, first differencing is done to make data stationarity and we observe that the t-value of both exchange rate and trade balance is less than 1%level of significance, also the p-value is sta-

tistically significant. Directing that the data is stationary at I (1) series. Similar observations are made in table 1(b). At level there is a presence of unit root, as the LM- stats at level is greater than 1% level of significance. Henceforth, first differencing is carried out to make the data stationary.

Table1(a): Summary of ADF test

Description	Differencing				Order of Integration
	ADF				
	Level		First difference		
	t-value	p- value	t-value	p-value	
EXR	0.510314	0.9688	-13.93526	0.0000	I(1)
TB	-0.40115	0.9055	-7.454028	0.0000	I(1)

Test critical value	1% level	-3.45763
	5% level	-2.87344
	10% level	-2.573187

Table1(b): Summary of KPSS unit root test results.

Description	Differencing		Order of integration
	KPSS		
	Level	First difference	
EXR	1.46253	0.213359	I(1)
TB	1.709979	0.114099	I(1)

Test critical value	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

From the above results of Unit root tests, it is learned that the Trade balance and Exchange rate will vary only within the constant long-term mean. This implies that both the series display mean reversion at I(1) series, displaying stationarity at first difference.

Granger causality and Johansen cointegration tests are enforced to learn the long-run dynamics of Trade balance and Exchange rate.

- **Granger causality Test**

Granger causality checks the cause and effect between two variables. Here, the notion of cause and effect is determined, between exchange rate and trade balance in the long -run.

Table: 2 Pairwise Granger Causality Tests

Null hypothesis	F-statistic	Prob
D(TB) does not granger cause D(EXR)	4.98752	0.0076
D(EXR) does not granger cause D(TB)	1.18688	0.307

From the above table, in the first case, the null hypothesis states that Trade balance does not Granger causes the Exchange rate. The P-value is lower than the critical values i.e.0.05 rejects the Null-hypothesis and proves that Trade balance Granger causes Exchange rate. This technique helps to determine the long-term relationship between variables. Similarly, here, the long-term dynamics of trade balance and exchange rate is analyzed, where the cause and effect of Trade balance towards Exchange rate are established and not vice-versa.

- **Johansen Cointegration Test**

Johansen Cointegration test are maximum likelihood estimators and two tests are involved to test the long- term relationship between variables 1) Maximum Eigenvalue test 2) Trace test. Johansen is applied to check whether the group of non-stationary series is cointegrated in the long run.

Table:3 Unrestricted Cointegration Rank-test analysis

Hypothesized no. of CE(s)	Eigenvalues	Trace Statistic	0.05 critical Value	Prob
None	0.069086	16.95222	15.49471	0.0300
At most 1	0.000243	0.05744	3.841465	0.8106

At “None” the null hypothesis states that there is no cointegration, here the null hypothesis is rejected as the p-value is not statistically significant. Also, the trace statistics is greater than the critical value leading to the rejection of the null hypothesis.

In the second case where the null hypothesis states that there is at most 1 cointegrating equation, here the null hypothesis is accepted, as the p-value is statistically significant. Also, the trace statistics is lesser than the critical value leading to the acceptance of the null hypothesis.

Table 4: Unrestricted cointegration rank maximum Eigenvalue test analysis results

Hypothesis no. of CE(s)	Eigenvalue	Max. Eigenvalue Statistic	0.05 Critical value	Prob
None	0.069086	16.89478	15.49471	0.0041
At most 1	0.000243	0.057440	3.841466	0.0749

Identical observation is made to Eigenvalue value, where at none the null hypothesis is rejected, and at most 1 the null hypothesis is accepted stating that there is 1 cointegrating equation at 0.05 level.

Looking at the Trace statistics and the Eigenvalue test, the null hypothesis stating that there is no cointegration between Exchange rate and Trade Balance is rejected based on the P-value significance and the Trace statistics. This rejection leads to the analysis of the other alternative of the test where it states that in the long- run there is cointegration between Exchange rate and Trade balance. The P-value and the trace statistics prove to be statistically significant, henceforth confirming that Exchange rate and Trade balance share a cointegrating relationship in the long run. Learning from the available literature review, the J curve hypothesis is witnessed in the economy when the Exchange rate and Trade balance share a cointegration relationship in the long run.

