



THE IMPACT OF STOCK PRICE ON EXCHANGE RATE: THE CASE OF INDIA

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The money market and the forex market form the most volatile markets in the economy based on speculative transactions. Both the markets have uncertainty incorporated in its very method of functioning. The Stock Market through its various capital market instruments act as an interface between the borrowers and the investors by providing a suitable arrangement in the form of primary and secondary market. The stability and performance of the market in terms of share prices is often viewed as a measure of business confidence as it augments the corporates and the big businesses with funds. The Forex market deals with more liquid asset- currencies, and hence is more volatile compared to the stock market. Exchange rate is the forex market index the investors rely on. Based on their risk tolerance and assets preference the investors make their choice regarding investments in the respective markets. Besides the selective investment in these markets the topic of the possibility, nature and intensity of relationship between the two markets remains a subject of interest for the investors. The relationship between the two markets, that is, the share prices and exchange rates have implications for the economy as well which indeed makes it a topic of inspection. High share prices indicate an environment conducive of growth and thus attracts investment from abroad. The increased demand for the domestic currency due to increased FDI inflows is expected to increase the exchange rate/ appreciation of the currency. The paper aims at diving into getting a better understanding of the same. The study is conducted for the case of India to look at the impact of the share price on the exchange rate. The study has covered the time frame post the Bengal crash of 1982 to check if the major fluctuations had left its trails on the forex market as well.

Literature Review

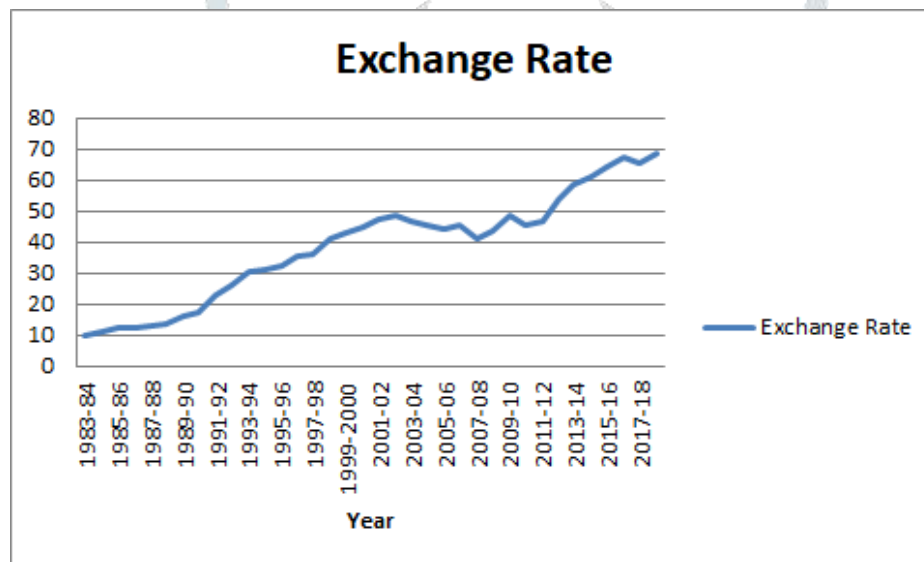
A paper which was an empirical investigation into the effects of share prices on exchange rate and money demand in India (Kumari,2012), through a VECM model, demonstrated a significant negative effect on the exchange rate. However the paper failed at providing a strong theoretical reasoning for the same. The paper also focused on the impact of the share prices on the money in the economy. A paper into the investigation of determinants of exchange rate (Kılıçarslan, 2018) listed out inflation and GDP to be the major factors. The study was conducted in the context of Turkey to study the exchange rate volatility in the period of 1974- 2016, using a GARCH model. However, it was explicitly mentioned that the nature of impact of these variables on exchange rate could not be extended and generalized to other nations, as every economy has a different environment prevalent thereby having a different channel

