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Abstract

This project tries to find the macro-economic relationship between exchange rate and FDI, whether it is valid for India or not. We have considered the data of exchange rate and FDI from 1974 to 2018 and try to find a significant relationship between them in context to the Indian economy. Before performing the OLS, we check some time series analysis techniques. These techniques include, the variables are stationary or nonstationary if nonstationary then whether it contains unit root or not, for this purpose we performed the **Dickey-Fuller** unit root test. Then we also applied the concept of **cointegration.** Here we apply the **Engle-Granger Co-integration** test which shows whether the variable has a long-term relationship or not, and it also shows whether we can apply OLS or not.

Introduction

From our basic macro-economic knowledge, we know that there exists a relationship between exchange rate and FDI or foreign direct investments. When a country's currency is devaluated then the country must have to pay more to buy a Doller price good in the foreign exchange market. For example, we consider India and America. When the Indian currency devaluates, it will be profitable for American buyers to buy Indian goods as their one Doller can buy more goods and services. From the domestic asset point of view, as the exchange rate depreciate the price for domestic assets reduces which will be profitable for the foreign investors. So, a devaluation of currency (a fall in the exchange rate) helps to improve the flow of investment. There is a negative relationship between the exchange rate and FDI.

Objective

The focus of this project is to inspect whether the negative relationship between exchange rate and FDI is applicable for the Indian context or not.

Methodology

We have considered two variables: the exchange rate and FDI of the Indian economy from 1970-2018. Here is the representation of the data in excel sheet.

	Year	Exchange rate	FDI(% OF GDP)	GDP	FDI
2	1970	7.5	0.072	37.0299	2.66615
3	1971	7.491	0.07	39.2324	2.74627
4	1972	7.594	0.024	42.1615	1.01188
5	1973	7.42	0.44	48.4219	21.3056
6	1974	8.101	0.057	56.4803	3.21938
7	1975	8.375	-0.01	59.5549	-0.59555
8	1976	8.96	-0.007	45.8655	-0.32106
9	1977	8.738	-0.029	50.1349	-1.45391
10	1978	8.192	0.013	53.0855	0.69011
11	1979	8.125	0.031	58.448	1.81189
12	1980	7.862	0.042	62.4225	2.62174
13	1981	8.658	0.047	67.351	3.1655
14	1982	9.455	0.035	71.4632	2.50121
15	1983	10.9	0.002	85.5153	0.17103
16	1984	11.362	0.009	99.5259	0.89573
17	1985	12.368	0.045	98.4728	4.43128
18	1986	12.61	0.047	102.717	4.82771
19	1987	12.961	0.076	121.487	9.23304
20	1988	13.917	0.03	137.3	4.11901
21	1989	16.225	0.085	152.992	13.0043
22	1990	17.503	0.073	186.325	13.6018
23	1991	22.742	0.027	193.491	5.22425
24	1992	25.918	0.095	200.715	19.0679
25	1993	30.493	0.197	218.262	42.9977
26	1994	31.373	0.297	212.158	63.011
27	1995	32.427	0.595	232.512	138.345
28	1996	35.433	0.617	248.986	153.624

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29	1997	36.313	0.86	279.034	239.969	
30	1998	41.259	0.625	296.589	185.368	
31	1999	43.055	0.472	296.042	139.732	
32	2000	44.941	0.765	320.979	245.549	
33	2001	47.186	1.056	270.105	285.231	
34	2002	48.61	1.011	288.208	291.379	
35	2003	46.583	0.605	279.296	168.974	
36	2004	45.316	0.765	327.276	250.366	
37	2005	44.099	0.088	360.282	31.7048	
38	2006	45.307	2.13	392.897	836.871	
39	2007	41.348	2.073	415.868	862.094	
40	2008	43.505	3.62	421.351	1525.29	
41	2009	48.405	2.651	458.82	1216.33	
42	2010	45.725	1.635	468.395	765.826	
43	2011	46.67	2.002	485.441	971.853	
44	2012	53.437	1.312	514.938	675.599	
45	2013	58.597	1.516	607.699	921.272	
46	2014	61.0295	1.695	709.149	1202.01	
47	2015	64.151	2.092	820.382	1716.24	
48	2016	67.195	1.937	940.26	1821.28	
49	2017	65.121	1.507	1216.74	1833.62	
50	2018	68.389	1.559	1198.9	1869.08	

We have used STATA 14MP software for analysis purposes.

Here are the steps which will be followed throughout the analysis process.

