Empirical Analysis of the Causal Relationship between Nominal Exchange Rate and Foreign Direct Investment in India using VAR (Vector Autoregression Model)

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Abstract

The present study tries to establish a causal relationship between the nominal exchange rate and foreign direct investment in India using a time series data between 1992 and 2010. It tries to understand whether the fluctuation in the exchange rate in turn causes the change in the quantum of foreign direct investments inflows and vice-versa which is of enormous importance in the wake of unprecedented depreciation of Indian Rupee against US dollar. Our analysis uses unit root test and Johenson cointegration test to show whether the variables under consideration exhibit stationarity and a long run association respectively. The test indicates absence of any long term association between the two variables under consideration. In the present context it appears that the data is not stationary at level and is stationary at first difference. The Vector Auto regression (VAR) model depicts that the coefficients do not have any long run association.

Index terms— unit root, co integration, ADF (augmented dickey fuller), depreciation, foreign direct investment.

1 Introduction

he role of FDI to any nation is highly documented. It is known to be a source of much needed capital, technology and managerial skills. The developing nations are attracting the much needed source of foreign capital to boost their economies thus making their growth rates more sustainable. India is also not an exception to this trend and has taken steps to attract the much needed foreign capital to bolster its economy. However the torpid pace of economic reforms has created a sluggish environment as far as the movement of foreign capital in India is concerned. Also the second noticeable trend that has grappled Indian economy is the volatility of the rupee vis a vis major currencies especially the US Dollar and British Pound. The past year has witnessed a sharp depreciation of Indian Rupee against dollar which stands at over 19% in a single year. There are observations that indicate a strong correlation between the foreign capital inflows and valuation of a rupee 1 . Any aggressive depreciation in the exchange rate creates turmoil in the economy. It increases the firm's debt component on the loan borrowed from the foreign soil. The imports get dearer thereby having a cascading effect on the production costs and the product, thereby triggering inflation. The present study tries to understand the correlation between the exchange rate (USDollar verses INRupee) and foreign direct investment in the Indian economy between 1992 and 2010. The question we are investigating here is: Does the fluctuation of the currency a have a bearing in Inward foreign direct investment flow? The answer to this kind of question has different answers in different economies. The investigation for the Indian context reveals that the volatility of Indian rupee value does not affect in any way the quantum of inward flow of FDI. Thus our research confirms the theoretical observations of McCulloch (1989).

2 II.

3 Literature Review

The literature pertaining to the correlation between FDI and exchange rate in general is highly contradictory in nature and ambiguous, with some studies exhibiting a positive correlation, while others show negative correlation between the chosen variables. Cushmann (1985) and Froot and Stein (1991) explore the factors that might contribute to correlation between extrernal value of dollar and level of FDI in US. They have found that modelling a link between FDI and Exchange rate would require some beliefs in long run and short run deviation from PPP (Purchasing power parity) on cross border investment process.. Caves (1989), Froot and Stein(1991), Harris and Ravenscroft (1991) and Swenson (1993) has concluded that depreciating dollar is associated with higher flows of FDI in US and a higher foreign takeover premia. Dewenter (1995) examined this issue but no statistically significant relationship between the level of exchange rate and FDI. It was found that inflows of FDI will have no significant effects on nominal exchange rates in Sri Lanka. On the other hand Pakistan should take into account the effect of FDI inflow s on the nominal exchange rates in short run although inconsequential in long run. 2 McCulloch(1989) summarises that the exchange rate movements should not affect FDI inflows because if an asset in particular country is viewed as a claim to future stream of profits denominated in that country's currency, and if profits will be converted back to domestic currency of the investor at the same exchange rate, the level of exchange rate does not affect the present discounted value of the investment. A random walk characterization for exchange rate evolution process implies that the expected future exchange rate levels should be same as current rate. This implies perfect elasticity of exchange rate expectation to present exchange rate, a notion strongly contradicted by survey evidence like Franke and Froot (1987). Froot and Stein (1991) claimed that the level of exchange rate may influence the inward flow of FDI. The depreciation of the host currency makes the asset price cheaper thereby increases the ability of the firms to invest. Thus the depreciation of the host currency should increase the FDI and conversely the appreciation of the host country currency should decrease the FDI. Campa (1993) says the firms decision whether or not to invest abroad depends on the expectations of future profitability. An appreciation of host currency will increase FDI in to the host country, ceteris paribus, which is contrary to the prediction of Froot and Stein (1991). Thus the literature shows several contradictory facts and thus the issue warrants careful observation in a country specific manner.

4 III.

5 Objectives

We would like to empirically study the long and short run causal relationship between the nominal exchange rate and foreign direct investment in India during 1992 -2010 using a time series data. A vector autoregression model establishes the existence of such correlation.

IV.

6 Methodology

The method involves time series analysis of the IFDI (Inward foreign direct investment) and average nominal exchange rate data (between Indian rupee and USdollar) between 1992 and 2010 using . We use a unit root test to check stationary of the time series data, and the Cointegration test for analyzing the long run association of the variables namely the foreign direct investment inflow and the average exchange rate between US Dollar and Indian Rupee. Since the time series of Exchange rates as well as the corresponding series for FDI do not exhibit stationarity, we go for an optimal lag selection through Akaike Information criterion. Also we use the Vector Auto regression (VAR) model to assess the long and short run correlation between the FDI and the exchange rate.