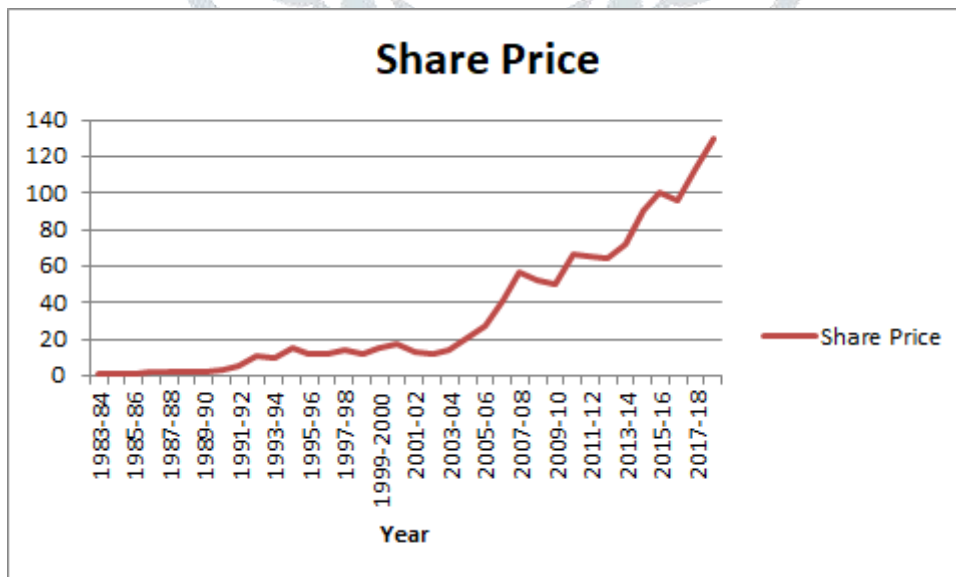
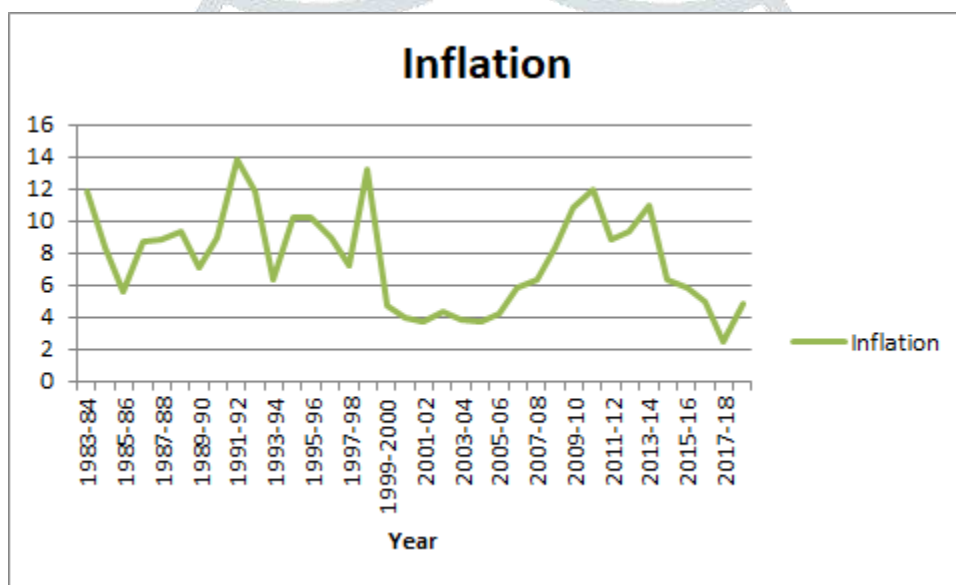
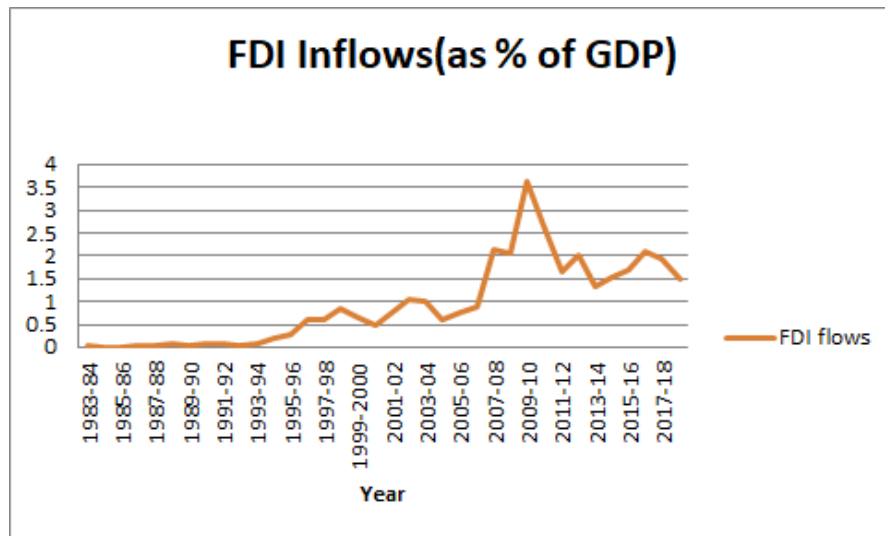
of functioning altogether. A paper (Singh, 2015) while studying the relationship between the share price and exchange rate, concludes a significant bi- directional relationship between both. Cointegration test and Granger Causality test was used to look into the long run relationship between them. (Mirchandani,2019) found that there has been substantial volatility in the exchange rate of India, which makes it difficult to attribute a particular nature of relationship between the exchange rate and its various possible determinants. The paper provides an insight into the major events and the trend of the exchange rate so far.

