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IMPACT OF EXCHANGE RATE VOLATILITY ON FOREIGN DIRECT INVESTMENT
A Case Study of Pakistan

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Abstract. The main objective of this study is to investigate the relationship of Foreign Direct Investment (FDI) with exchange rate and exchange rate volatility. The set of the determinants of FDI can be very large but exchange rate is one of the profound determinants. Nonetheless, exchange rates have become extremely volatile due to its fragility to adapt to the changes in domestic and international financial markets. In this study, time series data have been used for foreign direct investment, exchange rate, exchange rate volatility, trade openness and inflation from 1980-2010 for Pakistan. After collection of data on above stated variables, different time series econometrics techniques (unit root test, volatility analysis, cointegration technique and causality analysis) have been applied for the purpose of analysis. The results squeezed from the study demonstrate that FDI is positively associated with Rupee depreciation and exchange rate volatility deters FDI. Trade openness dramatically increases FDI while the premise doesn't hold for inflation as it is insignificant. The results of Granger causality test suggested that exchange rate volatility granger causes foreign direct investment but not *vice versa*.

Keywords: Exchange rate volatility, Foreign direct investment, Time series analysis

JEL classification: C22, E44, F21

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I. INTRODUCTION

Foreign Direct Investment is the metaphorical form of investment that is reshaping the world of finance as its volume is soaring with vengeance for the past two decades. Attracting FDI is the most plausible rhetoric of the policy makers especially in developing countries. Highly mobile capital amid globalization strengthens the role of the most novel form of investment, *i.e.* FDI. Developing countries are usually trapped in the vicious circle of poverty and it becomes seemingly impossible for them to break this wicked circle. FDI in this context is pivotal as it supplements the domestic capital to attain the critical minimum investment to break the vicious circle of poverty. Developing economies are facing shortage of capital thus they are racing with each other to attract more and more of FDI.

In many emerging economies, foreign capital plays an important role in infrastructure development, technological advancement and productivity enhancement. Developing countries can also manipulate these funds to stimulate positive growth externalities. Moreover, FDI to developing countries is also beneficial for both developed and developing countries because the marginal productivity of capital in developing countries is high due to its shortage and investors from developed countries seek high profits. This double coincidence of wants escalates the gains from international capital movement.

Foreign direct investment has gotten tremendous upsurge in 1990s throughout the world and particularly in developing countries. In the previous decade, sky-rocketing momentum of FDI has made it the largest source of foreign capital for developing countries. Developing countries received \$ 561 billion direct investment in 2010. The first phase of rising FDI began in 1990 then the inertia broke in 2002 where FDI inflows reached a trough. From 2003-2007, FDI reached at its peak with an astronomical momentum. Developing countries are aggressively looking for foreign capital to fulfill their obligations to the Millennium Development Goals (MDGs). FDI to developing countries started a tremendous upsurge from 2002. International investment boom started in 2004; enabled the world to witness the unprecedented level of FDI which astoundingly touched \$ 1.9 trillion in 2007. Due to financial crisis of 2007, world FDI inflows decline by 11.5% followed by a more abrupt fall of 32% in 2008 and 2009 respectively. However, FDI inflows showed a mild recovery of 4.9% in 2010. Khan and Kim (1999) pointed out the crucial importance of FDI for Pakistan in order to boast industrial production and manage its fragile balance of payment position. Pakistan stands at 51st position out of 82 countries on the basis of

2007-2011 average FDI inflows and FDI of Pakistan contributes 0.19% to the world total (*Economist Intelligence Unit*). In Pakistan; FDI as percentage of GDP remained below 1% before 1995. The share of FDI started increasing in 2003 and reached 5% peak in 2008. In the recent years, it fell substantially. Domestic political and security situation are the main drivers of this negative trend along with gloomy investment prospects throughout the world.

