



FINAL YEAR PROJECT

On

***AN EMPIRICAL EVIDENCE OF
INTERNATIONAL FISHER EFFECT BETWEEN
INDIA AND USA, CHINA, USING REGRESSION
ANALYSIS***

Course – MBA – 4th Semester

Submitted By - Arindam Chatterjee

University Roll No. –

University Registration No. -

Supervisor's Certificate

This is to certify that Mr. Arindam Chatterjee, a student of M.B.A. in Finance from the Indian Institute of Social Welfare and Business Management (IISWBM) under the University of Calcutta has worked under my supervision and guidance for his project work and prepared a project report with the title “ **AN EMPIRICAL EVIDENCE OF INTERNATIONAL FISHER EFFECT BETWEEN INDIA AND USA, CHINA, USING REGRESSION ANALYSIS** ”. This is his genuine and original work to the best of my knowledge.

Place: Kolkata

SIGNATURE:

Date: 03.05.2021

NAME: Prof. SOUMITRA KUMAR MALLICK

DESIGNATION: SIR ASHUTOSH MUKHERJEE
CHAIR PROFESSOR

NAME OF THE COLLEGE: I.I.S.W.B.M.

STUDENT'S DECLARATION

I hereby declare that this project work, titled title “ *AN EMPIRICAL EVIDENCE OF INTERNATIONAL FISHER EFFECT BETWEEN INDIA AND USA, CHINA, USING REGRESSION ANALYSIS* ” and submitted by me for the partial fulfillment of the degree of M.B.A. in Finance from the Indian Institute of Social Welfare and Business Management, under the University of Calcutta is my original work and the same has not been submitted earlier to any other University/ Institution for the fulfillment of the requirement of any course/ study.

I also declare that no chapter of this manuscript in whole or in part has been incorporated here in this report from any earlier work, done by others or by me. However extracts of any literature which has been used for this report has been duly acknowledged providing details of such literature in the references.

Place: Kolkata

SIGNATURE:

Date: 03.05.2021

NAME: ARINDAM CHATTERJEE

ADDRESS:

REGISTRATION NO.-

NAME OF THE INSTITUTION: I.I.S.W.B.M.

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Arindam Chatterjee
Student of MBA 2019-'21
Indian Institute of Social Welfare and Business Management (I.I.S.W.B.M.)

Place: Kolkata

Date: 03.05.2021

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1. ABSTRACT

This paper is an attempt to examine the empirical evidence of International Fisher Effect (IFE) between India and its two other major trading partners, China and USA. Interest Rate Differentials are used in IFE to explain why exchange rates change over time. Here Regression Analysis approach is considered to trace the relationship between nominal interest rates and exchange rates in these countries. The estimated value of R Squared, obtained by applying the Regression Analysis in the Minitab Statistical Software © from the data points collected and/ or calculated using the Microsoft Excel ©, is used to determine the relationship between interest rates and exchange rates for yearly data from 1981 to 2019 and separately from 2001 to 2019, to check whether the exchange rates can be explained more by applying the International Fisher Effect as the world has now become a global village due to Globalization and the concept Free Market with lesser intervention of the Central Banks on the exchange rates. The empirical results suggest that the International Fisher Effect (IFE) can be explained more by using the data points in the years 2001 to 2019 than 1981 to 2019. Later it can be seen from the analysis of weekly data of exchange rates of the years (2018,2019) that the exchanges rates can be explained by the Nominal Interest Rate Differential to a minimum extent, thereby proving the limitation of International Fisher Effect that it makes efficient predictions in the long term only than in the short/ near term. Further, the trends advocate that the forecasting of exchange rates with the hypothesis of IFE is more valid between India and USA, than between Indian and China.

Key Words:- Foreign Exchange(F31), International Finance Forecasting and Simulation: Models and Applications (F37), Mathematical and Quantitative Methods (C00), Exchange Rate, Interest Rate, Inflation, Interest Rate Differential, International Fisher Effect (IFE), Fisher Effect

2. PREFACE

Foreign Trade is one of the most significant indicator of economic development of a country. The Foreign Trade of a country consists of Inward and Outward movement of goods and services, which result in outflow and inflow of foreign exchange from home country to foreign country, thereby affecting the foreign exchange reserves of the home country. International Trade is an effective instrument of economic growth, employment generation and poverty alleviation for a country.

The Indian economy is characterized as an developing market economy. It's the world's 5th largest economy by nominal GDP and 3rd largest by purchasing power parity (PPP). Since the liberalization in 1991, the Indian economy has been more market oriented with the expansion of private and foreign investments. The composition of exports has undergone several significant changes in the post-reforms period. Trade volumes has risen and the inflow of foreign currency and outflow of Indian Rupee (INR) has increased considerably over the years. The Indian economy has been greatly benefitted by the effect of liberalization.

International Fisher Effect (IFE) is one of the oldest exchange-rate models. IFE is used in the financial sector to determine the future direction of financial markets. Here in this paper we shall examine the movement of exchange rates of Indian Rupee, w.r.t. US Dollar and Chinese Yuan in different time periods and thereby testing the relevance of the International Fisher Effect.

3. ***INTRODUCTION***

- ***Background of the International Fisher Effect:-***

The **International Fisher Effect**, also known as the **IFE**, is a popular and dominant hypothesis in the field of finance. It came into existence courtesy of Irving Fisher, an eminent economist of the 1900s. He created the theory in the early 1930s. Economist Irving Fisher also brought two other theories that relate to the IFE. These are the Fisher Index and the Quantity Theory of Money. These theories collectively state that the levels of prices in an economy are directly proportional to the rate of inflation and the money supply.

The two latter theories has contributed to the working of International Fisher Effect. These theories help it in making future predictions by explaining how exchange rates between different countries with floating exchange rates are expected to change.

4. UNDERSTANDING THE INTERNATIONAL FISHER EFFECT

The **IFE** is defined as an economic concept which states that the anticipated disparity between the exchange rate of one currency and another is somehow equal to the difference between the nominal interest rates of those countries, i.e. the difference between the nominal interest rates of any two countries is equal and proportional to the changes in their exchange rates at any given time.

The theory is derived from the concept that real interest rates are independent of other monetary variables, such as changes in the monetary policy of a particular nation, and the real interest rates provide a better indication of the health of a particular currency within the global market. It implies that a country with lower interest rates, is likely to experience lower inflation levels. This effectively leads to an increase in value of the currency when compared to other economies with higher interest rates. In a nutshell, a country with high interest rates is likely to witness the depreciation of its currency.

The concept of IFE is unique because unlike other economic indicators, it analyzes both interest and inflation rates to predict the future movement of a currency. Present and future investments which are considered risk-free (eg. Treasuries) is also considered by IFE. The other theories are mostly based on inflation rates only.

According to Irving Fisher, inflation has no significant effect on real interest rates because real interest rate is derived by subtracting inflation from nominal interest rate.

5. FISHER EFFECT AND INTERNATIONAL FISHER EFFECT

The Fisher Effect and the International Fisher Effect are related models but are not interchangeable. The Fisher effect describes the relationship between the interest rate and the rate of inflation. According to Fisher Effect the combination of anticipated rate of inflation and real rate of return are represented in the nominal rate of interest. It proposes that the nominal interest rate in a country is equal to the sum of real interest rate and inflation rate, i.e. real interest rate is equal to the difference between nominal interest rate and the rate of inflation. The IFE expands on the Fisher Effect, suggesting that nominal interest rates reflect anticipated inflation rates and currency exchange rate changes are driven by inflation rates. Therefore the changes in the value of the currency are proportional to the difference between the two nations' nominal interest rates.

Therefore, any increase in the rate of inflation will result in a proportional increase in the nominal interest rate, where the real interest rate is constant. Let us take an example. Let's assume that the real interest rate is 5.5% and the rate of inflation changes from 2.5% to 3.5%. The nominal interest rate is calculated as follows:

$$(1 + \text{Nominal Interest Rate}) = (1 + \text{Real Interest Rate}) (1 + \text{Rate of Inflation})$$

$$\text{Thus, Nominal Interest Rate} = [(1 + \text{Real Interest Rate}) (1 + \text{Rate of Inflation})] - 1$$

$$= [(1 + 0.055) (1 + 0.025)] - 1$$

$$= [(1.055) (1.025)] - 1$$

$$= 0.081 \text{ or } \mathbf{8.1\%}$$

$$\text{Again, Nominal Interest Rate} = [(1.055) (1.035)] - 1$$

$$= 0.092 \text{ or } \mathbf{9.2\%}$$

Therefore, the nominal interest rate would've increased from 8.1% to 9.2%, when the inflation rate changed from 2.5% to 3.5%.

The International Fisher Effect (IFE) does expand on the Fisher Effect theory. IFE suggests that the estimated appreciation or depreciation of the currencies of two countries is proportional to the difference in the nominal interest rates of the two countries. For example, if the nominal interest rate of USA is greater than that of the United Kingdom, the value of USD should fall by the interest rate differential.

6. HOW TO CALCULATE THE INTERNATIONAL FISHER EFFECT

The formula for calculating the IFE is –

$$E = [(I_1 - I_2) / (1 + I_2)] \cdot (I_1 - i_2)$$

Where:

E = Percentage (%) change in exchange rate of the country's currency

I₁ = Country's A's Interest rate

I₂ = Country's B's Interest rate

Now let us take an example.

Let us take the example of two currencies, the USD (the United States) and the CAD (the Canadian Dollar). The USD/CAD spot exchange rate is 1.30, and the interest rate of the United States is 5.0% while that of Canada is 6.0%.

Based on the IFE assumption, the country with a higher interest rate, Canada in this case, will see a higher inflation rate and that country will witness a depreciation in the value of its currency. The future spot rate is calculated by taking the spot rate and multiplying it by the ratio of the foreign interest rate to the domestic interest rate, as shown below:

$$1.3 \times [1 + \{(0.06 - 0.05) / 1.05\}] = 1.312$$

Given the future spot rate, the International Fisher Effect assumes that the CAD currency will depreciate against the USD. 1 USD will exchange into 1.312 CAD, up from the original rate of 1.30. Here the investors will receive a lower interest rate on the USD currency, but on the other hand, they will gain from an increase in the value of the US currency.

For the IFE to work, several assumptions have to be made. Some of the assumptions include free flow of capital between countries, capital market integration, and the lack of control on the currency for trade purposes.

7. **COLLECTION OF DATA AND REGRESSION OUTPUT**

According to Fisher Effect, the nominal interest rates in any country must compensate for the anticipated inflation and desired returns. If real rates of returns are equalized across world, then interest rates must keep pace with inflation rates.