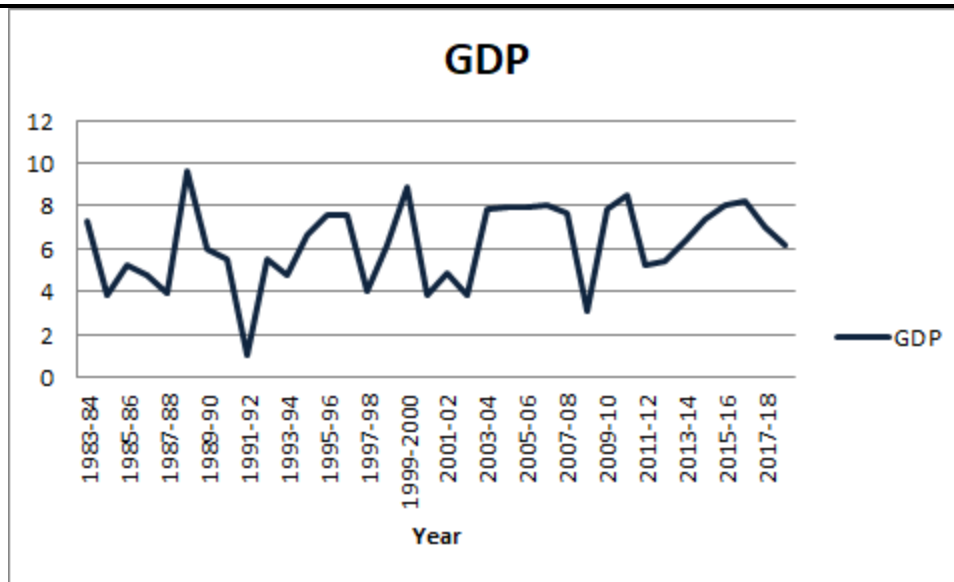
Data Description and Methodology

Time series secondary data for India has been collected and the time frame of 1983- 2018 has been used for the study. The time frame has been chosen keeping in mind the major stock market crash that occurred in India's latest history. The variables used in the study are exchange rate expressed as the price of domestic currency in terms of foreign currency, CPI Index for inflation, share prices, FDI inflows and GDP growth rate. The sources of data are OECD data and World Bank Data. Descriptive Statistics has been used to study the trend of the variables over the time frame and correlation matrix is used to look at the nature and strength of the relationship between them. Out of the four variables, inflation and GDP growth rate are I(0) processes, the rest three: exchange rate, share prices and FDI inflows are I(1) processes. Therefore an ARDL modelling has been used for the regression analysis. Exchange rate is taken as the dependent variable with share price, inflation and GDP growth rate as the explanatory variables in the regression.