- Time set for time series analysis purpose.
- Checking of trend in both variables to find whether nonstationary or not.
- Checking of unit root test, whether both variables contain unit root or not. For this purpose, the Dickey-Fuller unit root test will be performed.
- If both variables are nonstationary then we will consider difference stationary process (DSP) to make them stationary.
- We will find the order of integration of both variables, which will help to take difference.
- We will apply varsoc for this purpose in STATA.
- To find a long-run relationship between two variables and whether we can perform OLS or not, we will perform cointegration test.

Data analysis

For time series analysis, we must set time, so

- tsset year

time variable: year, 1970 to 2018

delta: 1 unit

After setting time we generate a variable which is the log of FDI. We didn't consider the log of exchange rate because it is a fractional value. So

- g log_fdi=log(fdi)

(3 missing values generated)

Now we inspect is there any kind of trend in both variables or not and we will also check log FDI shows any kind of trend or not. We consider the log of FDI because sometimes considering log trend disappears. So

- tsline exchangerate

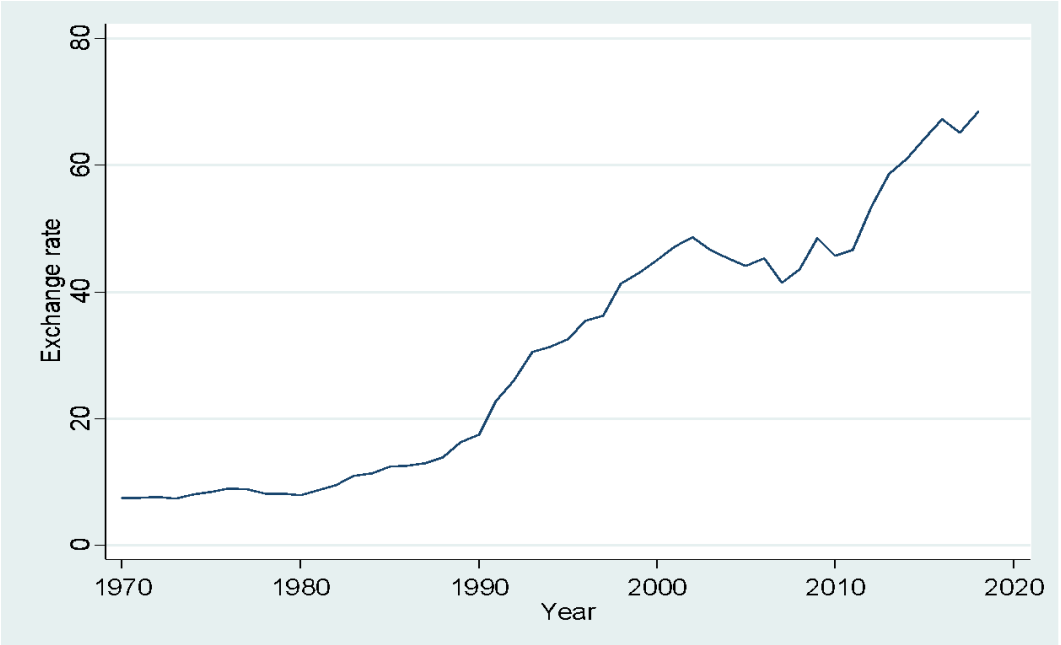


Fig 1: Exchange rate trend

- tsline fdi

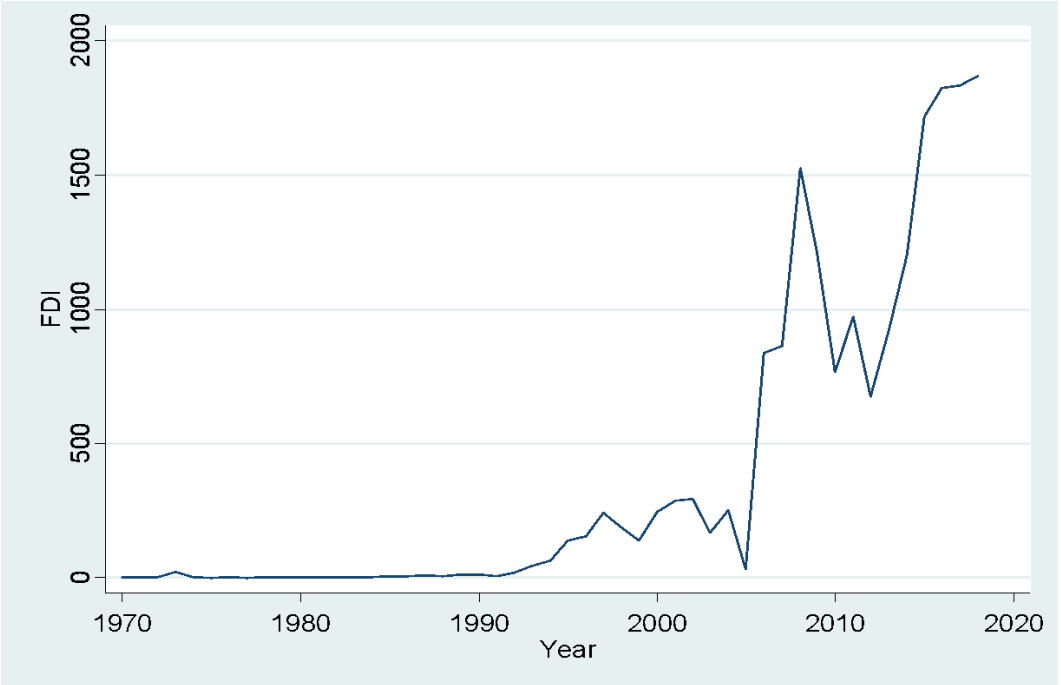


Fig 2: FDI trend

- tsline log_fdi

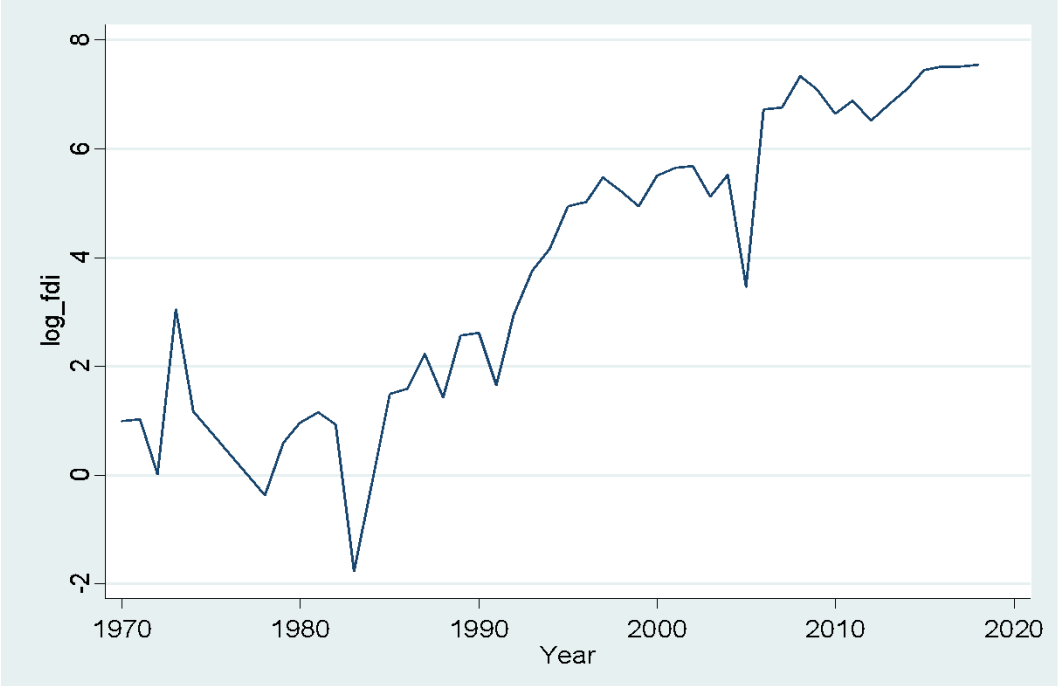


Fig 3: log_fdi trend

Fig 1, fig 2, fig 3, every variable shows a trend, which means variables are non-stationary, maybe containing unit root. To find unit root we consider the **Dickey-Fuller unit root test**.

- dfuller exchangerate

  The null & alternative hypotheses for the Dickey-Fuller unit root test are-
  H_0: ρ=0 Presence of unit root
  H_1: ρ<0 No presence of unit root

Dickey-Fuller test for unit root Number of obs = 48

---------- Interpolated Dickey-Fuller ---------				
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	1.210	-3.594	-2.936	-2.602

MacKinnon approximate p-value for Z(t) = 0.9961

p-value > 0.05 means null accepted, p-value <0.05 means null rejected.