Exchange rates have profound and far-reaching implications for the economy and its crucial importance in determining the competiveness of the economy is unquestionable. Nonetheless, exchange rates have become very sensitive to small changes in domestic and international economic scenario and show frequent changes. Especially in the short run, exchange rates are observed to overshoot their long run equilibrium level as investors reallocate their financial assets to achieve a new balanced portfolio in response to any change in interest rates, expectations, wealth etc. This stock of financial assets is very large as accumulated over a long period of time so the adjustment in financial stocks is surprisingly bigger and quicker than the adjustment in trade flows. The response rate of real sector is not as fast as that of the financial sector. So in the short run, exchange rates are more likely to reflect the effect of financial asset adjustments. Caporale *et al.* (2009) suggested that external, real and monetary shocks are responsible for exchange rate volatility in emerging countries with international financial integration as the main driving force therefore financial integration and economic liberalization should be pursued steadily in developing countries. Since 1973, from the collapse of Bretton woods system, exchange rates of various countries have been fluctuating frequently. These wayward movements of FDI stimulate uncertainty which puts the investor in dilemma of how to interpret these changes. Investors; in an indecisive mode may postpone the investment which results in reduction of FDI. Therefore, it is important to find out whether there exist a robust relationship between FDI and exchange rate volatility of Pakistan. Froot and Stein (1991) presented the relative wealth effect hypothesis of exchange rates. Increase in exchange rate increases the relative wealth of host country investors which results in boom of FDI inflows. Inflation is used as an indicator of the quality of macroeconomic management so the conceivable relationship between FDI and inflation is negative. Whereas; FDI is expected to be positively linked with trade openness which is commonly used proxy of the degree of openness of the economy in the empirical research.

II. LITERATURE REVIEW

Udomkergmogkol and Morrisey (2009) worked on the nexus of exchange rates and FDI. The results indicate that devaluation attracts while volatility in local currency depresses FDI. H-P filter approach is used to assess volatility. Increase in real effective exchange rate is interpreted as expected devaluation thus postpones FDI.

Brzozowski (2003) used Fixed Effects OLS and GMM Arellano-Bond model to examine the impact of exchange rate uncertainty on FDI for 32 countries. GARCH (1,1) method was utilized to measure volatility which had been detected to be negatively influencing the FDI. Barrell *et al.* (2003) explored the effect of exchange rate volatility on US FDI in Europe and UK by employing generalized method of moments (GMM) on panel of seven industries from 1982-1998. They found strong negative relation between US FDI and exchange rate volatility in Europe and UK. Another study on the impact of G-3 exchange rate volatility on outward FDI by Gerardo and Felipe (2002) reveals that stability in exchange rate is necessary to improve FDI. Annual data from 1975-1998 has been used by categorizing countries into different geographical regions. Exchange rate volatility was found to be negatively associated with the FDI to developing countries.

Furceri and Borelli (2008) suggested that the effect of exchange rate volatility on FDI depends on country's degree of openness. Exchange rate volatility has a positive or null effect on FDI for relatively closed economies but has a negative effect on economies with high level of openness. Bouoiyour and Rey (2005) sort out with annual data from 1960-2000 that volatility captured using standard deviation and misalignments of real effective exchange rate have no effect on the FDI to Morocco.

Tokunbo and Lloyd (2009) empirically investigated the impact of exchange rate volatility on inward FDI of Nigeria. Using cointegration and error correction techniques, they confirmed positive relationship between recipient currency depreciation and FDI inflows while exchange rate volatility has no deterministic effect which is incorporated through standard deviation of exchange rate. Jie Qin (2000) in a theoretical examination found a positive relation between exchange rate volatility and two-way FDI in an economy of one sector and two countries. This paper analyzes exchange rate risk as an incentive to materialize two-way FDI for risk diversification.

Goldberg and Kolstad (1994) enlightened by quarterly data that volatility of exchange rate acts as a catalyst for MNE's in internationalizing their production facilities. The optimally located country productive capacity increases with the increase in volatility without decrease in domestic investment in US, Canada, Japan and UK. Aizenman (1992) sort out the influence of exchange rate regimes on domestic and foreign investment dynamics. The correlation between investment and volatility of exchange rate is destined to be negative or positive depending on the nature of exchange rate regime. According to his study, in flexible exchange rate country correlation will be positive if the shocks are real and negative if the shocks are nominal.

