Jahangirnagar University Journal of Business Research (JUJBR), Vol. 22, June, 2021
ISSN 1681-9748

Relationship Between Exchange Rate and Inflation Rate in Bangladesh: An Empirical Investigation

JUJBR

Md. Wahidul Habib[*]
Mohammad Osman Gani[**]
Jarin Tasnim[***]

Abstract: *The paper investigates the relationship between the exchange rate and inflation rate in Bangladesh using yearly data from 1988 to 2018. The data on the relevant variables from 1988 to 2018 are obtained from various issues of Economic Trends, Bangladesh Bank and Economic Review, Ministry of Finance. The paper employs descriptive statistics, correlogram, unit root tests such as Augmented Dickey-Fuller (ADF), Dickey-Fuller test with GLS de-trending(DF-GLS), and Phillip Perron's (PP) tests, and Granger Causality Test. The results of the study show that there is bidirectional causation exists between the exchange rate and inflation rate. Policymakers and economic modelers should pay attention to these findings. It's critical to account for structural breaks when checking for unit roots when modeling inflation rates. The researchers could consider data from 1972 to 2020 instead of data from 1988 to 2018 to get a better picture or trend in the case of inflation and exchange rate. For analyzing data, the unit root test and Granger causality test have been used.*

Keywords: *Exchange rate, Inflation, Unit Root Test*

JEL Classification: *E31, F31 and F45*

1.0 Introduction

Exchange rates, which are one of the most essential variables in modeling open economies, have a significant impact on monetary policy. With floating exchange rate regimes becoming increasingly common, inflation targeting has been a focal point of monetary policy debates (Prasertnukul, Kim, and Kakinaka, 2010). The major argument in favor of stable exchange rate regimes is their capacity to foster price discipline and monetary policy efficiency. Under a fixed or stable exchange rate regime, a country with a higher rate of inflation than the rest of the world is more likely to have the

[*] Assistant Professor, Faculty of Business, ASA University Bangladesh, Dhaka, Bangladesh, E-mail: wahidul123@hotmail.com

[**] Assistant Professor, Department of Business Administration in Marketing, Bangladesh University of Professionals, Dhaka, Bangladesh, E-mail: osman@bup.edu.bd

[***] Lecturer, Department of Business Administration General, Bangladesh University of Professionals, Dhaka, Bangladesh, E-mail: jarin.tasnim@bup.edu.bd

recurrent balance of payments deficits, resulting in reserve losses. The national debt is unsustainable due to chronic deficits and reserve depletion. In a flexible exchange rate system, however, there is no such demand for price discipline because imbalances in the balance of payments are automatically and instantly remedied by changes in the exchange rate(Mohantya and Bhanumurthy, 2014).

Considerable research has been commenced to recognize the interface between the exchange rate, rate of inflation, and other macroeconomic variables. The study is an endeavor to reconsider the empirical issue of the relationship between the exchange rate and the rate of inflation in Bangladesh. The paper seeks to answer the following questions:

Q1. What is the causal relationship between the rate of inflation and the exchange rate in Bangladesh?

Q2. Is the rate of inflation exogenously or endogenously determined in the context of stabilizing the exchange rate?

The rest of the paper is organized as follows. Section 2 reviews the existing empirical literature.

Section 3 deals with methodologies applied in the paper. Section 4 analyzes the empirical results, and Section 5 discusses the empirical results.