Descriptive Statistics







Source: Based on author's calculations

The above graphs show the trends of the variables under study. The major observations are:

- The exchange rate and share price show similar trends as they remained low till the year 1992, but picked up a growing pace since then with minor fluctuations thenceforth.
- FDI inflows have recorded a growing pace since 1994 reaching its all time high in the year 2009-10, followed by a steep dip and continue to low.
- Price level has been fluctuating throughout the period of analysis.
- The GDP growth rate has followed a uniform trend compared to the other variables under study with regular fluctuations.

Table 1: Correlation Matrix

	Exchange Rate	Share Price	Inflation	FDI flows	GDP
Exchange Rate	1				
Share Price	0.84	1			
Inflation	-0.41	-0.25	1		
FDI flows	0.73	0.74	-0.07	1	
GDP	0.30	0.29	-0.16	0.30	1

Source: Based on author's calculations

There are three set of correlation that can be observed through the correlation matrix:

- The coefficient value of +0.84 signifies a strong positive correlation between exchange rate and share price. That means both variables move in the same direction, an increase in exchange rate would be accompanied by a simultaneous increase in the share price as well.
- The coefficient value of +0.73 suggests a moderate positive relationship between FDI flows and exchange rate.
- Share Price and FDI flows have a moderate positive correlation with a coefficient value of +0.74.

Regression Analysis

The dependent variable for the study is the exchange rate and the explanatory variables are exchange rate(-1), GDP, GDP(-1), GDP(-2), GDP(-3), share price, share price(-1), inflation, inflation(-1), inflation(-2), FDI flows, FDI flows(-1) and FDI flows(-2). The lags are based on the automatic AIC criteria, where the maximum lags entered was 4. The functional form of the model is:

$$ER_t = aER_{t-1} + b_1INF_t + b_2INF_{t-1} + b_3INF_{t-2} + c_1GDP_t + c_2GDP_{t-1} + c_3GDP_{t-2} + c_4GDP_{t-3} + d_1SHP_t + d_2SHP_{t-1} + e_1FDI_t + e_2FDI_{t-1} + e_3FDI_{t-2} + \varepsilon$$

- The CUSUM test and the CUSUM squared test have been conducted to validate the stability of the model.
- The model is free from the problems of heteroskedasticity and autocorrelation, which has been verified by the Breusch-Pagan-Godfrey and LM test.

Null hypothesis for LM test was: No serial correlation upto 2 lags

Null hypothesis for Breusch-Pagan-Godfrey test was: Homoscedasticity.

The prob values were more than 0.05, thus the null hypothesis was accepted in each case.

- The Error Correction Regression is run to check the short run relationship of the variables. The F- stat of bounds test was indeed more than the I(1) value at 5% significance level.
- However the VIF factor of share price and its lag value is more than 10 indicating the problem of multicollinearity.
- The RMSE value of the value is 2.73 which was the least among all the models stipulating it to be the best fit.