Now for the purpose explaining the International Fisher Effect w.r.t. India, I have considered two explaining economies of China and USA with two different time dimensions, one from 1981 to 2019 and another from 2001 to 2019. Later I have also collected weekly data w.r.t USD/ INR for only two years 2018, 2019 to check whether the International Fisher Effect is more relevant in the short term or in the long term.

The data has been collected for CNY/ INR, INR/ CNY and USD/ INR, INR/ USD for the years 1981 to 2019 and 2001 to 2019 respectively. For each instance Nominal Interest Rates have been worked out for the Home Country and the Foreign Country respectively by adopting the mathematical equation of the Fisher Effect. Then Nominal Interest Rate Differentials have been calculated for the Home Country and the Foreign Country alternatively.

The data in the form of Microsoft Excel © is fed to Minitab Statistical Software © in each instances to get the Regression output which has been explained in the ‘ Discussion ’ section later.

Year	Currency Value INR/ CNY	Currency Value CNY/ INR	Change In CNY/ INR over Previous Period	Change In INR/ CNY over Previous Period	Real Interest Rate, India (%)	Inflation Rate, India (%)	Nominal Interest Rate, India = $[(1 + \text{Real Interest Rate})(1 + \text{Inflation Rate})] - 1$	Real Interest Rate, China (%)	Inflation Rate, China (%)	Nominal Interest Rate, China = $[(1 + \text{Real Interest Rate})(1 + \text{Inflation Rate})] - 1$	Nominal Interest Rate Differential = (Nominal Intt. Home, India - Nominal Intt. Foreign, China) / (1 + Nominal Interest Foreign, China)	Nominal Interest Rate Differential = (Nominal Intt. Home, China - Nominal Intt. Foreign, India) / (1 + Nominal Interest Foreign, India)
1981	0.1889	5.2941	0.000	0.000	5.118	13.113	0.189	2.620	2.500	0.052	0.130	-0.115
1982	0.1915	5.2229	-0.013	0.014	7.775	7.891	0.163	7.351	2.000	0.095	0.062	-0.058
1983	0.1948	5.1347	-0.017	0.017	7.321	11.868	0.201	5.974	2.000	0.081	0.111	-0.100
1984	0.1849	5.407	0.053	-0.050	7.947	8.319	0.169	2.150	2.700	0.049	0.115	-0.103
1985	0.2210	4.525	-0.163	0.195	8.682	5.556	0.147	-2.077	9.300	0.070	0.072	-0.067
1986	0.2601	3.8442	-0.150	0.177	9.093	8.730	0.186	3.106	6.500	0.098	0.080	-0.074
1987	0.2860	3.496	-0.091	0.100	6.560	8.801	0.159	2.700	7.234	0.101	0.053	-0.050
1988	0.2852	3.5067	0.003	-0.003	7.639	9.383	0.177	-2.772	18.812	0.155	0.019	-0.019
1989	0.2457	4.0697	0.161	-0.138	7.436	7.074	0.150	2.521	18.246	0.212	-0.051	0.054
1990	0.2802	3.5687	-0.123	0.140	5.270	8.971	0.147	3.452	3.052	0.066	0.076	-0.071
1991	0.2809	3.5601	-0.002	0.002	3.625	13.870	0.180	1.804	3.557	0.054	0.119	-0.107
1992	0.2096	4.7708	0.340	-0.254	9.133	11.788	0.220	0.416	6.354	0.068	0.142	-0.125
1993	0.1839	5.438	0.140	-0.123	5.815	6.327	0.125	-3.651	14.610	0.104	0.019	-0.019
1994	0.2780	3.597	-0.339	0.512	4.337	10.248	0.150	-7.990	24.257	0.143	0.006	-0.006
1995	0.2696	3.7086	0.031	-0.030	5.864	10.225	0.167	-1.413	16.791	0.151	0.013	-0.013
1996	0.2288	4.3705	0.178	-0.151	7.793	8.977	0.175	3.355	8.313	0.119	0.049	-0.047
1997	0.2324	4.3037	-0.015	0.016	6.910	7.164	0.146	6.912	2.786	0.099	0.043	-0.041
1998	0.2150	4.651	0.081	-0.075	5.121	13.231	0.190	7.356	-0.773	0.065	0.117	-0.105
1999	0.1949	5.1316	0.103	-0.094	9.191	4.670	0.143	7.204	-1.401	0.057	0.081	-0.075
2000	0.1898	5.2687	0.027	-0.026	8.343	4.009	0.127	3.711	0.348	0.041	0.083	-0.076

2001	0.1785	5.6027	0.063	-0.060	8.591	3.779	0.127	3.727	0.719	0.045	0.079	-0.073
2002	0.1707	5.8587	0.046	-0.044	7.907	4.297	0.125	4.680	-0.732	0.039	0.083	-0.077
2003	0.1732	5.7729	-0.015	0.015	7.308	3.806	0.114	2.638	1.128	0.038	0.073	-0.068
2004	0.1829	5.4674	-0.053	0.056	4.910	3.767	0.089	-1.283	3.825	0.025	0.062	-0.059
2005	0.1897	5.2711	-0.036	0.037	4.855	4.246	0.093	1.613	1.776	0.034	0.057	-0.054
2006	0.1835	5.4482	0.034	-0.033	2.571	5.797	0.085	2.111	1.649	0.038	0.045	-0.044
2007	0.1764	5.6696	0.041	-0.039	5.682	6.373	0.124	-0.260	4.817	0.045	0.075	-0.070
2008	0.1828	5.4691	-0.035	0.037	3.772	8.349	0.124	-2.306	5.925	0.035	0.087	-0.080
2009	0.1399	7.147	0.307	-0.235	4.809	10.882	0.162	5.531	-0.728	0.048	0.109	-0.099
2010	0.1480	6.7564	-0.055	0.058	-1.984	11.989	0.098	-1.002	3.175	0.021	0.075	-0.069
2011	0.1443	6.9308	0.026	-0.025	1.318	8.858	0.103	-1.402	5.554	0.041	0.060	-0.056
2012	0.1275	7.8447	0.132	-0.116	2.474	9.312	0.120	3.585	2.620	0.063	0.054	-0.051
2013	0.1168	8.5641	0.092	-0.084	3.866	10.908	0.152	3.755	2.621	0.065	0.082	-0.076
2014	0.0967	10.34	0.207	-0.172	6.695	6.353	0.135	4.522	1.922	0.065	0.065	-0.061
2015	0.1008	9.9208	-0.041	0.042	7.556	5.872	0.139	4.353	1.437	0.059	0.076	-0.070
2016	0.0969	10.3191	0.040	-0.039	6.233	4.941	0.115	2.902	2.000	0.050	0.062	-0.059
2017	0.1020	9.8003	-0.050	0.053	5.522	2.491	0.082	0.113	1.593	0.017	0.063	-0.060
2018	0.0990	10.0961	0.030	-0.029	4.685	4.861	0.098	0.822	2.075	0.029	0.067	-0.062
2019	0.0945	10.5804	0.048	-0.046	6.369	7.660	0.145	3.024	2.899	0.060	0.080	-0.074

Regression Analysis: Change In CNY/ INR over Previous Period (From 1981 To 2019) versus Nominal Interest Rate Differential (Home Country – India, Foreign Country – China)

Regression Equation

Change In CNY/INR over Previous = -0.0187 + 0.636 Nominal Interest Rate Different Year

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-0.0187	0.0423	-0.44	0.661	
Nominal Interest Rate Different	0.636	0.544	1.17	0.250	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.121634	3.56%	0.96%	0.00%

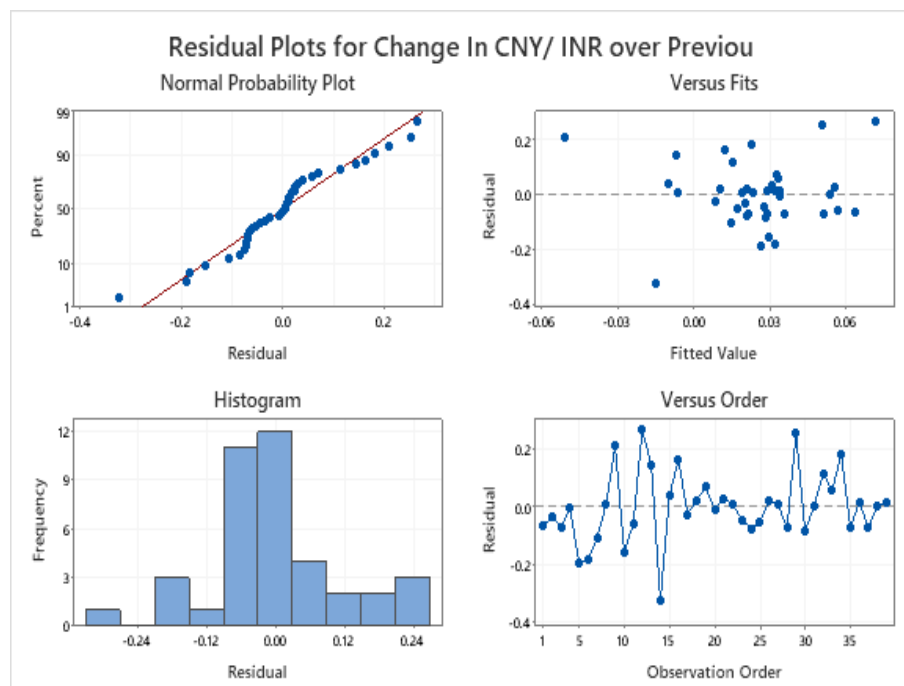
Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.02022	0.02022	1.37	0.250
Nominal Interest Rate Different	1	0.02022	0.02022	1.37	0.250
Error	37	0.54741	0.01479		
Total	38	0.56763			

Fits and Diagnostics for Unusual Observations

Change In
CNY/ INR
over
Previous

Obs	Year	Fit	Resid	Std Resid	
9	0.1606	-0.0512	0.2117	2.10	R X
12	0.3401	0.0718	0.2683	2.37	R
14	-0.3385	-0.0148	-0.3237	-2.81	R
29	0.3068	0.0508	0.2560	2.17	R



Regression Analysis: Change In INR/ CNY over Previous Period (From 1981 To 2019) versus Nominal Interest Rate Differential (Home Country – China, Foreign Country – India)

Regression Equation

Change In INR/ CNY Over Previous = 0.0376 + 0.752 Nominal Interest Rate Differe_1 Year

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.0376	0.0452	0.83	0.410	
Nominal Interest Rate Differe_1	0.752	0.634	1.19	0.243	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.128078	3.66%	1.06%	0.00%