- dfuller fdi

  The null & alternative hypotheses for the Dickey-Fuller unit root test are-
  H_0: ρ=0 Presence of unit root
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Dickey-Fuller test for unit root Number of obs = 48

---------- Interpolated Dickey-Fuller ---------				
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.103	-3.594	-2.936	-2.602

MacKinnon approximate p-value for Z(t) = 0.9663

p-value > 0.05 means null accepted, p-value <0.05 means null rejected.

Its clear unit root is present in both variables, so the presence of unit root shows shock will have a long-term effect. Now to remove the nonstationary we must take the difference. To take difference, we must know the order of integration, because the order of integration we help to consider the difference.

- varsoc exchangerate

Selection-order criteria

Sample: 1974 - 2018 Number of obs = 45

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-197.484				396.883	8.82151	8.83648	8.86166
1	-98.4276	198.11	1	0.000	5.08162*	4.46345*	4.49338*	4.54374*
2	-97.7212	1.4128	1	0.235	5.14908	4.4765	4.5214	4.59694
3	-97.7099	.02254	1	0.881	5.38186	4.52044	4.58031	4.68103
4	-95.6349	4.1499*	1	0.042	5.13309	4.47266	4.5475	4.6734

Endogenous: exchangerate

Exogenous: _cons

- varsoc fdi

Selection-order criteria

Sample: 1974 - 2018 Number of obs = 45

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-350.706				359871	15.6314	15.6463	15.6715
1	-304.19	93.031*	1	0.000	47602.6*	13.6085*	13.6384*	13.6888*
2	-303.676	1.028	1	0.311	48648.8	13.6301	13.675	13.7505
3	-302.769	1.8142	1	0.178	48863.4	13.6342	13.6941	13.7948
4	-301.485	2.5685	1	0.109	48271.7	13.6216	13.6964	13.8223

Endogenous: fdi

Exogenous: _cons

The result shows both variables are integrated of order 1, so we take the first-order difference of both variables.