- **Vector error correction model**

When I(1) series are cointegrated, vector error correction model is used to determine the short-run dynamics of the series.

The conventional error correction model for cointegration series is:

$$\Delta Y_t = \beta_{0+} \sum_{i=1}^{n} \beta i \, \Delta y_{t-1} + \sum_{i=0}^{n} \delta \Delta x_{t-1} + \Phi Z_{t-1} + \mu_t$$

Z is the error correction term and is the OLS residuals from the following long-run cointegrating regression

$$y_t = \beta_o + \beta_1 X_t + \varepsilon_t$$

Since the variables do cointegrate, the estimated log run cointegrating equation using the vector error correction model we get

$$ect_{t-1} = 1.000\ EXR_{t-1} + 0.017412 TB_{t-1} - 31.9115$$

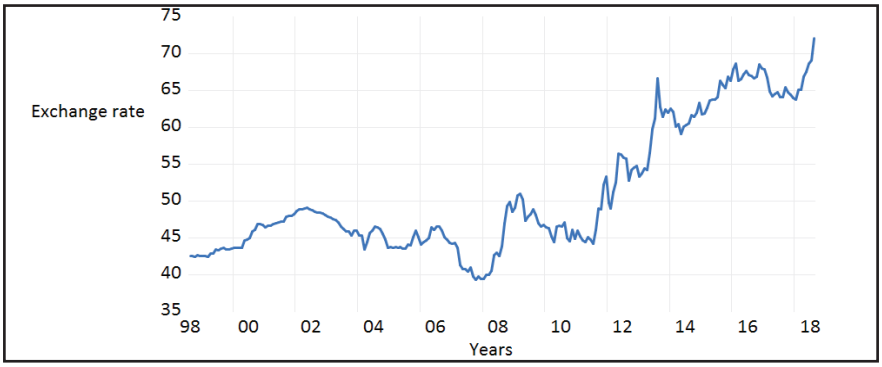
Table 5: Vector error correction model

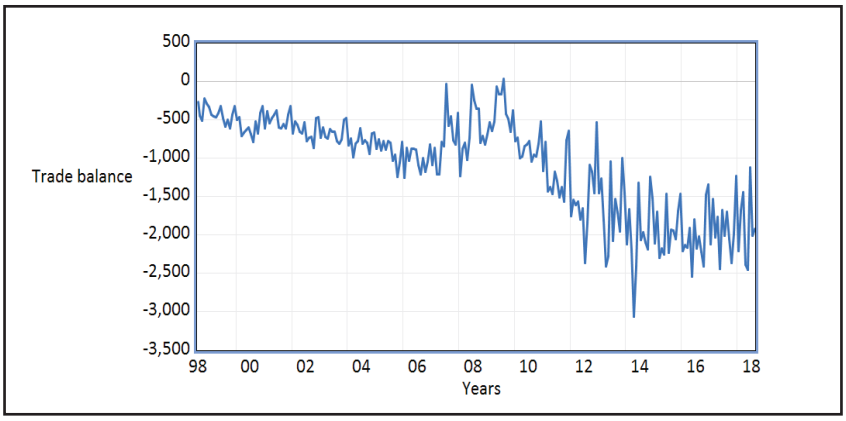
Variable	Coefficient	Std. error	t-statistic	Prob
ECM	-0.041009	0.012798	-3.20437	0.0015
D(EXR(-1)	0.133498	0.064813	2.059739	0.0405
D(TB(-1)	0.000206	0.000247	0.833120	0.4056

The negative coefficient of the error correction term (- 0.040119) implies that any departure in one direction will be pulled in another direction so that equilibrium is restrained. In the above table, we notice that any deviation by 4% will be corrected in each period and will be brought back to equilibrium. On the other hand, we discover that the trade balance variable has a positive coefficient (0.000206)

and not statistically significant implying that the immediate impact of currency depreciation will have a negligible impact on exchange rate.