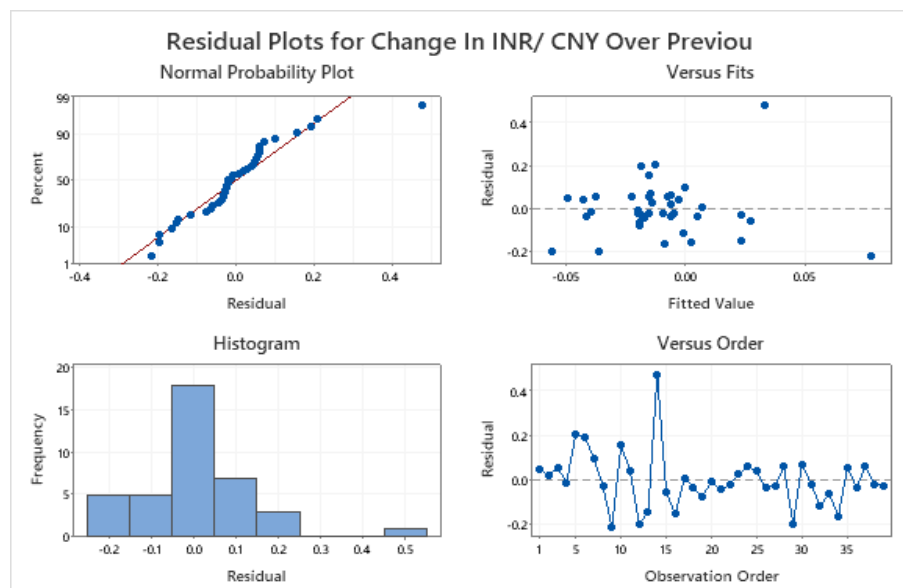
Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.02308	0.02308	1.41	0.243
Nominal Interest Rate Differe_1	1	0.02308	0.02308	1.41	0.243
Error	37	0.60694	0.01640		
Total	38	0.63002			

Fits and Diagnostics for Unusual Observations

Change In
INR/ CNY
Over
Previous

Obs	Year	Fit	Resid	Std Resid	
9	-0.1383	0.0781	-0.2164	-2.12	R X
14	0.5118	0.0331	0.4787	3.95	R



Year	Currency Value INR/ CNY	Currency Value CNY/ INR	%Change In CNY/INR over Previous Period	%Change In INR/CNY over Previous Period	Real Interest Rate, India (%)	Inflation Rate, India (%)	Nominal Interest Rate, India (%) = [(1+Real Interest Rate)(1+ Inflation Rate)]-1	Real Interest Rate, CHINA (%)	Inflation Rate, CHINA (%)	Nominal Interest Rate, CHINA (%) = [(1+Real Interest Rate)(1+ Inflation Rate)]-1	Nominal Interest Rate Differential = (Nominal Intt. Home, India - Nominal Intt. Foreign, China)/ (1 + Nominal Interest Foreign, China)	Nominal Interest Rate Differential = (Nominal Intt. Home, China - Nominal Intt. Foreign, India)/ (1 + Nominal Interest Foreign, India)
2001	0.1785	5.6027	0.0000	0.0000	8.591	3.779	0.127	3.727	0.719	0.045	0.079	-0.073
2002	0.1707	5.8587	0.046	-0.044	7.907	4.297	0.125	4.68	-0.732	0.039	0.083	-0.077
2003	0.1732	5.7729	-0.015	0.015	7.308	3.806	0.114	2.638	1.128	0.038	0.073	-0.068
2004	0.1829	5.4674	-0.053	0.056	4.91	3.767	0.089	-1.283	3.825	0.025	0.062	-0.059
2005	0.1794	5.5755	0.020	-0.019	4.855	4.246	0.093	1.613	1.776	0.034	0.057	-0.054
2006	0.1835	5.4482	-0.023	0.023	2.571	5.797	0.085	2.111	1.649	0.038	0.045	-0.044
2007	0.1764	5.6696	0.041	-0.039	5.682	6.373	0.124	-0.26	4.817	0.045	0.075	-0.070
2008	0.1828	5.4691	-0.035	0.037	3.772	8.349	0.124	-2.306	5.925	0.035	0.087	-0.080
2009	0.1399	7.147	0.307	-0.235	4.809	10.882	0.162	5.531	-0.728	0.048	0.109	-0.099
2010	0.1480	6.7564	-0.055	0.058	-1.984	11.989	0.098	-1.002	3.175	0.021	0.075	-0.069
2011	0.1443	6.9308	0.026	-0.025	1.318	8.858	0.103	-1.402	5.554	0.041	0.060	-0.056
2012	0.1275	7.8447	0.132	-0.116	2.474	9.312	0.120	3.585	2.62	0.063	0.054	-0.051
2013	0.1168	8.5641	0.092	-0.084	3.866	10.908	0.152	3.755	2.621	0.065	0.082	-0.076
2014	0.0967	10.34	0.207	-0.172	6.695	6.353	0.135	4.522	1.922	0.065	0.065	-0.061
2015	0.1008	9.9208	-0.041	0.042	7.556	5.872	0.139	4.353	1.437	0.059	0.076	-0.070
2016	0.0969	10.3191	0.040	-0.039	6.233	4.941	0.115	2.902	2	0.050	0.062	-0.059
2017	0.1020	9.8003	-0.050	0.053	5.522	2.491	0.082	0.113	1.593	0.017	0.063	-0.060
2018	0.0990	10.0961	0.030	-0.029	4.685	4.861	0.098	0.822	2.075	0.029	0.067	-0.062
2019	0.0945	10.5804	0.048	-0.046	6.369	7.66	0.145	3.024	2.899	0.060	0.080	-0.074

Regression Analysis: Change In CNY/ INR over Previous Period (From 2001 To 2019) versus Nominal Interest Rate Differential (Home Country – India, Foreign Country – China)

Regression Equation

%Change In CNY/ INR over Previous Year = -0.148 + 2.60 Nominal Interest Rate Different

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-0.148	0.105	-1.40	0.178	
Nominal Interest Rate Different	2.60	1.45	1.80	0.090	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0882294	15.95%	11.01%	0.00%

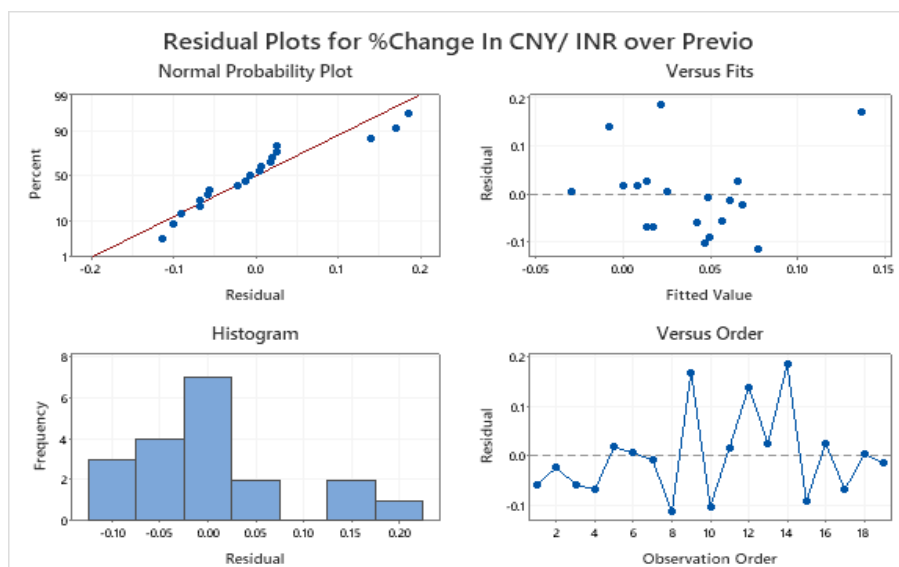
Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.02512	0.025116	3.23	0.090
Nominal Interest Rate Different	1	0.02512	0.025116	3.23	0.090
Error	17	0.13234	0.007784		
Total	18	0.15745			

Fits and Diagnostics for Unusual Observations

Obs	%Change In CNY/ INR over Previous Year	Fit	Resid	Std Resid	
9	0.3068	0.1366	0.1702	2.58	R X
14	0.2074	0.0219	0.1855	2.17	R

R Large residual
X Unusual X



Regression Analysis: Change In INR/ CNY over Previous Period (From 2001 To 2019) versus Nominal Interest Rate Differential (Home Country – China, Foreign Country – India)

Regression Equation

%Change In INR/ CNY over Previous Year = 0.1178 + 2.22 Nominal Interest Rate Differe_1

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.1178	0.0966	1.22	0.239	
Nominal Interest Rate Differe_1	2.22	1.43	1.55	0.139	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0754644	12.42%	7.26%	0.00%

Analysis of Variance

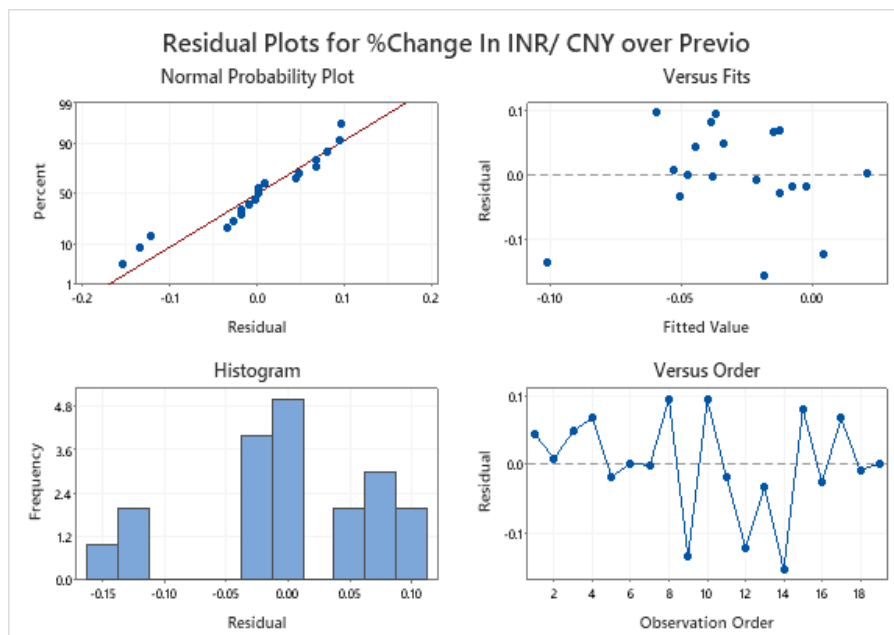
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.01373	0.013725	2.41	0.139
Nominal Interest Rate Differe_1	1	0.01373	0.013725	2.41	0.139
Error	17	0.09681	0.005695		
Total	18	0.11054			