V.

7 Mathematical Aspects of our Methodology

In the present study we are trying to estimate the equations that define for the long run, the dependence of FDI with several macroeconomic variables. The usual procedure adopted for such estimation is Multivariate regression which leads to an equation of the form (1)1 2 2 3 3 ..... t t t n nt t x g x g x g x e ?????.

. (1) The variables that we have considered are current FDI, current exchange rate, the lag values of FDI and the lag values of Exchange rate exhibit autocorrelations meaning that they exhibit dependencies on their lags. Hence autoregressive modeling is being taken up. A typical autoregressive model (AR(p)) of order p is used when the variables concerned are depending on 'p' lags. In (2) below we write the equation that models such an autoregressive process. We note that t e and t are stochastic terms incorporating the fluctuations or noises attributed to certain unexpected events happening. We also note that in our specific case the value of n is 4 and the value of p is 2. The equation (**??**) is a typical autoregressive model for a single variable. Let 1t y represent the variable in the AR model corresponding to 1t

x , 2t y represent the variable in the AR model corresponding to 2t x and so on. Thus we have the vector Now if the white noise elements are not serially correlated than OLS schemes work out and hence a moving average representation leads to the final relationship. However if the white noise elements exhibit a serial correlation indicating that there exist linear dependencies among the n variables we have chosen, then the Relationship established by OLS scheme (Ordinary least squares) is not reliable and hence inaccurate. This leads to the concept of cointegration.

Cointegration : The Matrix representation given above leads to a characteristic equation as a polynomial in lag operators. If the process is stationary then as indicated in the previous section a moving average representation is feasible. This needs some tests to be done to check for existence of unit roots. Essentially it means one checks for the eigen values of the matrix obtained in the VAR model. If the eigen values are strictly bounded by 1, i.e 1 i then stationarity is guaranteed, else there is no stability in the VAR model even after taking p-lags. Here ,0 i i n are the n eigen-values corresponding to the characteristic equation. This justifies the introduction of cointegrated variables, since here we assume that two or more variables in the n-variable time series move along in an integrated fashion (together). The technique of cointegration introduced by Granger develops a more reliable method to look for causality and hence may lead to better forecasting tools. Using the software E-views we estimate the cointegration coefficients so as to check the significance of short term and long term causality of exchange rate to influence FDI decisions.

In a typical VAR model involving two variables like Foreign direct Investment (Y t FDI) and Exchange rate (X t EXR), Y t is influenced by current X t and past values of X t and similarly X t is influenced by current Y t and past values of Y t . More generally if one wishes to consider more variables, such variables are decided by economic principles and proper literature survey, while the number of lags is chosen by AIS test.

8 VI.

9 Findings

Our research had as it null hypothesis that Foreign direct Investment decisions are not influenced by the host country's nominal exchange rate. Johenson Cointegration test shows that the none of the variables under consideration are cointegrated, the trace statistics shows that the p value is > 5 % indicating that we cannot reject the Null Hypothesis. The Unit root test is a test to show whether the two variables under consideration i.e FDI (Foreign direct investment) and EXR (Exchange rate) are stationary or not.

The **??**) is significant with p value of 0.0000 and the FDI(-2) with coefficient C(2) is significant with p value of 0.0050. All the other coefficients are not significant indicating no long run correlation. Similarly Wald test was conducted to show the influence of two or more variables together on Independent variables i.e. C(3) and C(4) together, C(8) and C (9) together. Here the results we obtained show Chi square value with probability of 0.5246 and 0.4622 respectively indicating that the variables jointly cannot influence the dependent variable. Hence we see that there is no statistical evidence for the quantum of FDI investments into India to be dictated by the trends in nominal Exchange rate.

10 VII.

11 Conclusions

The exchange rate fluctuation essentially does not impair the quantum of foreign direct investment. It can be assumed that inward flow of direct investment is independent of exchange rate volatility. But the first lag and second lag of the foreign direct investment exhibits a significant relationship between the foreign direct investment indicating that the lagged FDI could be responsible for attracting FDI in the subsequent year. [1] [2] [3] [4]

Figure 1:

Figure 2:

System: UNTITLED
Estimation Method: Least Squares
Date: 09/05/12 Time: 20:46
Sample: 1994 2010
Included observations: 17
Total system (balanced) observations 34

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.697534	0.251837	6.740620	0.0000
C(2)	-0.905518	0.292621	-3.094508	0.0050
C(3)	-149.2891	471.0752	-0.316911	0.7541
C(4)	281.6353	410.0798	0.686782	0.4988
C(5)	-3133.282	7066.626	-0.443391	0.6615
C(6)	-0.000174	0.000166	-1.048213	0.3050
C(7)	0.000232	0.000193	1.197992	0.2426
C(8)	0.525049	0.311384	1.686180	0.1047
C(9)	0.257073	0.271066	0.948378	0.3524
C(10)	10.12907	4.671090	2.168460	0.0403
Determinant residual covariance		39499313		

Figure 3:

.1 Appendix

Statistical Data Processing Output

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