Table 2: Regression Results

Variable	Coefficient	Prob*
EXCHANGE RATE(-1)	1.06	0
GDP	-0.02	0.91
GDP(-1)	-0.16	0.36
GDP(-2)	-0.03	0.87
GDP(-3)	0.55	0.01
INFLATION	0.29	0.08
INFLATION(-1)	0.01	0.95
INFLATION(-2)	0.30	0.03
SHARE PRICE	-0.16	0.00
SHARE PRICE(-1)	0.20	0.00
FDI FLOWS	-0.69	0.36

FDI FLOWS(-1)	-1.99	0.04
FDI FLOWS(-2)	1.09	0.15
C	-6.23	0.07

Source: Based on author's calculations

- The prob value of the following variables is less than 0.05 implying a significant impact of these variables on the dependent variable- exchange rate:
 - ❖ First lag of exchange rate
 - ❖ Second lag of inflation
 - ❖ Third lag of GDP growth rate
 - ❖ Share price
 - ❖ First lag of share price and
 - ❖ First lag of FDI inflows
- The rest of the variables are insignificant at 5% significance level.
- A one unit increase in the first lag of exchange rate causes an almost proportionate change in the exchange rate of the current period and a one unit increase in third lag of GDP is followed by 0.55 units of increase in exchange rate.
- A one unit increase in the second lag of inflation causes a 0.30 unit increase in the exchange rate
- A one unit increase in the share price leads to 0.16 units decrease in the exchange rate and vice versa. On a contrast, a directly proportional relationship exists between the first lag of share price and the exchange rate, where a one unit increase in the lag value would cause a 0.20 units increase in the exchange rate.
- The FDI inflows have a negative impact as one unit increase in first lag of FDI inflows causes a 1.99 units decrease in exchange rate.

Inference

A major takeaway from the model is the fact that the lag value of most of the variables turned out to be significant instead of the current values. This means there is a lag involved for these variables to have its impact on the exchange rate. The share price of the previous period has a positive impact on the exchange rate. This can be seen as the outcome of static expectations, that is when people form their expectations based on the past statistics. A favourable trend in the share price of the last period is seen as a healthy environment for development of the domestic economy in the present period attracting foreign funds leading to consequent appreciation of the currency, that is an increase in exchange rate. However, the share price in period t has a negative effect on the exchange period in the same period, that is an increase in the share price would be followed by a depreciation of the domestic currency. This could be attributed to the bearish factor who are pessimistic of the prices and business environment in the future thereby inhibiting future investments and having a negative impact on the exchange rate.

The exchange rate of the previous period has a proportionate increasing effect on its value in the next period. The inflation of the period (t-2) has an impact on the exchange rate of period t. The increased GDP growth involves a substantial lag in transferring its positive externalities to the exchange rate.

Conclusion

The paper was an empirical investigation into the impact of share price on the exchange rate in India. Through the descriptive and regression analysis, a relationship was observed between both the variables. The lag value of the share price was also found to have a profound impact on the exchange rate. A favourable lagged value of the share price is favourable in terms of value of the domestic

currency. Except for share price the other variables did not have an instant impact on the exchange rate suggesting a slow adjustment of the exchange rate to the trend of the other variables.