Fits and Diagnostics for Unusual Observations

%Change In
INR/ CNY
over Previous

Obs	Year	Fit	Resid	Std Resid
9	-0.2348	-0.1012	-0.1336	-2.33 R X
14	-0.1718	-0.0182	-0.1536	-2.10 R

R Large residual
X Unusual X



Year	Currency Value INR/USD	Currency Value USD/ INR	Change In USD/INR Over Previous Period	Change In INR/USD Over Previous Period	Real Interest Rate, India (%)	Inflation Rate, India (%)	Nominal Interest Rate, India = [(1+Real Interest Rate)(1+Inf lation Rate)]-1	Real Interest Rate, USA (%)	Inflation Rate, USA (%)	Nominal Interest Rate, USA = [(1+Real Interest Rate)(1+I nflation Rate)]-1	Nominal Interest Rate Differential = (Nominal Intt. Home, India - Nominal Intt. Foreign, USA)/ (1 + Nominal Interest Foreign, USA)	Nominal Interest Rate Differential = (Nominal Intt. Home, USA - Nominal Intt. Foreign, India)/ (1 + Nominal Interest Foreign, India)
1981	0.1235	8.100	0.000	0.000	5.118	13.113	0.189	8.595	10.335	0.198	-0.008	0.008
1982	0.1094	9.140	0.128	-0.114	7.775	7.891	0.163	8.177	6.131	0.148	0.013	-0.013
1983	0.1009	9.910	0.084	-0.078	7.321	11.868	0.201	6.618	3.212	0.100	0.091	-0.083
1984	0.0929	10.760	0.086	-0.079	7.947	8.319	0.169	8.141	4.301	0.128	0.037	-0.035
1985	0.0789	12.670	0.178	-0.151	8.682	5.556	0.147	6.563	3.546	0.103	0.040	-0.038
1986	0.0810	12.340	-0.026	0.027	9.093	8.730	0.186	6.194	1.898	0.082	0.096	-0.088
1987	0.0767	13.040	0.057	-0.054	6.560	8.801	0.159	5.593	3.665	0.095	0.059	-0.056
1988	0.0765	13.080	0.003	-0.003	7.639	9.383	0.177	5.590	4.078	0.099	0.071	-0.067
1989	0.0659	15.180	0.161	-0.138	7.436	7.074	0.150	6.691	4.827	0.118	0.029	-0.028
1990	0.0592	16.880	0.112	-0.101	5.270	8.971	0.147	6.040	5.398	0.118	0.026	-0.026
1991	0.0536	18.655	0.105	-0.095	3.625	13.870	0.180	4.915	4.235	0.094	0.079	-0.073
1992	0.0385	26.001	0.394	-0.283	9.133	11.788	0.220	3.884	3.029	0.070	0.140	-0.123
1993	0.0319	31.377	0.207	-0.171	5.815	6.327	0.125	3.547	2.952	0.066	0.055	-0.052
1994	0.0319	31.366	0.000	0.000	4.337	10.248	0.150	4.898	2.607	0.076	0.069	-0.064
1995	0.0319	31.375	0.000	0.000	5.864	10.225	0.167	6.594	2.805	0.096	0.065	-0.061
1996	0.0274	36.450	0.162	-0.139	7.793	8.977	0.175	6.324	2.931	0.094	0.073	-0.068
1997	0.0279	35.850	-0.016	0.017	6.910	7.164	0.146	6.603	2.338	0.091	0.050	-0.048
1998	0.0259	38.650	0.078	-0.072	5.121	13.231	0.190	7.148	1.552	0.088	0.094	-0.086
1999	0.0235	42.490	0.099	-0.090	9.191	4.670	0.143	6.457	2.188	0.088	0.051	-0.048
2000	0.0229	43.625	0.027	-0.026	8.343	4.009	0.127	6.845	3.377	0.105	0.020	-0.020
2001	0.0216	46.390	0.063	-0.060	8.591	3.779	0.127	4.627	2.826	0.076	0.048	-0.045
2002	0.0206	48.510	0.046	-0.044	7.907	4.297	0.125	3.045	1.586	0.047	0.075	-0.070
2003	0.0209	47.800	-0.015	0.015	7.308	3.806	0.114	2.224	2.27	0.045	0.065	-0.061
2004	0.0221	45.270	-0.053	0.056	4.91	3.767	0.089	1.605	2.677	0.043	0.043	-0.042
2005	0.0229	43.645	-0.036	0.037	4.855	4.246	0.093	2.981	3.393	0.065	0.027	-0.026
2006	0.0228	43.925	0.006	-0.006	2.571	5.797	0.085	4.786	3.226	0.082	0.003	-0.003
2007	0.0227	44.080	0.004	-0.004	5.682	6.373	0.124	5.223	2.853	0.082	0.039	-0.037
2008	0.0255	39.280	-0.109	0.122	3.772	8.349	0.124	3.082	3.839	0.070	0.050	-0.048
2009	0.0205	48.850	0.244	-0.196	4.809	10.882	0.162	2.469	-0.356	0.021	0.138	-0.121
2010	0.0217	46.125	-0.056	0.059	-1.984	11.989	0.098	2.061	1.64	0.037	0.058	-0.055
2011	0.0218	45.800	-0.007	0.007	1.318	8.858	0.103	1.137	3.157	0.043	0.057	-0.054
2012	0.0202	49.500	0.081	-0.075	2.474	9.312	0.120	1.307	2.069	0.034	0.083	-0.077
2013	0.0188	53.260	0.076	-0.071	3.866	10.908	0.152	1.469	1.465	0.030	0.119	-0.106
2014	0.0160	62.680	0.177	-0.150	6.695	6.353	0.135	1.375	1.622	0.030	0.101	-0.092
2015	0.0161	62.010	-0.011	0.011	7.556	5.872	0.139	2.196	0.119	0.023	0.113	-0.101
2016	0.0147	67.868	0.094	-0.086	6.233	4.941	0.115	2.451	1.262	0.037	0.075	-0.069

2017	0.0148	67.490	-0.006	0.006	5.522	2.491	0.082	2.172	2.13	0.043	0.036	-0.035
2018	0.0157	63.540	-0.059	0.062	4.685	4.861	0.098	2.409	2.443	0.049	0.046	-0.044
2019	0.0141	70.950	0.117	-0.104	6.369	7.66	0.145	3.277	1.812	0.051	0.089	-0.082

Regression Analysis: Change In USD/ INR over Previous Period (From 1981 To 2019) versus Nominal Interest Rate Differential (Home Country – India, Foreign Country – USA)

Regression Equation

Change In USD/ INR Over Previous Year = -0.0122 + 1.188 Nominal Interest Rate Different

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-0.0122	0.0303	-0.40	0.689	
Nominal Interest Rate Different	1.188	0.430	2.76	0.009	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0903332	17.09%	14.84%	3.25%

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.06222	0.062215	7.62	0.009
Nominal Interest Rate Different	1	0.06222	0.062215	7.62	0.009
Error	37	0.30192	0.008160		
Total	38	0.36414			

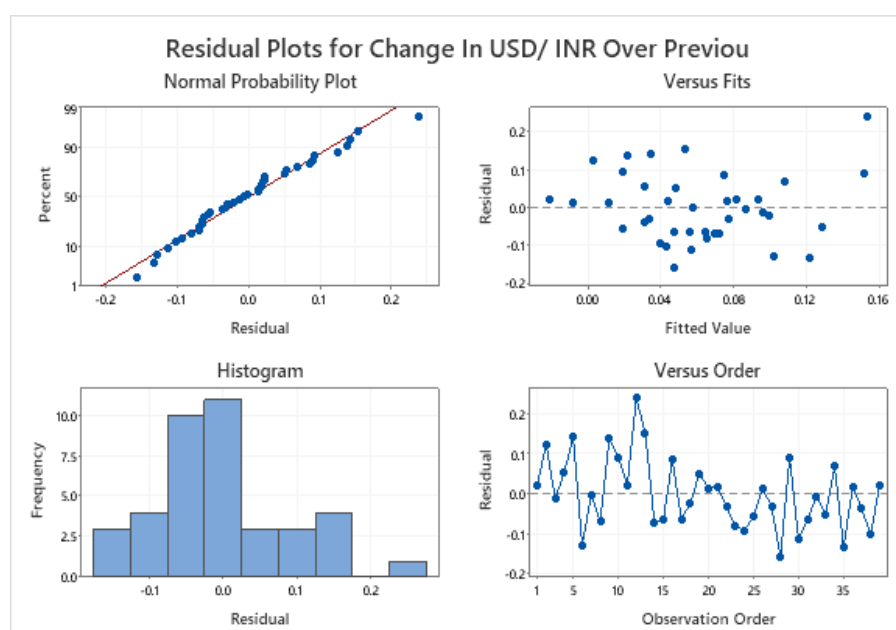
Fits and Diagnostics for Unusual Observations

Change In
USD/ INR
Over
Previous

Obs	Year	Fit	Resid	Std Resid	
12	0.3938	0.1539	0.2399	2.90	R X
29	0.2436	0.1519	0.0917	1.11	X

R Large residual

X Unusual X



Regression Analysis: Change In INR/ USD over Previous Period (From 1981 To 2019) versus Nominal Interest Rate Differential (Home Country – USA, Foreign Country – India)

Regression Equation

Change In INR/ USD Over Previous Year = 0.0075 + 1.010 Nominal Interest Rate Differe_1

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.0075	0.0270	0.28	0.783	
Nominal Interest Rate Differe_1	1.010	0.418	2.42	0.021	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0772720	13.64%	11.31%	1.94%