From the technique of Granger Causality test, we confirm that there are cause and effect of Trade balance towards Exchange rate. To understand the short term dynamics and analyze the impact of Trade balance towards exchange rate in the short run, Vector Error Correction Model is applied. The result obtained from the VECM confirms that there is no immediate impact of Trade Balance on Exchange Rate. This analysis is confirmed when looked at the P-value of Trade Balance. Hence, confirming that there is no immediate impact of Trade balance towards Exchange Rate in Indian Economy.





CONCLUSION

The study analyses the impact of the rising exchange rate in the Indian economy. With this elevation, the paper tries to understand whether in the long- run this leap will be a boon to the economy or not. With time, as the substitution of goods and services takes place the devaluation of the home currency will lead to

the benefit of the country. This paper studies the short and long-run behavior of Trade balance and Exchange rate for the Indian economy. Firstly, the stationarity of the series is checked by applying the Augmented Dicky Fuller(ADF) and Kwiatkowski–Phillips–Schmidt–Shin(KPSS) test. The variance is not rectified at the level. Hence, first differencing is done to attain stationarity. Acquiring stationarity at I(1) series Granger causality technique is applied to understand the notion of cause and effect between Trade balance and Exchange rate. From the results obtained we understand that Trade balance affects Exchange rate and not conversely. Understanding this direction of impact, the paper aims to understand whether there is any cointegration between the variables in the long- run. Based on the P-value and trace statistics, the study finds there is long- term relation between exchange rate and trade balance. Secondly, Vector Error Correction Model studies the short- term equation between exchange and trade balance. The results showcases that any deviation by a rate of 4% will be corrected in each period and will be brought back to equilibrium. Hence, equilibrium will be stored through the technique of VECM. However, looking at the P-value and the coefficient of trade balance the impact of trade balance on exchange proves to be insignificant.

References

A.Nusair, S. (2016). The J-Curve phenomenon in European transition economies: A nonlinear ARDL approach. *International Review of Applied Economics*, 1-27.

AFZAL, H. U. (2003). THE J CURVE PHENOMENON: AN EVIDENCE FROM PAKISTAN. *Pakistan Economic and Social Review*, 45-58.

Ahtiala, P. (1983). A Note on the J-Curve. *Journal of Economics*, 541-542.

Akbostanci, E. (2004). Dynamics of the Trade Balance: The Turkish J-Curve. *Emerging Markets Finance & Trade*, 57-73.

Bahmani-Oskooee, M. (1985). Devaluation and the J-Curve: Some Evidence from LDCs. *The Review of Economics and Statistics*, 500-504.

Harvey, M. B.-O. (2009). The J-curve: Indonesia vs. Her Major Trading Partners. *Journal of Economic Integration*, 765-777.

Lowinger, A. K. (2002). The J-Curve: Evidence from East Asia. *Journal of Economic Integration*, 397-415.

Musawa, N. (2014). Relationship between Zambia Exchange Rates and the Trade Balance – J Curve Hypothesis. *International Journal of Finance and Accounting*, 192-196.

Niyati Bhanja, A. B. (2014). Exchange Rate and Monetary Fundamentals: Long term relationship revisited. *PANOECONOMICUS*, 33-54.

Noland, M. (1989). Japanese Trade Elasticities and the J-Curve. *The Review of Economics and Statistics*, 175-179.

P. C. Waller, C. G. (1988). Coronary Flow Reserve And The J Curve. *British Medical Journal*, 1606-1608.

Rahman, R. K. (2009). Assessing the existence of the J- curve effect in Bangladesh. *The Bangladesh Development Studies*, 79-96.

RATHA, M. B.-O. (2004). The J-Curve: a literature review. *Applied Economics*, 1377–1398.

Sukar, A. (1998). Real Effective Exchange Rates and Export Adjustment in the U. S. *Quarterly Journal of Business and Economics*, 3-12.

Wilbratte, H. S. (1997). The Relationship Between The Real Exchange Rate and The Trade Balance: An Empirical Reassessment. *International Economic Journal*, 39-50.

Yazici, A. K. (2016). THE J-CURVE HYPOTHESIS: AN INVESTIGATION OF BILATERAL TRADE BETWEEN NIGERIA AND EUROPEAN UNION. *Journal of International and Global Economic Studies*, 46-74.