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Appendix

Appendix 1: The ARDL Model

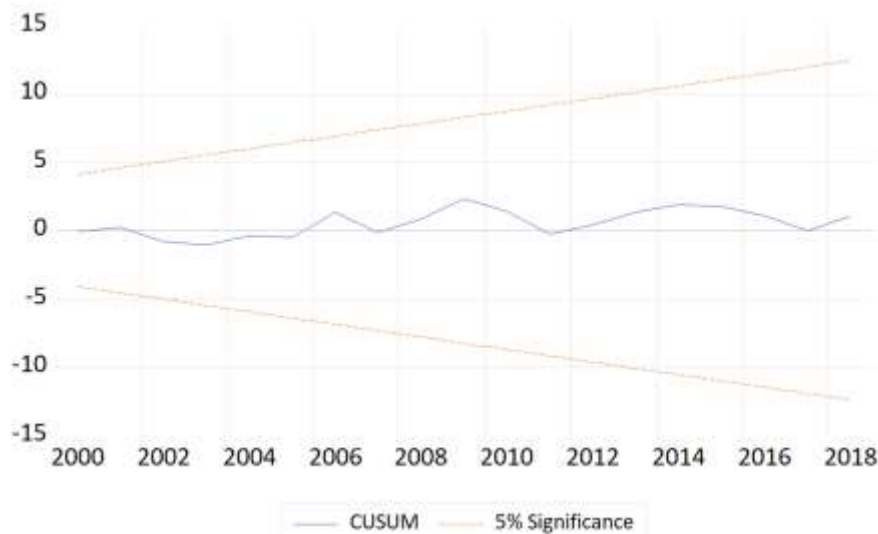
Dependent Variable: EXCHANGE_RATE
 Method: ARDL
 Date: 04/07/21 Time: 15:30
 Sample (adjusted): 1986 2018
 Included observations: 33 after adjustments
 Maximum dependent lags: 4 (Automatic selection)
 Model selection method: Akaike info criterion (AIC)
 Dynamic regressors (4 lags, automatic): GDP INFLATION
 SHARE_PRICE FDI_FLOWS
 Fixed regressors: C
 Number of models evaluated: 2500
 Selected Model: ARDL(1, 3, 2, 1, 2)
 Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
EXCHANGE_RATE(-1)	1.062099	0.044354	23.94620	0.0000
GDP	-0.020384	0.186870	-0.109083	0.9143
GDP(-1)	-0.167655	0.177440	-0.944855	0.3566
GDP(-2)	-0.029758	0.185265	-0.160622	0.8741
GDP(-3)	0.554849	0.194025	2.859675	0.0100
INFLATION	0.286412	0.157792	1.815130	0.0853
INFLATION(-1)	0.007425	0.134498	0.055208	0.9565
INFLATION(-2)	0.303142	0.135437	2.238245	0.0374
SHARE_PRICE	-0.162511	0.050664	-3.207804	0.0046
SHARE_PRICE(-1)	0.195945	0.056645	3.459154	0.0026
FDI_FLOWS	-0.691325	0.740166	-0.934013	0.3620
FDI_FLOWS(-1)	-1.987439	0.924867	-2.148891	0.0447
FDI_FLOWS(-2)	1.094524	0.725235	1.509199	0.1477
C	-8.229839	3.263119	-1.909106	0.0715

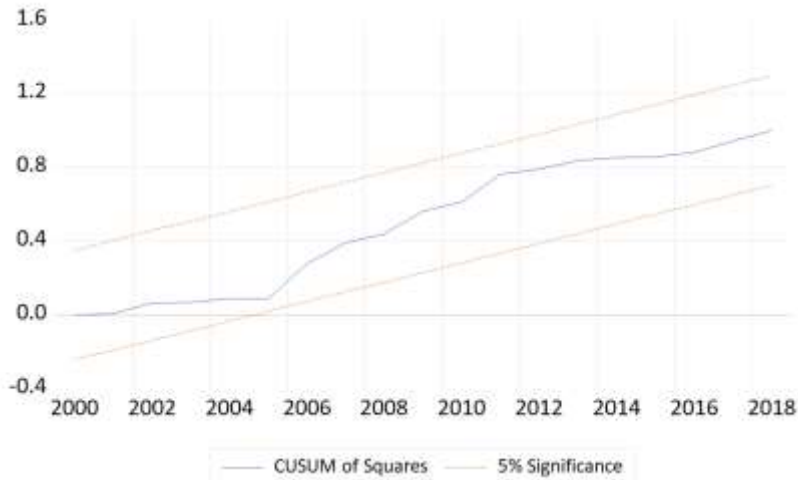
R-squared	0.994534	Mean dependent var	41.14720
Adjusted R-squared	0.990793	S.D. dependent var	15.92025
S.E. of regression	1.527504	Akaike info criterion	3.981642
Sum squared resid	44.33558	Schwarz criterion	4.616524
Log likelihood	-51.69709	Hannan-Quinn criter	4.195260
F-statistic	265.9052	Durbin-Watson stat	2.378579
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model

Appendix 2: CUSUM TEST



Appendix 3: CUSUM Square test



Appendix 4: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.516326	Prob. F(2,17)	0.2478
Obs*R-squared	4.995719	Prob. Chi-Square(2)	0.0823