Analysis of Variance

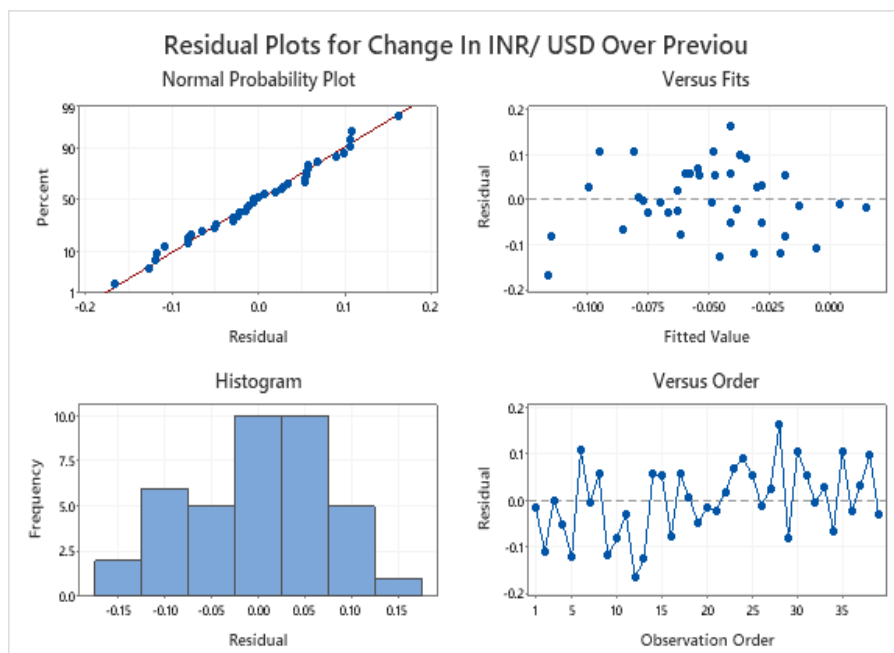
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.03490	0.034903	5.85	0.021
Nominal Interest Rate Differe_1	1	0.03490	0.034903	5.85	0.021
Error	37	0.22093	0.005971		
Total	38	0.25583			

Fits and Diagnostics for Unusual Observations

Change In
INR/ USD
Over
Previous
Year

Obs	Year	Fit	Resid	Std Resid
12	-0.2825	-0.1165	-0.1661	-2.33 R
28	0.1222	-0.0410	0.1632	2.14 R

R Large residual



Year	Currency Value INR/USD	Currency Value USD/INR	%Change In USD/INR over Previous Period	%Change In INR/USD over Previous Period	Real Interest Rate, India (%)	Inflation Rate, India (%)	Nominal Interest Rate, India (%) = [(1+Real Interest Rate)(1+ Inflation Rate)]-1	Real Interest Rate, USA (%)	Inflation Rate, USA (%)	Nominal Interest Rate, USA (%) = [(1+Real Interest Rate)(1+ Inflation Rate)]-1	Nominal Interest Rate Differential = (Nominal Intt. Home, India - Nominal Intt. Foreign, USA)/ (1 + Nominal Interest Foreign, USA)	Nominal Interest Rate Differential = (Nominal Intt. Home, USA - Nominal Intt. Foreign, India)/ (1 + Nominal Interest Foreign, India)
2001	0.0216	46.39	0	0	8.591	3.779	0.127	4.627	2.826	0.076	0.048	-0.045
2002	0.0206	48.51	0.046	-0.044	7.907	4.297	0.125	3.045	1.586	0.047	0.075	-0.070
2003	0.0209	47.8	-0.015	0.015	7.308	3.806	0.114	2.224	2.27	0.045	0.065	-0.061
2004	0.0221	45.27	-0.053	0.056	4.91	3.767	0.089	1.605	2.677	0.043	0.043	-0.042
2005	0.0229	43.645	-0.036	0.037	4.855	4.246	0.093	2.981	3.393	0.065	0.027	-0.026
2006	0.0228	43.925	0.006	-0.006	2.571	5.797	0.085	4.786	3.226	0.082	0.003	-0.003
2007	0.0227	44.08	0.004	-0.004	5.682	6.373	0.124	5.223	2.853	0.082	0.039	-0.037
2008	0.0255	39.28	-0.109	0.122	3.772	8.349	0.124	3.082	3.839	0.070	0.050	-0.048
2009	0.0205	48.85	0.244	-0.196	4.809	10.882	0.162	2.469	-0.356	0.021	0.138	-0.121
2010	0.0217	46.125	-0.056	0.059	-1.984	11.989	0.098	2.061	1.64	0.037	0.058	-0.055
2011	0.0218	45.8	-0.007	0.007	1.318	8.858	0.103	1.137	3.157	0.043	0.057	-0.054
2012	0.0202	49.5	0.081	-0.075	2.474	9.312	0.120	1.307	2.069	0.034	0.083	-0.077
2013	0.0188	53.26	0.076	-0.071	3.866	10.908	0.152	1.469	1.465	0.030	0.119	-0.106
2014	0.0160	62.68	0.177	-0.150	6.695	6.353	0.135	1.375	1.622	0.030	0.101	-0.092
2015	0.0161	62.01	-0.011	0.011	7.556	5.872	0.139	2.196	0.119	0.023	0.113	-0.101
2016	0.0147	67.868	0.094	-0.086	6.233	4.941	0.115	2.451	1.262	0.037	0.075	-0.069
2017	0.0148	67.49	-0.006	0.006	5.522	2.491	0.082	2.172	2.13	0.043	0.036	-0.035
2018	0.0157	63.54	-0.059	0.062	4.685	4.861	0.098	2.409	2.443	0.049	0.046	-0.044
2019	0.0141	70.95	0.117	-0.104	6.369	7.66	0.145	3.277	1.812	0.051	0.089	-0.082

Regression Analysis: Change In USD/ INR over Previous Period (From 2001 To 2019) versus Nominal Interest Rate Differential (Home Country – India, Foreign Country – USA)

Regression Equation

%Change In USD/ INR over Previous = -0.0936 + 1.794 Nominal Interest Rate Different
Year

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-0.0936	0.0328	-2.86	0.011	
Nominal Interest Rate Different	1.794	0.439	4.08	0.001	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0639517	49.49%	46.52%	29.53%

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.06813	0.068126	16.66	0.001
Nominal Interest Rate Different	1	0.06813	0.068126	16.66	0.001

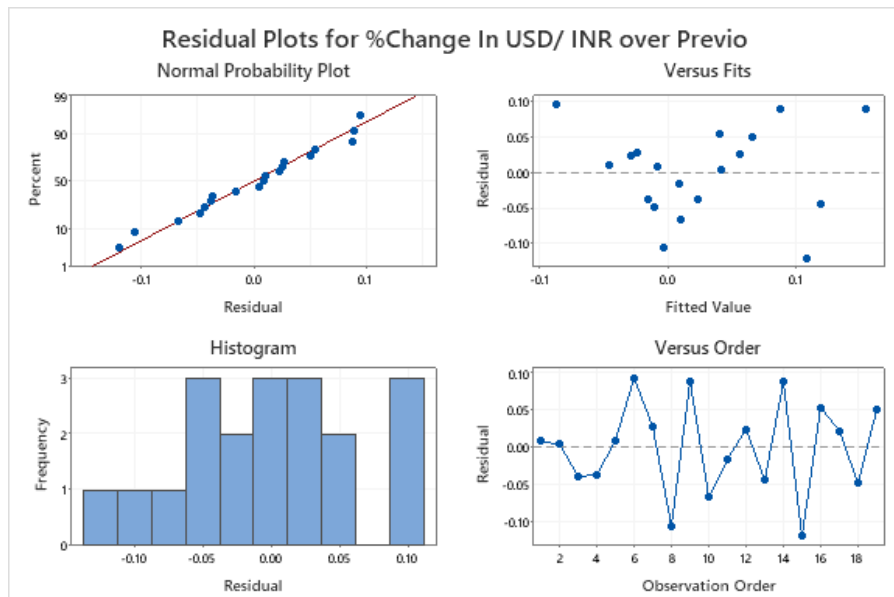
Error	17	0.06953	0.004090
Total	18	0.13765	

Fits and Diagnostics for Unusual Observations

%Change In
USD/ INR
over Previous

Obs	Year	Fit	Resid	Std Resid
15	-0.0107	0.1089	-0.1196	-2.03 R

R Large residual



Regression Analysis: Change In INR/ USD over Previous Period (From 2001 To 2019) versus Nominal Interest Rate Differential (Home Country – USA, Foreign Country – India)

Regression Equation

%Change In INR/ USD over Previous = 0.0907 + 1.780 Nominal Interest Rate Differe_1
Year

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.0907	0.0322	2.81	0.012	
Nominal Interest Rate Differe_1	1.780	0.473	3.76	0.002	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0600215	45.42%	42.21%	25.86%

Analysis of Variance

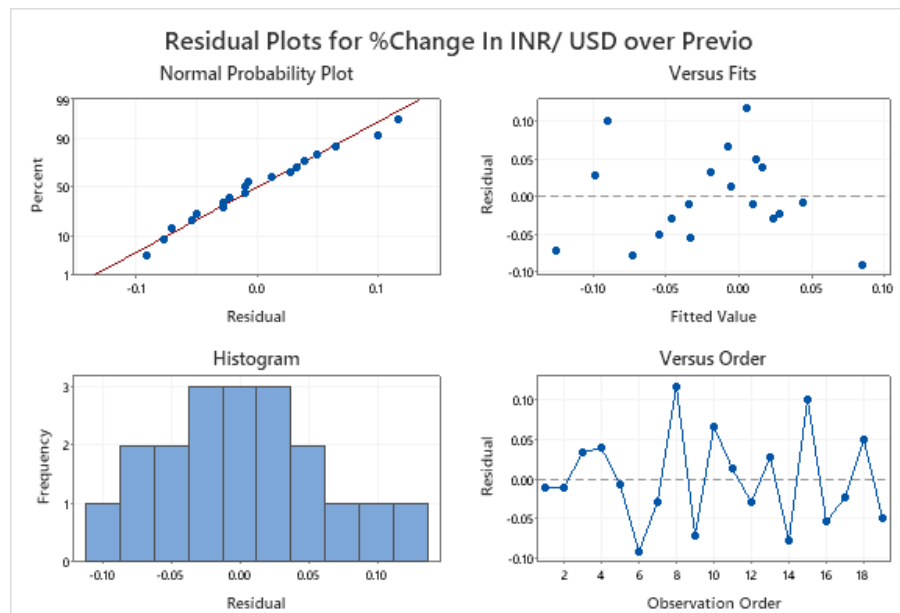
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.05097	0.050972	14.15	0.002
Nominal Interest Rate Differe_1	1	0.05097	0.050972	14.15	0.002
Error	17	0.06124	0.003603		
Total	18	0.11222			

Fits and Diagnostics for Unusual Observations

%Change
In INR/
USD over
Previous

Obs	Year	Fit	Resid	Std Resid
8	0.1222	0.0052	0.1170	2.01 R

R Large residual



As written earlier, to check whether the International Fisher Effect is more relevant in the short term or in the long term, I have collected weekly USD/ INR data for the years 2018-2019. The same is appended below -