Impact of surging Chinese FDI inflows on Asian economies was explored by Nimesh (2009). Panel data of 11 Asian host economies from 1989-2004 is employed with the help of Arellano Bond and Instrumental variables estimations. Market size, infrastructure, openness and exchange rate volatility are the variables used in the study. Exchange rate volatility turned out with strong explanatory powers. Volatility of exchange rate had negative impact on FDI from US.

Rashid and Fazal (2010) investigated the outcomes of capital inflows for Pakistan by applying linear and non-linear cointegration on monthly data from 1990-2007. The results indicate monetary expansion and inflation due to capital inflows. Capital inflows are also fuelling exchange rate volatility. Becker and Hall (2003) found that R&D foreign direct investment tends to readjust from Europe to UK because of Euro-Dollar exchange rate volatility by exploiting GMM. GARCH is used to capture volatility. Long-term interest rates, output fluctuations are among other significant variables.

Arbatli (2011) has undertaken a multidimensional study on the determinants of FDI. He incorporated both global push factors and country specific pull factors including macroeconomic and institutional variables. The data sample consists of 46 countries from 1990-2009. Fixed or managed floating exchange rate regime was found to be more conductive for FDI as freely floating regime is more prone to risk.

III. METHODOLOGY AND DATA

The variables used in the study are FDI, exchange rate, exchange rate volatility, trade openness and inflation. Sample covers yearly data from 1980-2010 for Pakistan. Data has been extracted from World Bank's reliable data source World Development Indicators (WDI). All the variables have been used in log form which makes interpretation more robust and meaningful and inflationary effect has been isolated by dividing it with GDP deflator (on the basis of 2000). Volatility is measured by ARCH/GARCH techniques (Engle, 1982; Bollerslev, 1986). Different time series econometric techniques are utilized to fulfill our objectives which include Cointegration and Vector Error Correction Mechanism (VECM). Finally Granger Causality Test is employed to check for causality.

Unit Root

Almost all the economic variables are non-stationary at their level form which makes the coefficients inconsistent and empirical results spurious. Ground making information about whether stochastic processes follow unit root phenomenon can be obtained by simply plotting the variables and making corellograms. These are the informal ways to check for unit root process. More rigorous methods are Phillips-Perron Test (PP) and Augmented Dickey Fuller Test (ADF) which is broader version of Dickey Fuller Test and also counteracts the problem of the serial correlation of error terms which is violation of the key assumption of its paternal Dickey Fuller Test.

Considering a simple AR(1) process

$$Y_t + \rho Y_{t-1} + \eta X_t + \mu_t \tag{1}$$

Where Y_t depicting a time series variable and X_t is a vector of independent variables, ρ and η are the parameters of Y_t and X_t respectively which are to be estimated and μ_t is the white noise error term with zero mean and constant variance. If $\rho = 1$ then the equation (1) becomes random walk model confirming unit root.

Subtracting Y_{t-1} from both sides:

$$\Delta Y_t = \beta Y_{t-1} + \eta X_t + \mu_t \tag{2}$$

Where Δ is difference and $\beta = \rho - 1$. In practice equation (2) is estimated to see whether $\beta = 0$ or not. If $\beta = 0$, it means in turn that $\rho = 1$ and our variable follows unit root process. Thus Dickey Fuller statistic tests Null Hypothesis H_0: $\beta = 0$ ($\rho = 1$) through ordinary least square (OLS) estimation under the critical values of tau statistic. If this null hypothesis is accepted it means our variable is non-stationary and its variance is increasing function of time.