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 04/07/21 Time: 15:31
Sample: 1986 2018
Included observations: 33
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE(-1)	0.015209	0.044821	0.339329	0.7385
GDP	-0.066844	0.212927	-0.313928	0.7574
GDP(-1)	0.073099	0.186548	0.391850	0.7000
GDP(-2)	-0.005233	0.182698	-0.028644	0.9775
GDP(-3)	-0.055946	0.197611	-0.283111	0.7805
INFLATION	0.057177	0.162797	0.351215	0.7297
INFLATION(-1)	0.016520	0.132756	0.124439	0.9024
INFLATION(-2)	-0.006439	0.144602	-0.044532	0.9650
SHARE_PRICE	0.029646	0.053879	0.550223	0.5893
SHARE_PRICE(-1)	-0.036627	0.061935	-0.591374	0.5621
FDI_FLOWS	0.284313	0.756530	0.375813	0.7117
FDI_FLOWS(-1)	-0.148429	0.908495	-0.163379	0.8721
FDI_FLOWS(-2)	-0.114321	0.714726	-0.159951	0.8748
C	-0.704785	3.239978	-0.217528	0.8304
RESID(-1)	-0.414570	0.276243	-1.500744	0.1518
RESID(-2)	-0.310445	0.314700	-0.986480	0.3377

R-squared	0.151385	Mean dependent var	6.51E-15
Adjusted R-squared	-0.597392	S.D. dependent var	1.177067
S.E. of regression	1.487671	Akaike info criterion	3.938704
Sum squared resid	37.62382	Schwarz criterion	4.664283
Log likelihood	-48.98861	Hannan-Quinn criter.	4.182839
F-statistic	0.202177	Durbin-Watson stat	1.951662
Prob(F-statistic)	0.998380		

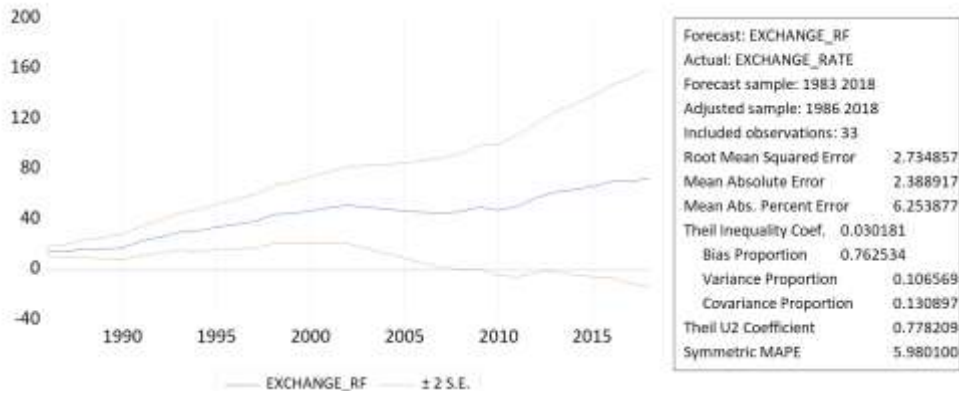
Appendix 5: Breusch-Pagan-Godfrey Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
Null hypothesis: Homoskedasticity				
F-statistic	2.140151	Prob. F(13,19)	0.0641	
Obs*R-squared	19.60685	Prob. Chi-Square(13)	0.1054	
Scaled explained SS	6.996002	Prob. Chi-Square(13)	0.9024	
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 04/07/21 Time: 15:31				
Sample: 1986 2018				
Included observations: 33				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.132462	3.534910	0.320365	0.7522
EXCHANGE_RATE(-1)	-0.110729	0.048048	-2.304529	0.0326
GDP	0.098679	0.202434	0.487460	0.6315
GDP(-1)	0.493957	0.192219	2.569762	0.0188
GDP(-2)	-0.036127	0.200696	-0.180011	0.8591
GDP(-3)	0.231913	0.210186	1.103372	0.2836
INFLATION	-0.082882	0.170934	-0.484875	0.6333
INFLATION(-1)	0.003445	0.145701	0.023646	0.9814
INFLATION(-2)	-0.147083	0.146718	-1.002486	0.3287
SHARE_PRICE	0.094579	0.054884	1.723240	0.1011
SHARE_PRICE(-1)	-0.085398	0.081363	-1.391680	0.1801
FDI_FLOWS	2.021861	0.801815	2.521604	0.0208
FDI_FLOWS(-1)	-2.096712	1.001901	-2.092734	0.0500
FDI_FLOWS(-2)	0.802864	0.785641	1.021923	0.3197
R-squared	0.594208	Mean dependent var	1.343503	
Adjusted R-squared	0.316560	S.D. dependent var	2.001680	
S.E. of regression	1.654798	Akaike info criterion	4.141651	
Sum squared resid	52.02875	Schwarz criterion	4.776533	
Log likelihood	-54.33724	Hannan-Quinn criter.	4.355269	
F-statistic	2.140151	Durbin-Watson stat	2.430941	
Prob(F-statistic)	0.064122			