Time Period (Weeks)	Currency Value INR/USD	Currency Value USD/INR	Change In USD/INR over Previous Period	Change In INR/USD over Previous Period	Real Interest Rate, India (%)	Inflation Rate, India (%)	Nominal Interest Rate, India (%) = $[(1 + \text{Real Interest Rate})(1 + \text{Inflation Rate})] - 1$	Real Interest Rate, USA (%)	Inflation Rate, USA (%)	Nominal Interest Rate, USA (%) = $[(1 + \text{Real Interest Rate})(1 + \text{Inflation Rate})] - 1$	Nominal Interest Rate Differential = (Nominal Intt. Home, India - Nominal Intt. Foreign, USA) / (1 + Nominal Interest Foreign, USA)	Nominal Interest Rate Differential = (Nominal Intt. Home, USA - Nominal Intt. Foreign, India) / (1 + Nominal Interest Foreign, India)
Jan 07, 2018	0.0157	63.61	0.004	-0.004	4.685	5.11	0.100	2.409	2.07	0.045	0.053	-0.050
Jan 14, 2018	0.0157	63.83	0.003	-0.003	4.685	5.11	0.100	2.409	2.07	0.045	0.053	-0.050
Jan 21, 2018	0.0157	63.59	-0.004	0.004	4.685	5.11	0.100	2.409	2.07	0.045	0.053	-0.050
Jan 28, 2018	0.0156	64.13	0.008	-0.008	4.685	5.11	0.100	2.409	2.07	0.045	0.053	-0.050
Feb 04, 2018	0.0155	64.375	0.004	-0.004	4.685	4.74	0.096	2.409	2.21	0.047	0.048	-0.045
Feb 11, 2018	0.0156	64.215	-0.002	0.002	4.685	4.74	0.096	2.409	2.21	0.047	0.048	-0.045
Feb 18, 2018	0.0155	64.71	0.008	-0.008	4.685	4.74	0.096	2.409	2.21	0.047	0.048	-0.045
Feb 25, 2018	0.0153	65.22	0.008	-0.008	4.685	4.74	0.096	2.409	2.21	0.047	0.048	-0.045
Mar 04, 2018	0.0154	65.125	-0.001	0.001	4.685	4.36	0.092	2.409	2.36	0.048	0.042	-0.040
Mar 11, 2018	0.0154	64.99	-0.002	0.002	4.685	4.36	0.092	2.409	2.36	0.048	0.042	-0.040
Mar 18, 2018	0.0154	64.99	0.000	0.000	4.685	4.36	0.092	2.409	2.36	0.048	0.042	-0.040

Mar 25, 2018	0.0154	65.115	0.002	-0.002	4.685	4.36	0.092	2.409	2.36	0.048	0.042	-0.040
Apr 01, 2018	0.0154	64.93	-0.003	0.003	4.685	3.97	0.088	2.409	2.46	0.049	0.037	-0.036
Apr 08, 2018	0.0153	65.255	0.005	-0.005	4.685	3.97	0.088	2.409	2.46	0.049	0.037	-0.036
Apr 15, 2018	0.0151	66.21	0.015	-0.014	4.685	3.97	0.088	2.409	2.46	0.049	0.037	-0.036
Apr 22, 2018	0.0150	66.62	0.006	-0.006	4.685	3.97	0.088	2.409	2.46	0.049	0.037	-0.036
Apr 29, 2018	0.0150	66.82	0.003	-0.003	4.685	3.97	0.088	2.409	2.46	0.049	0.037	-0.036
May 06, 2018	0.0148	67.36	0.008	-0.008	4.685	3.96	0.088	2.409	2.8	0.053	0.034	-0.033
May 13, 2018	0.0147	67.99	0.009	-0.009	4.685	3.96	0.088	2.409	2.8	0.053	0.034	-0.033
May 20, 2018	0.0148	67.73	-0.004	0.004	4.685	3.96	0.088	2.409	2.8	0.053	0.034	-0.033
May 27, 2018	0.0149	66.995	-0.011	0.011	4.685	3.96	0.088	2.409	2.8	0.053	0.034	-0.033
Jun 03, 2018	0.0148	67.53	0.008	-0.008	4.685	3.93	0.088	2.409	2.87	0.053	0.033	-0.032
Jun 10, 2018	0.0147	68.06	0.008	-0.008	4.685	3.93	0.088	2.409	2.87	0.053	0.033	-0.032
Jun 17, 2018	0.0147	67.87	-0.003	0.003	4.685	3.93	0.088	2.409	2.87	0.053	0.033	-0.032
Jun 24, 2018	0.0146	68.46	0.009	-0.009	4.685	3.93	0.088	2.409	2.87	0.053	0.033	-0.032
Jul 01, 2018	0.0145	68.805	0.005	-0.005	4.685	5.61	0.106	2.409	2.95	0.054	0.049	-0.046
Jul 08, 2018	0.0146	68.5	-0.004	0.004	4.685	5.61	0.106	2.409	2.95	0.054	0.049	-0.046
Jul 15, 2018	0.0145	68.74	0.004	-0.003	4.685	5.61	0.106	2.409	2.95	0.054	0.049	-0.046
Jul 22, 2018	0.0146	68.605	-0.002	0.002	4.685	5.61	0.106	2.409	2.95	0.054	0.049	-0.046
Jul 29, 2018	0.0146	68.545	-0.001	0.001	4.685	5.61	0.106	2.409	2.95	0.054	0.049	-0.046
Aug 05, 2018	0.0145	68.89	0.005	-0.005	4.685	5.61	0.106	2.409	2.7	0.052	0.051	-0.049
Aug 12, 2018	0.0143	70.1	0.018	-0.017	4.685	5.61	0.106	2.409	2.7	0.052	0.051	-0.049
Aug 19, 2018	0.0143	69.97	-0.002	0.002	4.685	5.61	0.106	2.409	2.7	0.052	0.051	-0.049
Aug 26, 2018	0.0141	71.005	0.015	-0.015	4.685	5.61	0.106	2.409	2.7	0.052	0.051	-0.049
Sep 02, 2018	0.0139	71.79	0.011	-0.011	4.685	5.61	0.106	2.409	2.28	0.047	0.056	-0.053
Sep 09, 2018	0.0139	71.88	0.001	-0.001	4.685	5.61	0.106	2.409	2.28	0.047	0.056	-0.053
Sep 16, 2018	0.0138	72.24	0.005	-0.005	4.685	5.61	0.106	2.409	2.28	0.047	0.056	-0.053
Sep 23, 2018	0.0138	72.51	0.004	-0.004	4.685	5.61	0.106	2.409	2.28	0.047	0.056	-0.053
Sep 30, 2018	0.0136	73.77	0.017	-0.017	4.685	5.61	0.106	2.409	2.28	0.047	0.056	-0.053
Oct 07, 2018	0.0136	73.61	-0.002	0.002	4.685	5.23	0.102	2.409	2.52	0.050	0.049	-0.047
Oct 14, 2018	0.0136	73.375	-0.003	0.003	4.685	5.23	0.102	2.409	2.52	0.050	0.049	-0.047
Oct 21, 2018	0.0136	73.46	0.001	-0.001	4.685	5.23	0.102	2.409	2.52	0.050	0.049	-0.047
Oct 28, 2018	0.0138	72.44	-0.014	0.014	4.685	5.23	0.102	2.409	2.52	0.050	0.049	-0.047
Nov 04, 2018	0.0138	72.48	0.001	-0.001	4.685	4.86	0.098	2.409	2.18	0.046	0.049	-0.047
Nov 11, 2018	0.0139	71.98	-0.007	0.007	4.685	4.86	0.098	2.409	2.18	0.046	0.049	-0.047
Nov 18, 2018	0.0142	70.655	-0.018	0.019	4.685	4.86	0.098	2.409	2.18	0.046	0.049	-0.047
Nov 25, 2018	0.0144	69.65	-0.014	0.014	4.685	4.86	0.098	2.409	2.18	0.046	0.049	-0.047
Dec 02, 2018	0.0141	70.86	0.017	-0.017	4.685	5.24	0.102	2.409	1.91	0.044	0.056	-0.053

Dec 09, 2018	0.0139	71.92	0.015	-0.015	4.685	5.24	0.102	2.409	1.91	0.044	0.056	-0.053
Dec 16, 2018	0.0143	70.14	-0.025	0.025	4.685	5.24	0.102	2.409	1.91	0.044	0.056	-0.053
Dec 23, 2018	0.0143	69.933	-0.003	0.003	4.685	5.24	0.102	2.409	1.91	0.044	0.056	-0.053
Dec 30, 2018	0.0144	69.55	-0.005	0.006	4.685	5.24	0.102	2.409	1.91	0.044	0.056	-0.053
Jan 06, 2019	0.0142	70.399	0.012	-0.012	6.369	6.6	0.134	3.277	1.55	0.049	0.081	-0.075
Jan 13, 2019	0.0140	71.21	0.012	-0.011	6.369	6.6	0.134	3.277	1.55	0.049	0.081	-0.075
Jan 20, 2019	0.0141	70.9	-0.004	0.004	6.369	6.6	0.134	3.277	1.55	0.049	0.081	-0.075
Jan 27, 2019	0.0140	71.435	0.008	-0.007	6.369	6.6	0.134	3.277	1.55	0.049	0.081	-0.075
Feb 03, 2019	0.0140	71.175	-0.004	0.004	6.369	6.97	0.138	3.277	1.52	0.048	0.085	-0.079
Feb 10, 2019	0.0140	71.33	0.002	-0.002	6.369	6.97	0.138	3.277	1.52	0.048	0.085	-0.079
Feb 17, 2019	0.0141	71.035	-0.004	0.004	6.369	6.97	0.138	3.277	1.52	0.048	0.085	-0.079
Feb 24, 2019	0.0141	71	0.000	0.000	6.369	6.97	0.138	3.277	1.52	0.048	0.085	-0.079
Mar 03, 2019	0.0143	70.012	-0.014	0.014	6.369	7.67	0.145	3.277	1.86	0.052	0.089	-0.081
Mar 10, 2019	0.0145	68.963	-0.015	0.015	6.369	7.67	0.145	3.277	1.86	0.052	0.089	-0.081
Mar 17, 2019	0.0145	69.17	0.003	-0.003	6.369	7.67	0.145	3.277	1.86	0.052	0.089	-0.081
Mar 24, 2019	0.0145	69.185	0.000	0.000	6.369	7.67	0.145	3.277	1.86	0.052	0.089	-0.081
Mar 31, 2019	0.0145	69.17	0.000	0.000	6.369	7.67	0.145	3.277	1.86	0.052	0.089	-0.081
Apr 07, 2019	0.0145	69.19	0.000	0.000	6.369	8.33	0.152	3.277	2	0.053	0.094	-0.086
Apr 14, 2019	0.0144	69.407	0.003	-0.003	6.369	8.33	0.152	3.277	2	0.053	0.094	-0.086
Apr 21, 2019	0.0143	69.85	0.006	-0.006	6.369	8.33	0.152	3.277	2	0.053	0.094	-0.086
Apr 28, 2019	0.0145	69.095	-0.011	0.011	6.369	8.33	0.152	3.277	2	0.053	0.094	-0.086
May 05, 2019	0.0143	70.015	0.013	-0.013	6.369	8.65	0.156	3.277	1.79	0.051	0.099	-0.090
May 12, 2019	0.0142	70.28	0.004	-0.004	6.369	8.65	0.156	3.277	1.79	0.051	0.099	-0.090
May 19, 2019	0.0144	69.38	-0.013	0.013	6.369	8.65	0.156	3.277	1.79	0.051	0.099	-0.090
May 26, 2019	0.0144	69.58	0.003	-0.003	6.369	8.65	0.156	3.277	1.79	0.051	0.099	-0.090
Jun 02, 2019	0.0144	69.355	-0.003	0.003	6.369	8.59	0.155	3.277	1.65	0.050	0.100	-0.091
Jun 09, 2019	0.0143	69.833	0.007	-0.007	6.369	8.59	0.155	3.277	1.65	0.050	0.100	-0.091
Jun 16, 2019	0.0144	69.615	-0.003	0.003	6.369	8.59	0.155	3.277	1.65	0.050	0.100	-0.091
Jun 23, 2019	0.0145	68.95	-0.010	0.010	6.369	8.59	0.155	3.277	1.65	0.050	0.100	-0.091
Jun 30, 2019	0.0146	68.45	-0.007	0.007	6.369	8.59	0.155	3.277	1.65	0.050	0.100	-0.091
Jul 07, 2019	0.0146	68.56	0.002	-0.002	6.369	5.98	0.127	3.277	1.81	0.051	0.072	-0.067
Jul 14, 2019	0.0145	68.86	0.004	-0.004	6.369	5.98	0.127	3.277	1.81	0.051	0.072	-0.067
Jul 21, 2019	0.0145	68.88	0.000	0.000	6.369	5.98	0.127	3.277	1.81	0.051	0.072	-0.067
Jul 28, 2019	0.0143	69.7	0.012	-0.012	6.369	5.98	0.127	3.277	1.81	0.051	0.072	-0.067
Aug 04, 2019	0.0141	70.924	0.018	-0.017	6.369	6.31	0.131	3.277	1.75	0.051	0.076	-0.071
Aug 11, 2019	0.0141	71.155	0.003	-0.003	6.369	6.31	0.131	3.277	1.75	0.051	0.076	-0.071
Aug 18, 2019	0.0140	71.513	0.005	-0.005	6.369	6.31	0.131	3.277	1.75	0.051	0.076	-0.071