But a sufficient condition for Dickey Fuller is that the error terms must not be serially correlated. In case of such violation, Augmented Dickey fuller (ADF) can be a remedy. It augments the contemporary DF equation with lagged values of dependent variable. Assuming that Y_t follows AR(p) process, it incorporates p lagged terms of regressand in the equation (2).

$$\Delta Y_t = \beta Y_{t-1} + \eta X_t + \sum_{k=1}^{p} \delta \Delta Y_{t-k} + \varepsilon_t$$

Cointegration

Engle and Granger (1987) revolutionized the traditional view of time series econometrics by stating that even if two or more time series are non-stationary, linear relationship among them can be stationary. Cointegration is basically the long-run or equilibrium relationship among different random variables. If two or more series are non-stationary and integrated of the same order then there can be a long-run stationary relationship among them. Such series are said to be cointegrated and the resulting OLS regression is called cointegrating regression leading to super consistent coefficients.

Given a simple equation

$$Y_t = \alpha + \beta X_t + \mu_t \quad (3)$$

Where Y_t and X_t are non-stationary series [I(1)], α, β are parameters and μ_t is the stochastic disturbance term.

Now subtracting from the random disturbance term

$$\mu_t = Y_t - \alpha - \beta X_t$$

If these error terms stationary [I(0)], it means that there exists a long-run linear combination among series, hence they are cointegrated.

When cointegration among different time series exists, Error Correction Mechanism (ECM) is used to capture short-run dynamics. If two or more series are cointegrated then ECM reconciles the short-run relationship with long-run behaviour of the variable. Engle and Granger (1987) stated that cointegrating variables must have an Error Correction Mechanism.

$$\Delta Y_t = \gamma + \delta \Delta Y_t + \theta \mu_{t-1} + e_t$$

Here Δ is the first difference operator, e_t is the stochastic error term and μ_{t-1} is the lagged value of the error term from cointegrating equation (3) which explicitly indicate that ΔY_t is also depending on μ_{t-1} along with ΔX_t .We augment the difference form of the equation with the first period lag of the cointegrating equation error term. If θ is non-zero, it means that the model is having disequilibrium. In case, θ is statistically significant and having negative sign, we say that the model is converging towards equilibrium. Absolute value of θ determines the magnitude of the movement to restore equilibrium.

Granger Causality Test

Granger (1969) developed Granger Causality test to evaluate the direction of relationship. If a variable X_t is granger causing Y_t then the changes in X_t are preceding changes in Y_t. Thus, if X_t is included in regression of Y_t on its own and other variables lags, it helps to boost the forecasting of Y_t. This is precisely what Granger Causality test determines whether one variable is useful in forecasting other or not.

Given the equations

$$Y_t = \alpha + \sum_{i=1}^{k} \phi_i Y_{t-i} + \sum_{i=1}^{k} \gamma_i X_{t-i} + \mu_{1t}$$

$$X_t = \alpha + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{i=1}^{k} \vartheta_i X_{t-i} + \mu_{2t}$$

The null hypotheses which are tested are:

H_0: $Y_i = 0$, $i = 1, 2, 3, \ldots k$; significance of this hypothesis means that X_t doesn't granger cause Y_t.

H_0: $\beta_i = 0$, $i = 1, 2, 3, \ldots k$; significance of this hypothesis means that Y_t doesn't granger cause X_t.

Two variables are independent of each other if none of the hypothesis is rejected. It means neither X_t causes *Yt* nor Y_t causes X_t. If mere one hypothesis is rejected it means that there is one-way causality whereas if both hypotheses are rejected, it shows bidirectional relationship.

Vector Error Correction Mechanism

If we add the first period lag of the error term of the cointegrating equation in the difference form of the Vector Autoregressive model (VAR) that becomes Vector Error Correction Mechanism (VECM).

Given the VAR equations

$$Y_t = \alpha + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{i=1}^{k} \gamma_i X_{t-i} + \mu_{1t}$$

$$Y_t = \alpha + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{i=1}^{k} \gamma_i X_{t-i} + \mu_{2t}$$

If we augment difference form of these equations with the lagged error term; we get VECM. At first, we run the simple VAR and find out the most plausible lag length on the basis of lag selection criteria using Akaike Information (AIC) or Schwartz Bayesian (SBC) criterion. The minimum value of AIC or SBC guides us to the appropriate lag length. Then we estimate following equations of VECM:

$$\Delta Y_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta X_{t-i} + \sigma_1 e_{1t-1} + \mu_{1t}$$

$$\Delta Y_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta X_{t-i} + \sigma_2 e_{2t-1} + \mu_{2t}$$