- tsline d.exchangerate

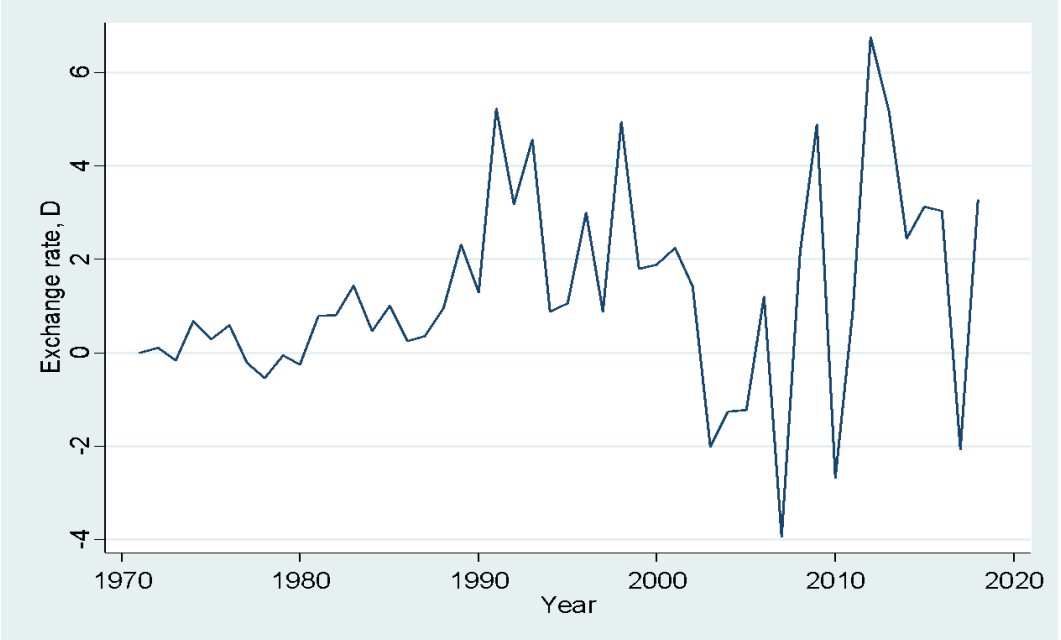


Fig 4: Trend of first difference of exchange rate

- tsline d.fdi

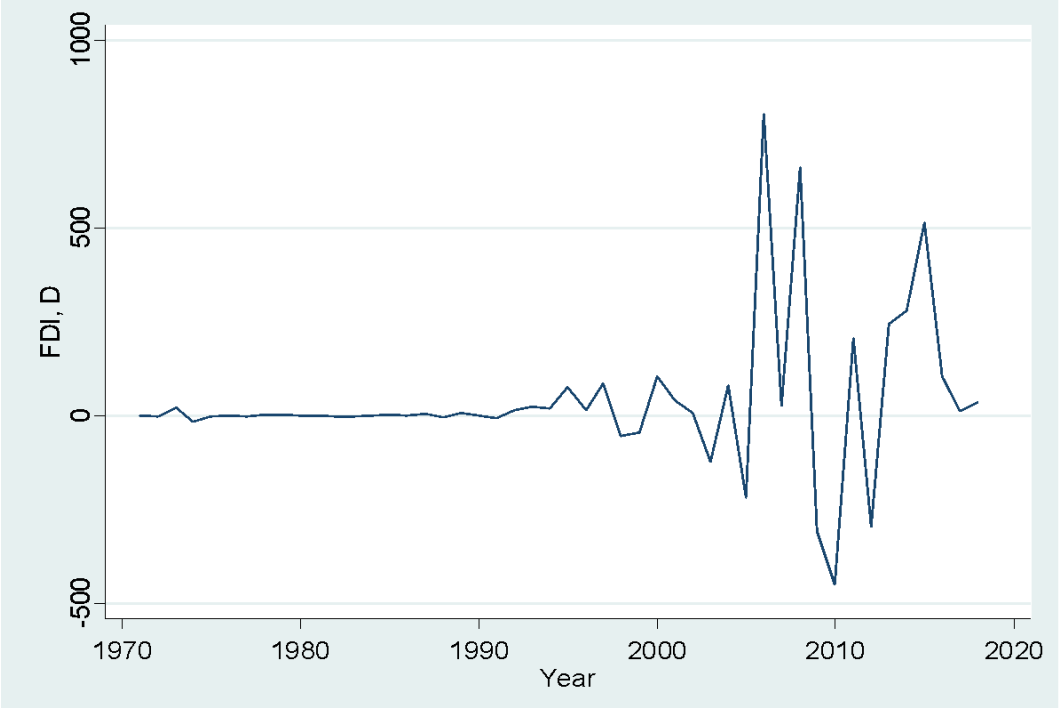


Fig 5: Trend for first difference of FDI

After taking the first difference it is clear that the trend disappears. So, both variables are first-order integrated, now we perform cointegration test.

The null and alternative hypotheses for cointegration test is

H_0: The variables are not cointegrated

H_1: The variables are cointegrated

- egranger exchangerate fdi

Engle-Granger test for cointegration N (1st step) = 49

N (test) = 48

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.895	-4.134	-3.466	-3.134

Critical values from MacKinnon (1990, 2010)

- egranger d.exchangerate d.fdi

Replacing variable _egresid...

Engle-Granger test for cointegration N (1st step) = 48

N (test) = 47

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.319	-4.140	-3.469	-3.136

Critical values from MacKinnon (1990, 2010)

In the case of the first test the null hypothesis is accepted, which means no cointegration, in the second test we consider a difference of both variables, the null hypothesis is rejected, which means cointegrated. As both the variables are

cointegrated so there exists a long-term relationship and we can also perform the OLS.

- reg fdi exchangerate

Source	SS	df	MS
Model	10475672.4	1	10475672.4
Residual	5617436.77	47	119519.931
Total	16093109.2	48	335273.108

Number of obs = 49
F(1,47) = 87.65
Prob > F = 0.0000
R-squared = 0.6509
Adj R-squared = 0.6435
Root MSE = 345.72

fdi	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
exchangerate	23.23437	2.481762	9.36	0.000	18.24171	28.22703
_cons	-331.826	90.56961	-3.66	0.001	-514.0285	-149.6234

From the OLS result, we find r square is 0.65 which is far below the industry standard and the ROOT MSE is also absart. R square shows a significant relationship between two variables but here the r square is low which means there is no significant relationship between variables.

Conclusion

The main motive of this project is to inspect the macroeconomic relationship between FDI and Exchange rate for the Indian economy context. From the analysis, both variables are cointegrated and have a long-term relationship and we can also perform OLS. But from the regression result, Adjusted R square is 0.64 which implies not a strong significant relationship between Exchange rate and FDI in Indian economy context, one more noticeable point ROOT MSE is 345.72 which is absert.