Aug 25, 2019	0.0140	71.453	-0.001	0.001	6.369	6.31	0.131	3.277	1.75	0.051	0.076	-0.071
Sep 01, 2019	0.0140	71.645	0.003	-0.003	6.369	6.98	0.138	3.277	1.71	0.050	0.083	-0.077
Sep 08, 2019	0.0141	70.985	-0.009	0.009	6.369	6.98	0.138	3.277	1.71	0.050	0.083	-0.077
Sep 15, 2019	0.0141	71.075	0.001	-0.001	6.369	6.98	0.138	3.277	1.71	0.050	0.083	-0.077
Sep 22, 2019	0.0142	70.509	-0.008	0.008	6.369	6.98	0.138	3.277	1.71	0.050	0.083	-0.077
Sep 29, 2019	0.0141	70.825	0.004	-0.004	6.369	6.98	0.138	3.277	1.71	0.050	0.083	-0.077
Oct 06, 2019	0.0141	70.924	0.001	-0.001	6.369	7.62	0.145	3.277	1.76	0.051	0.089	-0.082
Oct 13, 2019	0.0141	71.09	0.002	-0.002	6.369	7.62	0.145	3.277	1.76	0.051	0.089	-0.082
Oct 20, 2019	0.0141	70.82	-0.004	0.004	6.369	7.62	0.145	3.277	1.76	0.051	0.089	-0.082
Oct 27, 2019	0.0141	70.76	-0.001	0.001	6.369	7.62	0.145	3.277	1.76	0.051	0.089	-0.082
Nov 03, 2019	0.0140	71.36	0.008	-0.008	6.369	8.61	0.155	3.277	2.05	0.054	0.096	-0.088
Nov 10, 2019	0.0140	71.65	0.004	-0.004	6.369	8.61	0.155	3.277	2.05	0.054	0.096	-0.088
Nov 17, 2019	0.0139	71.792	0.002	-0.002	6.369	8.61	0.155	3.277	2.05	0.054	0.096	-0.088
Nov 24, 2019	0.0139	71.749	-0.001	0.001	6.369	8.61	0.155	3.277	2.05	0.054	0.096	-0.088
Dec 01, 2019	0.0140	71.283	-0.006	0.007	6.369	9.63	0.166	3.277	2.29	0.056	0.104	-0.094
Dec 08, 2019	0.0141	70.798	-0.007	0.007	6.369	9.63	0.166	3.277	2.29	0.056	0.104	-0.094
Dec 15, 2019	0.0141	71.06	0.004	-0.004	6.369	9.63	0.166	3.277	2.29	0.056	0.104	-0.094
Dec 22, 2019	0.0140	71.455	0.006	-0.006	6.369	9.63	0.166	3.277	2.29	0.056	0.104	-0.094
Dec 29, 2019	0.0139	71.77	0.004	-0.004	6.369	9.63	0.166	3.277	2.29	0.056	0.104	-0.094

Regression Analysis: Weekly Change In USD/ INR over Previous Period(2018-2019) versus Nominal Interest Rate Differential(Home Country – India, Foreign Country – USA)

Regression Equation

Change In USD/ INR over Previous Week = 0.00398 - 0.0403 Nominal Interest Rate Different

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.00398	0.00241	1.65	0.101	
Nominal Interest Rate Different	-0.0403	0.0335	-1.20	0.231	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0079105	1.40%	0.44%	0.00%

Analysis of Variance

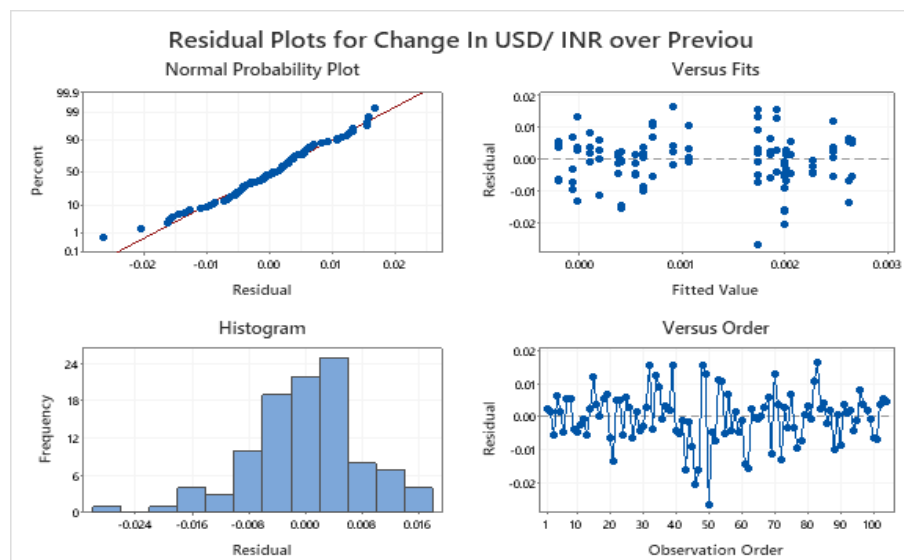
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.000091	0.000091	1.45	0.231
Nominal Interest Rate Different	1	0.000091	0.000091	1.45	0.231
Error	102	0.006383	0.000063		
Lack-of-Fit	22	0.001884	0.000086	1.52	0.090
Pure Error	80	0.004499	0.000056		
Total	103	0.006474			

Fits and Diagnostics for Unusual Observations

Change In
USD/ INR
over Previous

Obs	Week	Fit	Resid	Std Resid
43	-0.01389	0.00199	-0.01588	-2.02 R
46	-0.01841	0.00200	-0.02041	-2.60 R
47	-0.01422	0.00200	-0.01622	-2.07 R
50	-0.02475	0.00173	-0.02648	-3.37 R
83	0.01756	0.00091	0.01665	2.12 R

R Large residual



Regression Analysis: Weekly Change In INR/ USD over Previous Period(2018-2019) versus Nominal Interest Rate Differential(Home Country – USA, Foreign Country – India)

Regression Equation

Change In INR/ USD over Previous = -0.00403 - 0.0453 Nominal Interest Rate Differe_1
Week

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-0.00403	0.00254	-1.59	0.116	
Nominal Interest Rate Differe_1	-0.0453	0.0383	-1.18	0.239	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0079175	1.35%	0.39%	0.00%

Analysis of Variance

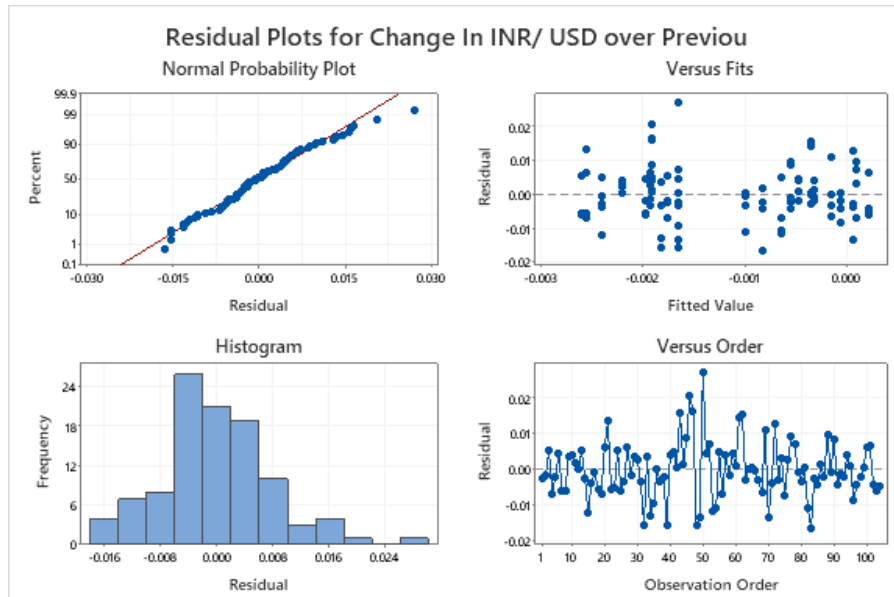
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.000088	0.000088	1.40	0.239
Nominal Interest Rate Differe_1	1	0.000088	0.000088	1.40	0.239
Error	102	0.006394	0.000063		
Lack-of-Fit	22	0.001887	0.000086	1.52	0.090
Pure Error	80	0.004507	0.000056		
Total	103	0.006482			

Fits and Diagnostics for Unusual Observations

Change In INR/ USD over Previous

Obs	Week	Fit	Resid	Std Resid
43	0.01408	-0.00191	0.01599	2.04 R
46	0.01875	-0.00192	0.02067	2.63 R
47	0.01443	-0.00192	0.01635	2.08 R
50	0.02538	-0.00165	0.02702	3.43 R
83	-0.01726	-0.00083	-0.01643	-2.09 R

R Large residual



8. RESULTS AND DISCUSSIONS

In statistical modeling, **regression analysis** is defined as a statistical process for estimating the relationship between a dependent/ outcome variable and one or more independent/ predictor variables. Linear Regression is the most common form of regression analysis. Here we find the line (or a more complex linear combination) that most closely fits the data according to a specific mathematical criterion.