Appendix 6: Error Correction Regression

ARDL Error Correction Regression				
Dependent Variable: D(EXCHANGE_RATE)				
Selected Model: ARDL(1, 3, 2, 1, 2)				
Case 2: Restricted Constant and No Trend				
Date: 04/07/21 Time: 15:33				
Sample: 1983 2018				
Included observations: 33				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP)	-0.020384	0.111999	-0.182004	0.8575
D(GDP(-1))	-0.525092	0.141754	-3.704249	0.0015
D(GDP(-2))	-0.554849	0.115220	-4.815576	0.0001
D(INFLATION)	0.286412	0.114436	2.502824	0.0216
D(INFLATION(-1))	-0.303142	0.101766	-2.978813	0.0077
D(SHARE_PRICE)	-0.162511	0.038062	-4.269596	0.0004
D(FDI_FLOWS)	-0.691325	0.558471	-1.237989	0.2308
D(FDI_FLOWS(-1))	-1.094524	0.598477	-1.828847	0.0832
CoIntEq(-1)*	0.062099	0.006359	9.765281	0.0000
R-squared	0.772415	Mean dependent var	1.697597	
Adjusted R-squared	0.696553	S.D. dependent var	2.467341	
S.E. of regression	1.359160	Akaike info criterion	3.678612	
Sum squared resid	44.33558	Schwarz criterion	4.086750	
Log likelihood	-51.89709	Hannan-Quinn criter.	3.815938	
Durbin-Watson stat	2.378579			
* p-value incompatible with t-Bounds distribution.				
F-Bounds Test				
Null Hypothesis: No levels relationship				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	12.58232	10%	2.2	3.09
k	4	5%	2.56	3.48
		2.5%	2.88	3.87
		1%	3.20	4.27

Appendix 7: RMSE Value



Appendix 8: Multicollinearity Test

Variance Inflation Factors
 Date: 04/07/21 Time: 15:52
 Sample: 1983 2018
 Included observations: 33

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
EXCHANGE_RATE(-1)	0.001967	50.12702	6.830044
GDP	0.034920	21.27621	1.796484
GDP(-1)	0.031485	19.05028	1.633301
GDP(-2)	0.034323	20.25252	1.853848
GDP(-3)	0.037646	21.97048	1.982413
INFLATION	0.024898	23.44060	3.175096
INFLATION(-1)	0.018090	17.08691	2.281096
INFLATION(-2)	0.018343	17.82167	2.103160
SHARE_PRICE	0.002567	97.30035	47.72259
SHARE_PRICE(-1)	0.003209	98.59673	48.94047
FDI_FLOWS	0.547845	14.00911	6.067048
FDI_FLOWS(-1)	0.855379	21.04112	9.727447
FDI_FLOWS(-2)	0.525966	12.09200	5.953241
C	10.64795	150.5847	NA