2.0 Literature Review

Several empirical studies have been conducted to discover the relationship between the rate of inflation and the exchange rate. Vadivel(2009) investigated the effectiveness of the Reserve Bank of India's intrusion on the exchange rate and its volatility. For analyzing exchange rate data, he introduced a generalized autoregressive conditionally heteroskedastic (GARCH) test. The results of the study suggested that intervention of the Reserve Bank of India (RBI) does not affect the exchange rate. The exchange rate appreciates substantially in response to good news while poor news seems to have little effect on the exchange rate. Good news also raises exchange rate volatility while bad news does not affect volatility. He mainly measured exchange rate volatility in India. For measuring volatility he introduced the GARCH model. Narayan and Narayan (2010) investigated whether or not the rate of inflation can be modeled as a stationary mechanism for 17 OECD countries. They note that (1) traditional univariate unit root tests without any structural breaks usually reveal that the inflation rate contains a unit root; (2) the KPSS univariate multi-structural break test reveals that inflation is stationary for 10 out of 17 countries. They mainly check the stationary rate of inflation with the help of a unit root test like KPSS.

Nortey, Ngoh, Amponsah, and Kenneth (2015) investigated the volatility and link among exchange rate, inflation rate, and interest rate. Here they introduced the GARCH model for analyzing data. They tried to measure the volatility of inflation rate, exchange rate, and interest rates. Shastri and Shastri (2016) examined the relationships between exchange rates and interest rates in India. They employ ADF, DF-GLS, KPSS, and PP tests for checking stationarity. They also employ Johansen and Juselius tests to assess co-integration. The results of the study show that there is a long-run relationship among interest rate, exchange rate, and inflation rate. Low and Chan (2017) examined the link among gross domestic product, exchange rate, inflation rate, and interest rate. Here they introduced unit root test, co-integration test, vector error correction model, and impulse response function and variance decomposition for analyzing data. The results of the study show that there is a positive relationship between GDP and exchange rate and a negative relationship among GDP –inflation rate and GDP –interest rate.

Quah(2017) examined the feasibility of currency fixation among today's largest economies, namely the US, Japan, China, and the Germany / Eurozone, by evaluating variables by the optimum currency area system. The idea is that the monetary integration dimensions should be more convergent with greater interconnectedness in general over time. Naknoi(2017) evaluated the effect of the variance of US – Canada wage differences in the sector and aggregate level variance of the real exchange rate.

Hajilee and Al Nasser (2017) showed that exchange rate volatility has short-term and long-term effects in the majority of countries. For 16 countries out of 26, financial depth has been shown to respond significantly to exchange rate volatility (nine positive, seven negative).

In addition, using the bounds test approach shows that exchange rate volatility has a significant impact on the financial deepening of 20 out of 26. Aftab and Rehman (2017) examined the impact of exchange rate risk on the bilateral trade of two closely interlinked East Asian open economies – Malaysia and Singapore – at the industrial level. For analyzing data, they introduced the Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) model and Autoregressive Distributed Lag (ARDL) approach.

The findings of the study suggest that exchange risk has an impact on a moderate number of industries in the short term, although this influence is long-term in very few industries. It is interesting to note that exchange-rate volatility accelerates the import demand of major Malaysian importing industries such as gas and plastics.

Cabral, Carneiro & Mollick (2020) investigated inflation rate and exchange rate volatility in emerging markets. They employ panel data, ordinary least squares, and a generalized method of moments for analyzing data.

Chang, Rajput, Bhutto & Abro (2020) examined the effects of extremely large to extremely small changes in the series of exchange rate volatility on US imports from Brazil, India, Mexico and South Africa. The results of the study indicate that the effects of extremely large changes in the series of exchange rate volatilities differ significantly from the effects of extremely small changes in the series of exchange rate volatilities on US imports.

Most of the authors investigated inflation rate and exchange rate volatility with the help of the unit root test, GARCH model, OLS, GMM, and panel data analysis. They researched the US, Brazil, India, and so on but not Bangladesh context. There is a research gap and that's why we investigated the relationship between the exchange rate and inflation rate in Bangladesh.

3.0 Data and Methodology

The data on the relevant variables from 1988 to 2018 are obtained from various issues of Economic Trends, Bangladesh Bank and Economic Review, Ministry of Finance. To check the time series data whether it is stationary or non-stationary, the study uses three alternative unit root tests such as ADF test, DF-GLS tests, and PP tests. Apart from that the study also employs descriptive statistics and Granger Causality tests.