Volatility measurement ARCH/GARCH

Instead of using traditional unconditional measures of volatility which are naive approaches such as standard deviation and coefficient of variation, we focus on conditional volatility. Autoregressive Conditional Hetroscedasticity (Engle, 1982) and Generalized Autoregressive Conditional Hetroscedasticity (Bollerslev, 1986) come in handy for this. Engle (1982) stated that unconditional measures of volatility ignore the information regarding the random process of the generation of exchange rates. These naive measures capture fluctuations but not uncertainty. ARCH and its variants are corrective developments to solve such problems and also to incorporate the phenomenon of volatility clustering. The time varying variance of the error term in ARCH is conditional on the past values of the series.

Given a random walk phenomenon without drift

$$Y_t = Y_{t-1} + \mu_t \tag{4}$$

Where Y_t is a variable which depends on its lagged value and a white noise error term (mean = 0, variance = σ^2).

Taking first difference of equation (4):

$$Y_t - Y_{t-1} = \mu_t$$

$$\Delta Y_t = \mu_t \tag{5}$$

Equation (5) exhibits that Time series Y_t is stationary at its first difference. Estimation problem in modeling these first differences is that they exhibit wide swings. Their variance is a hyper varying function of time. Engel (1982) devise a technique ARCH to model such fluctuating variance.

In ARCH, the conditional variance of error term (μ_t) depends on the squared previous error terms.

$$Var(\mu_t) = \sigma_t^2 = \alpha_0 + \alpha_1 \mu_{t-1}^2 + \alpha_2 \mu_{t-2}^2 + \cdots + \alpha_p \mu_{t-p}^2$$

The above model is an example of ARCH(p) model. The hypothesis we test is

H_0: $\alpha_1 = \alpha_2 = \ldots.\ \alpha_p = 0$; if the hypothesis is accepted and we have $Var(\mu_t) = \alpha_0$, it means that there is no autocorrelation and there is no ARCH effect.

GARCH model is as

$$\sigma_t^2 = \alpha_0 + \alpha_1 \mu_{t-1}^2 + \alpha_2 \sigma_{t-1}^2$$

Where, conditional variance of error term (σ_t^2) at time t depends on squared error term (μ_{t-1}^2) in the previous time period and also on the previous lag of the conditional variance (σ_{t-1}^2). The sum of α_1 and α_2 measures the persistence of volatility. This model is GARCH (1, 1) and it can be generalized to GARCH(p, q).

IV. RESULTS AND DISCUSSIONS

Unit root analysis has been done to get familiarize with the nature of data. As expected in case of most of the economic time series, all the variables in our

TABLE 1

Unit Root Test Results

Variables	Level		First difference	
	Test Statistic	Critical Value	Test Statistic	Critical Value
Log (RFDI)	–2.367429	–2.954021	–7.582403	–2.957110
Log (TOP)	–2.996129	–3.540328	–5.991824	–3.544284
Log (INF)	–2.753911	–3.557759	–6.443919	–3.544284
Log (ER)	–1.751163	–3.540328	–4.331213	–3.544284
Log (VOLT)	3.646663	–2.948404	–3.343577	–2.951125

All the variables for Pakistan are stationary at on first difference at 5% level of significance.

study are non-stationary. Augmented Dickey Fuller (ADF) test has been applied to check for the unit root. ADF test verified that all the variables are non-stationary in their level form but their first difference is stationary at 5% level of significance. The results are presented in Table 1 which show that the variables in our study are I(1).

Volatility series is constructed through GARCH (*p, q*) technique and GARCH (1, 1) model is chosen on the basis of AIC and SBC. Minimum value of AIC and SBC indicates the significance of the model in explaining hetroscedasticity. All types of volatility modeling has been done in EViews 6.0 but for convenience only best fitted model on the basis of minimized AIC and SBC criteria is presented in Table 2.