After the construction of the regression model, it is important to confirm the goodness of fit of the model and to find the statistical significance of the estimated parameters. Commonly used checks of goodness of fit include the R-squared which has been used along with the p-value to check whether the regression model is significant.

Again R-squared is a statistical measure of how closely the data is fitted to the regression line. The measure, R-squared is also known as the coefficient of determination. R-Squared is defined as the percentage of the response variable variation that is explained by a linear model, i.e. $R\text{-squared} = (\text{Explained variation} / \text{Total variation})$. R-squared is always between 0 and 100%, where 0% indicates that the model explains none of the variability of the response data around its mean. And 100% indicates that the model explains all the variability of the response data around its mean. Thus the higher the value of R-squared, the better the model of regression.

Following are three tables showing the value of R-Squared when the Indian Rupee (INR) has been considered as the Home Currency and also the Foreign Currency against the Chinese Yuan(CNY) and the US Dollar(USD) respectively for two yearly time periods of 1981 to 2019 (**Table-I**) and 2001 to 2019 (**Table-II**) and also for weekly forex data values collected for the years 2018,2019 for the same currencies(**Table-III**).

Years Considered - 1981-2019			
Value of R-Squared			
Home Country	Foreign Country		
	India	China	USA
India	***	3.56	17.09
China	3.66	***	***
USA	13.64	***	***

Tabel -I

Years Considered - 2001-2019			
Value of R-Squared			
Home Country	Foreign Country		
	India	China	USA
India	***	15.95	49.49
China	12.42	***	***
USA	45.42	***	***

Tabel -II

Collection of Weekly Data From Jan.,'18 To Dec.,'19		
Value of R-Squared		
Home Country	Foreign Country	
	India	USA
India	***	1.4
USA	1.35	***

Tabel –III

Here for all the tests during all time periods, the Null Hypothesis and the Alternate Hypothesis are –

$H_0 : a = x$

AND

$H_a : a \neq x;$

Where a = Percentage change in Foreign Currency w.r.t. Domestic Currency and
 x = Nominal Interest Rate Differential

Thus if the Null Hypothesis is accepted, the International Fisher Effect holds. Again if the Null Hypothesis is rejected and Alternative Hypothesis if accepted, the International Fisher Effect does not hold.

The R-squared value for India with USA turned out to be greater than India with China for both the time periods considered, i.e. 1981-2019 and 2001-2019. For 1981-2019, the R-Squared values were **17.09, 13.64** considering Indian Rupee, INR and United States Dollar, USD as the Home Currency and Foreign Currency respectively) as compared to 2001-2019, when the R-Squared values were **49.49, 45.42** considering Indian Rupee, INR and United States Dollar, USD as the Home Currency and Foreign Currency respectively. Again **at 95% level of significance, the p-values being lesser than 0.05 during both the time periods considered (1981-2019 and 2001-2019)**, explains the fact that the nominal interest differentials has significant impacts on the USD/ INR and INR/ USD exchange rate changes. Thus the International Fisher Effect theory holds here.

Again though the value of R-Squared is greater in 2001-2019 (R-Squared value being **15.95, 12.42** considering Indian Rupee, INR and Chinese Yuan, CNY as Home and Foreign Currency respectively) as compared to 1981-2019 (R-Squared value being **3.56, 3.66** considering Indian Rupee, INR and Chinese Yuan, CNY as Home and Foreign Currency respectively) between India with China, all of these R-Squared values are relatively low. The **p-values (being larger than 0.05 at 95% level of significance)** also fail to explain the significance of the respective nominal interest rate differentials on the movement of CNY/ INR and INR/ CNY exchange rate. Thus the International Fisher Effect theory does not hold here.

This scenario can be explained by the fact that China has been more of a closed economy and is still considered the same by the Economic/ Financial experts, with the Chinese Central Bank intentionally keeping the foreign exchange rate at lower value to benefit the exporters, without going for the market determined rates, as we see in the United States of America (USA) and other developed countries. China has largely focused on promoting its exports only, while remaining closed to foreign goods. While China's trade system still has important protectionist elements, China, from being a closed economy has had dramatic transformation since the late 1970s. The same is evident from the

value of R-Squared which has risen from the 3-4 odd level during 1981-2019, to 12-15 odd level during 2001-2019. It is said that China has become more open to foreign direct investment (FDI) than any other country in East Asia and indeed, it is one of the most open emerging market economies in the world as of the last decade, if we see the amount of FDIs that China received.

India also took the path of Globalization during the early 1990's, when it's Forex Reserves came to a bare minimum. Since then India has completely accepted the path of ***Liberalization and Globalization***, by adopting the International Financial Standards and freeing it's Foreign Exchange Market to the market forces, without very less intervention by the Reserve Bank of India. It is evident from the fact that R-Squared value has significantly increased in all considered cases during 2001-2019, as compared to 1981-2019.

In the later part of my research, it can be seen from the analysis of weekly data of exchange rates of the years (2018, 2019) that the exchanges rates can be explained by the Nominal Interest Rate Differential to a minimum extent between India with USA, thereby proving the limitation of International Fisher Effect that it makes efficient long term future predictions only.

9. LIMITATIONS OF INTERNATIONAL FISHER EFFECT

While the IFE concept appears like a perfect leading indicator of future economic changes, it has certain limitations. This is because it is based on several assumptions. These assumptions, in turn, give rise to several limitations of the concept.

The limitations of the International Fisher Effect are mentioned below:

1. IFE makes long-term Predictions only

One of the major limitations of the IFE is that it can only make long term forecasts. Thus IFE cannot be used in analyzing the financial performances for periods of less than one year. It has been proved from the very low/ insignificant R-Squared values, obtained from the weekly data for the period Jan.,'18 to Dec.,'19. Whereas the R-Squared values were considerably larger for the other two periods of observations (1981-2019 & 2001-2019).

2. Uncovered Interest Parity

The second limitation of IFE is the uncovered interest parity. IFE can make almost-accurate currency movement predictions. But IFE can not tell when the effects will start. As such, while it might make true conclusions about the future currency movements, the users cannot have a specific time to watch. Therefore IFE is said to be unreliable in providing specific timelines.

3. Uncontrolled Exchange Rates

When International Fisher Effect theory was being developed, most nations controlled their exchange rates because of trade and economic purposes. Today most of the currencies are free-floating. This has brought on many questions over the effectiveness of IFE in today's economic environments.

4. Interest Rates used to Determine Inflation

The other limitation of the IFE is that in today's economic scenarios, most central banks are turning to inflation targeting for determining their interest rates, as against the interest rate targets which they have been following previously, i.e. they are now using inflation rates to make their predictions and conclusions. Where this new development is used, the IFE becomes useless.

5. Other Factors affecting Exchange Rates

Studies have confirmed that there are multiple other factors that affect the exchange rate movements beside inflation. These factors are government controls, exchange rate risks and income levels. Therefore, though the expected appreciation or depreciation of a currency's movement might be accurate, but depending solely on it to make forecasts is subject to significant errors.

In this paper, I have explored the International Fisher Effect (IFE) by applying regression analysis between India with China and USA. With the help of historical annual and weekly (in the later part of research) data for exchange rates, real interest rate and rate of inflation between India with China and USA, I have tested the IFE using regression analysis. Like a home country and foreign country, each of these countries were considered interchangeably and the trail of the effect were tracked and explored. Data have been collected from the Reserve Bank of India, World Bank and one website on the Financial Markets (investing.com).

The International Fisher effect (IFE) holds better between India with USA than India with China during both of the investigated time periods. The insignificant coefficient values show that the exchange rate movements react to other factors in addition to nominal interest differentials, for India and China. It indicates that the money markets of these two countries are not truly internationalized, as compared to the USA. There are many restrictions that prevent free flow of capital across borders to directly match nominal interest rate differentials. Those restraining factors are political risk, currency risk, transaction costs, taxes and psychological barriers. The exchange rate changes can also come through some sort of activity between the goods market and the money market, some real cross-border investment activity or change in trade patterns in the goods market. The observations also show that the exchange rate sometimes has changed in the opposite direction as predicted by the theory, indicating a reaction to real interest differentials rather than relative inflationary expectations.

Again, the International Fisher Effect theorem holds that the real interest rates must be same across borders and the capital markets must be integrated. This certainly means that there must be free flow of capital across borders. However, in the developing countries like India and China, it can be observed that the currency restrictions and other regulation, limit that integration. The same is more evident in China, than in India, as verified from the value of R-Squared differing considerably between India with USA (on the very high side, with significant p-values) than between India with China(considerably low R-Squared values, with insignificant p-values). Thus, the empirical evidence now indicates that IFE does hold very well between India and USA, than between India and China.

11. CONFLICT OF INTEREST AND ETHICAL STATEMENT

- i. **Conflict of Interest** - This is to state that there is no Conflict of Interest.
- ii. **Funding** - This is to state that no funding has been received from any organization/ departments.
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12. REFERENCES

<i> Rajiv Srivastava(2018), “ International Finance ” Pg. 171-172

<ii> <https://en.wikipedia.org>

<iii> <https://data.worldbank.org>

<iv> <https://in.investing.com>

<v> <https://www.mitrade.com/forex/learn-to-trade/financial-dictionary/international-fisher-effect>

<vi> Marijana Joksimović, Dušan Joksimović, Biljana Grujić Vučkovski for their article on “A TEST OF INTERNATIONAL FISHER EFFECT: RESEARCHING FROM SERBIA AND THE EUROPEAN UNION ”, published in Ekonomika Vol. 66, april-june 2020, № 2 ISSN 0350-137X, EISSN 2334-9190, UDK 338 (497,1)

THANK YOU