4.0 Empirical Results

Table 1: Descriptive statistics of exchange rate and inflation

Statistics	Inflation Rate	Exchange Rate
Mean	6.197	58.92333
Median	6.565	59.165
Maximum	10.62	83.73
Minimum	1.94	32.27
Std. Dev.	2.261192	16.58821
Skewness	-0.1244	-0.090488
Kurtosis	2.251818	1.577127
Jarque-Bera (J-B)	0.777098	2.571648
Probability	0.67804	0.276423
Sum	185.91	1767.7
Sum Sq. Dev.	148.2766	7979.895
Observations	30	30

It is evident from Table 1 that inflation and exchange rate have negative skewness with test statistics of -0.1244 and -0.090488 respectively. The test statistics of kurtosis of inflation and exchange rate are less than 3. The mean

value of inflation and exchange rate are 6.197 and 58.92333 respectively. The J-B statistics of inflation and exchange rate are 0.777098 and 2.571648 respectively.

Figure 1: Correlogram of Exchange Rate at Level

Sample: 1 30

Included observations: 30 Level

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |****** |	. |****** |	1	0.902	0.902	26.903	0.000
. |****** |	. | . |	2	0.811	-0.011	49.435	0.000
. |***** |	. | . |	3	0.725	-0.023	68.102	0.000
. |***** |	. | . |	4	0.645	-0.013	83.465	0.000
. |**** |	. | . |	5	0.563	-0.061	95.618	0.000
. |*** |	. *| . |	6	0.468	-0.115	104.39	0.000
. |**. |	.**| . |	7	0.343	-0.236	109.31	0.000
. |**. |	. | . |	8	0.239	0.000	111.80	0.000
. |* . |	. | . |	9	0.148	-0.012	112.80	0.000
. | . |	. | . |	10	0.062	-0.051	112.99	0.000
. | . |	. | . |	11	-0.022	-0.055	113.01	0.000
. *| . |	. *| . |	12	-0.110	-0.082	113.66	0.000
. *| . |	. | . |	13	-0.186	-0.017	115.62	0.000
.**| . |	. | . |	14	-0.248	-0.042	119.32	0.000
.**| . |	. *| . |	15	-0.307	-0.082	125.36	0.000
***| . |	. | . |	16	-0.353	-0.011	133.92	0.000

Figure 1 depicts that spikes of exchange rate crosses the boundary lines in both ACF and PACF cases. Moreover, the p value shows significance at a 1% level and it indicates that there is a non-stationary trend.

Figure 2: Correlogram of Exchange Rate at 1st Difference

Sample: 1 30

Included observations: 29

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.015	0.015	0.0072	0.932
.**| . |	.**| . |	2	-0.267	-0.267	2.3807	0.304
. *| . |	. *| . |	3	-0.197	-0.202	3.7229	0.293
. *| . |	.**| . |	4	-0.197	-0.305	5.1234	0.275
. |* . |	. | . |	5	0.127	-0.015	5.7296	0.333
. |**. |	. |* . |	6	0.314	0.166	9.5846	0.143
. | . |	. *| . |	7	-0.051	-0.089	9.6923	0.207
. *| . |	. | . |	8	-0.093	0.010	10.065	0.261
. *| . |	. *| . |	9	-0.184	-0.136	11.583	0.238
. | . |	. | . |	10	-0.039	0.002	11.654	0.309
. |* . |	. | . |	11	0.130	-0.028	12.499	0.327
. *| . |	.**| . |	12	-0.067	-0.239	12.733	0.389

Figure 2 depicts that spikes of exchange rate didn't cross the boundary lines in both ACF and PACF cases. Moreover, the p value shows insignificance and indicates that there is a stationary trend.