TABLE 2

Estimated Coefficients of Exchange Rate Volatility for Pakistan

GARCH (1, 1)		
	Coefficient	ρ-value
Mean Equation		
C	–0.504134	0.2186
ER(–1)	1.094624	0.0000
Variance Equation		
C	–0.153496	0.1640
RESID(–1)^2	–0.129071	0.6492
GARCH(–1)	1.447420	0.0002
Akaike Info Criterion	3.623586	
Schwartz Bayes Criterion	3.843519	

The next step is checking for cointegration which is applied through Johansen and Jeselius (1990). Trace statistics and Eigen values are the two criteria used to check for cointegration. Both trace and Max-Eigen statistics confirm the existence of two cointegrating equations for foreign direct investment, exchange rate, exchange rate volatility, inflation and trade openness at 1% level of significance. The results are presented in Table 3.

TABLE 3

Cointegrating Trace Statistic and Eigen Values for Pakistan

Null Alternative	$r = 0$ $r \geq 1$	$r \leq 1$ $r \geq 2$	$r \leq 2$ $r \geq 3$	$r \leq 3$ $r \geq 4$	$r \leq 4$ $r \geq 5$
Trace Statistics	120.5661	65.51088	27.71318	10.41992	0.218787
Eigen value	0.830681	0.704557	0.427560	0.280406	0.007033
Critical value	69.81889	47.85613	29.79707	15.49471	3.841466
Probability	0.0000	0.0005	0.0854	0.2498	0.6400

$$\underset{}{LRFDI} = 4.789878 + \underset{\substack{(0.11263)\\ [5.87797]}}{0.608511\ LER} - \underset{\substack{(0.01469)\\ [-3.70139]}}{0.054358\ VOLT} + \underset{\substack{(0.10352)\\ [0.90303]}}{0.101711\ LINF} + \underset{\substack{(0.67052)\\ [6.90826]}}{4.632142\ LTOP}$$

The equation shows that exchange rate has a positive relationship with real FDI and it increases by 0.608511 units because of 1 unit increase in exchange rate. This positive relationship is in uniformity with Froot and Stein (1991), Blonigen (1997), Udomkergmogkol and Morrisey (2009) and Tokunbo and Lloyd (2009). Coefficient of LER is statistically significant at 1% level of significance as t-statistic is considerably greater than 2. Whereas, volatility of exchange rate is impacting Real FDI negatively. Gerardo and Felipe (2002), Brzozowski (2003), Barrell *et al.* (2003), Kun-Ming-Cheng *et al.* (2006), Dumludag (2007) and Udomkergmogkol and Morrisey (2009) have found the same direction of relationship. A unit increase in exchange rate volatility reduces Real FDI of Pakistan by 0.054358 units. Coefficient of VOLT is highly significant at 1% level of significance as t-statistic is greater than 2. Inflation and trade openness have a positive effect on Real FDI but coefficient of inflation is insignificant. One unit increase in Inflation and Trade openness causes real FDI to rise by 0.101711 units and 4.632142 units respectively. Coefficient of trade openness is significant at 1% level of significance. The magnitude of the influence of trade openness on FDI inflows is tremendous. Arbatli (2011), Cevis and Camurdan (2007) have also confirmed a profound positive effect of trade openness on foreign direct investment. The intercept of the cointegrating equation has the value 4.8 implying that real FDI would still be positive if all the explanatory variables set equal to zero. The signs of all variables are according to the priori expectations except inflation which is statistically insignificant. Exchange rate, exchange rate volatility and trade openness are statistically significant at 1% level of significance.

Now we apply Pairwise Granger Causality test. Granger Causality test is used to determine whether one variable is capable of predicting another variable. The p-value less than 0.05 correspond to the rejection of null hypothesis at 5% level of significance. Results for Granger Causality test are presented in Table 5.

TABLE 5

Granger Causality Test for Pakistan

Null Hypothesis	F-Statistic	Probability
LER does not Granger Cause LRFDI	3.40298	0.0750
LRFDI does not Granger Cause LER	4.30654	0.0466
VOLT does not Granger Cause LRFDI	4.41854	0.0441
LRFDI does not Granger Cause VOLT	0.87662	0.3566
LTOP does not Granger Cause LRFDI	0.10506	0.7481
LRFDI does not Granger Cause LTOP	3.99327	0.0548
LINF does not Granger Cause LRFDI	0.00886	0.9256
LRFDI does not Granger Cause LINF	0.00045	0.9833
VOLT does not Granger Cause LER	1.56771	0.2196
LER does not Granger Cause VOLT	0.74488	0.3945
LTOP does not Granger Cause LER	3.12137	0.0865
LER does not Granger Cause LTOP	0.00104	0.9745
LINF does not Granger Cause LER	0.02408	0.8776
LER does not Granger Cause LINF	0.62016	0.4366
LTOP does not Granger Cause VOLT	1.18703	0.2841
VOLT does not Granger Cause LTOP	0.02691	0.8707
LINF does not Granger Cause VOLT	4.45475	0.0427
VOLT does not Granger Cause LINF	2.27985	0.1409
LINF does not Granger Cause LTOP	0.50525	0.4822
LTOP does not Granger Cause LINF	0.00028	0.9868

Results show that exchange rate volatility granger cause Real FDI at 5% level of significance but not vice versa. While exchange rate granger cause real FDI at 10 % level of significance and Real FDI granger cause exchange rate at 5% level of significance. Inflation also granger cause volatility. Trade openness granger cause exchange rate while foreign direct investment granger cause trade openness at 10% level of significance. FDI does not granger cause exchange rate volatility which is contrary to the view that FDI exacerbates exchange rate volatility.

V. CONCLUSIONS AND POLICY RECOMMENDATIONS

The estimation framework reveals that foreign direct investment in Pakistan increases with the depreciation of the Rupee (Rs.). FDI of Pakistan increases by 0.61 units in response to 1 unit increase in exchange rate. Depreciation of Rupee is taken as an incentive by the foreign investors and they are attracted to invest in Pakistan because of their relative increase in worth of their assets. Pakistan is following freely floating exchange rate system since 2000 which makes country more sensitive to the slight variations in the foreign exchange market. Exchange rate volatility acts like a market friction for FDI in Pakistan as evident by our results. Future prone to risk and uncertainty provoked by exchange rate volatility hampers FDI in Pakistan. But its effect is quite small as compared to effect of exchange rate appreciation. A unit increase in volatility of exchange rate depresses FDI by 0.054358 units which is still noticeable.

Inflation is affecting FDI positively in our model contrary to conventional wisdom but it is highly insignificant. Trade openness is magnificently explaining the variations in FDI of Pakistan. It is obvious from its coefficient that liberalization of the Pakistan's economy is a pivotal factor that encourages FDI. The coefficient value of trade openness is 4.632 making it the largest contributor to increase in FDI in our model. 1 unit increase in trade openness causes Real FDI to increase by 4.632 units.

Finally, Granger Causality test confirms that there exist a unidirectional relationship between foreign direct investment and exchange rate volatility. Volatility of exchange rate granger cause foreign direct investment. FDI doesn't seem to galvanize exchange rate volatility. Inflation also granger cause exchange rate volatility. Though, inflation is insignificant in our model to explain FDI but it granger cause volatility thus pointing that it may have an indirect negative effect on FDI via volatility.

Pakistan is a developing country which is in dire need of foreign investment to stimulate domestic economy, seek new technology, modern managerial skills and employment generation for ever increasing population. Foreign Direct Investment in this regard can play a decisive role not only to manage difficult economic conditions but it also promotes competition in the economy which brings efficiency leading to the beauty of capitalism;

innovation. Our policy recommendation is to minimize the exchange rate volatility and to keep exchange rates in a compatible mode. Any such movement in the exchange rates that leads to the loss of competitiveness should be avoided by proper planning and well regulated foreign exchange market. Economic liberalization with stable exchange rate should be promoted in order to bring fresh FDI by revising the exchange controls and developing modern financial markets.

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