Figure 3: Correlogram of Inflation rate at Level

Sample: 1 30

Included observations: 30 Level

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |**. |	. |**. |	1	0.335	0.335	3.7169	0.054
. |* . |	. | . |	2	0.116	0.004	4.1799	0.124
. |* . |	. |* . |	3	0.152	0.126	5.0055	0.171
. |* . |	. | . |	4	0.127	0.044	5.6026	0.231
.**| . |	***| . |	5	-0.249	-0.359	7.9783	0.157

. *| . |	. | . |	6	-0.150	0.028	8.8737	0.181
. | . |	. |* . |	7	0.030	0.104	8.9110	0.259
. | . |	. | . |	8	-0.042	-0.032	8.9885	0.343
. | . |	. |* . |	9	-0.022	0.115	9.0102	0.436
. *| . |	.**| . |	10	-0.078	-0.246	9.3025	0.504
.**| . |	.**| . |	11	-0.254	-0.339	12.561	0.323
. *| . |	. |* . |	12	-0.152	0.140	13.787	0.315
. | . |	. |* . |	13	0.002	0.138	13.787	0.389
. *| . |	. | . |	14	-0.091	-0.004	14.286	0.429
. *| . |	. | . |	15	-0.100	-0.040	14.932	0.456
. | . |	.**| . |	16	0.039	-0.266	15.036	0.522

Figure 3 depicts that spikes of inflation rate didn't cross the boundary lines in both ACF and PACF cases. Moreover, the p value shows insignificance and it indicates that there is a stationary trend.

Table 2: Results of Unit Root Test

Variables	**ADF test statistic**	**DF-GLS test statistic**	**PP test statistic**
	H_o: Series has unit root	**H_o: Series has unit root**	**H_o: Series has unit root**
Exchange Rate(Level)	-2.397275(0)	-2.509670(0)	-2.307846
Exchange Rate(1^{st} Difference)	-4.902106(0)**	-5.088253(0)**	-7.885344**
Inflation Rate(Level)	-4.033048(0)*	-3.865389(0)**	-4.033048*
Inflation Rate(1^{st} Difference)	-7.185169(0)**	-6.632615(0)**	-17.51564**

Notes: () indicates lag. ADF indicates Augmented Dickey-Fuller and PP indicates Phillips Perron.* shows significance at 5% level and ** show significance at 1% level.

Table 2 presents the results of the ADF, DF-GLS, and PP tests for the variables at the level and first difference with trend and intercept. At levels, the ADF, DF-GLS, and PP tests could not reject the null hypothesis of the unit root for exchange rate and it indicates that the series is non-stationary. After the first difference, the ADF, DF-GLS and PP tests rejected the null hypothesis of the unit root for exchange rate and it confirms that the series is stationary. At levels, the ADF, DF-GLS and PP tests rejected the null

hypothesis of the unit root for inflation rate and it confirms that the series is stationary. Therefore, we conclude that the series of exchange rates integrated of order one i.e. I(1) but the series of inflation rates integrated of order zero i.e. I(0). Due to both series being integrated into different orders we cannot introduce any co-integration test. We compel to choose Granger Causality Test.

Table 3: Results of Granger Causality Test

Null Hypothesis	F-Statistic	p-Value	Conclusion
Exchange Rate does not Granger Cause Inflation Rate	0.73410	0.4908	Do not reject
Inflation Rate does not Granger Cause Exchange Rate	0.08081	0.9226	Do not reject

The F-statistics with corresponding probabilities indicate that there is bidirectional causation exists between exchange rate and inflation rate (table 3).

5.0 Results and Discussions

This study investigates the links between the exchange rate and the rate of inflation in Bangladesh from 1988 to 2018. Based on descriptive statistics and J-B tests it is found that both the time series- exchange rate and inflation rate are not normally distributed. After checking the time series whether it is stationary or non-stationary, it is found that at the level the series of the exchange rate is non-stationary and after the first difference, it is stationary. But on the other hand, at the level the series of the inflation rate is stationary. Though both the series are not co-integrated at the same order level, then we cannot employ any co-integration tests. We compel to employ the Granger Causality test and the tests indicate that there is bidirectional causation exists between exchange rate and inflation rate.

6.0 Conclusions

Given its extensive economic modeling and policy implications, the question of whether the inflation rate can be treated as a nonstationary process has piqued everyone's curiosity. While the integrational features of the inflation rate are an important initial step in many elements of econometric modeling, the degree of inflation is a critical factor in the condition since it imposes a real cost on society.

Finally, the nature of the link between the two variables may provide a method via which financial depth and exchange rate exercise their effects on economic growth, which is particularly relevant for policymakers, portfolio investors, and international traders.

6.1 Theoretical, Practical, and Managerial Implications

Policymakers and economic modelers should pay attention to our findings. It's critical to account for structural breaks when checking for unit roots when modeling inflation rates. This discovery has ramifications for predicting inflation rates using other macro factors including the exchange rate, GDP, stock prices, and money demand.

6.2 Limitations and Future Research Directions

We mainly consider data from 1988 to 2018. We can consider data from 1972 to 2020. For this, we will get a better picture or trend in the case of inflation and exchange rate. For analyzing data, we employ the unit root test and Granger causality test. Next time, we will employ the ARCH-GARCH model and ARDL model.

References

Aftab, Muhammad and Rehman , Ijaz Ur (2017). Exchange Rate Risk and Bilateral Trade between Malaysia and Singapore. *Studies in Economics and Finance*, *34*(3), 407-426.

Cabral , Carneiro & Mollick(2020). Inflation Targeting and Exchange Rate Volatility in Emerging Markets. *Empirical Economics*,*58*(2), 605-626.

Chang , Rajput , Bhutto & Abro (2020). Asymmetric effect of extreme changes in the exchange rate volatility on the US imports: Evidence from multiple threshold nonlinear autoregressive distributed lag model. *Studies in Economics and Finance*,*37*(2),293-309.

Hajilee, Massomeh and Al Nasser, Omar M. (2017). Financial Depth and Exchange Rate Volatility: A Multicountry Analysis. *The American Economist*, *62*(1), 19-30.

Low and Chan (2017). Foreign Exchange Rate, Interest Rate, Inflation Rate and Economic Growth in Malaysia. *Global Business and Management Research: An International Journal, 9*(4), 110-127.

Mohantya and Bhanumurthy(2014). Exchange Rate Regimes and Inflation: Evidence from India. *International Economic Journal*, *28*(2), 311-332.

Naknoi, Kanda (2017). Real exchange rate fluctuations, wage stickiness and tradability. *Canadian Journal of Economics*, *50*(1), 94-110.

Narayan ,Paresh Kumar and Narayan, Seema (2010). Is there a unit root in the inflation rate? New evidence from panel data models with multiple structural breaks. *Applied Economics*, *42*(13), 1661-1670.

Nortey, Ngoh, Amponsah and Kenneth (2015). Modeling Inflation Rates and Exchange rates in Ghana: Application of Multivariate GARCH Models, *Springer Plus*, *4*(86), 1-10.

Prasertnukul, Kim and Kakinaka, (2010).Exchange Rates, Price Levels, and Inflation Targeting: Evidence from Asian Countries. *Japan and the World Economy*, *22*, 173-182.

Quah , Chee-Heong(2017). Exchange Rate Fixation between U.S. China, Japan and Eurozone. *Margin-The Journal of Applied Economic Research*, *11*(2), 99-120.

Shastri and Shastri (2016). Exchange Rate Interest Rate Linkages in India: An Empirical Investigation. *Journal of Financial Economic Policy* , *8*(4), 443-457.

Vadivel A. (2009).Exchange Rate Intervention and Volatility of Exchange Rate in India. *The Indian Economic Journal*, *56*(4), 143-152.