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# Impact of Democratic/Non-Democratic Regimes on Foreign Direct Investment in Pakistan: Pre and Post September 11, 2001 Scenarios

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**Abstract**

In this study the impact of democratic and non-democratic regime (pre and post September 11, 2001seenarios) on foreign direct investment in Pakistan have been investigated using quarterly data over the period of 1976Q1 to 2006Q4. Stepwise regression, Box-Jenkins methodologies have been applied initially then GARCH-type models are used to counter the problems of auto-correlation and ARCH effect and to model the conditional variance of FDI. It is found that foreign direct investment in Pakistan mainly depends upon on the past trends, as higher order auto-regressive terms are statistically significant. It has also been observed that the volatility shocks are quite persistent and take a long time to die out. September 11, 2001incident and thereafter war on terror has increased the conditional volatility of foreign direct investment and has statistically significant impact while FDI was not volatile before the September, 11, 2001. CPI plays a significant role to decrease conditional volatility. One interesting finding of this study is that the impact of Non-Democratic regime before September, 11 scenario is statistically significant and severely bad on foreign direct investment but with the inclusion of observations of post September, 11 the variable becomes insignificant.

**Keywords**: Box and Jenkins Methodology, GARCH Model, Auto-correlation, ARCH Effect, Volatility.

## 1. Introduction

Foreign direct investment is a form of international capital flows (Assaf and Efrain, 2007). Pakistan being a developing country requires FDI to develop its different sectors like Industrial Sector, Agricultural Sector, Science and Technology, and to reduce unemployment in order to emerge as a developed country. The importance of FDI can be judged from the rapid growth of the neighboring countries of Pakistan like China and India which are the economic hub of Asia and are receiving the bulk of foreign investment. There are many factors in economic theory which can affect FDI like Foreign Exchange Rate (EXR), Foreign Exchange Reserves, Inflation Rate (CPI), Trade Balance, Privatization Policies, Local Investments, Natural Resources, Political stability, Competitiveness, infrastructure and etc. Pakistan has the history of politically unstable country as frequent Non-Democratic takeover and an ordinary law and order situation abandoned the FDI inflows in Pakistan. Moreover, the tense situation on borders especially on Eastern borders after September 11, 2001 incident and more recently the war against terror also played its part. It is reported in the Pakistan Economic Survey 2001-2003 that FDI decreased by 66.5 % in 2001. Only in period of three months (October – December 2001), Pakistan has lost billions in exports and imports orders that resulted in the increase in unemployment and deterioration in capital and current account deficit (Khan, 2001).

Bulk of literature is available on the impact of FDI in a country's economic growth**.** Dondeti and Mohany (2007) report that foreign direct investment promotes economic growth, and further provided an estimate that one dollar of FDI adds about 3.27 dollars in GDP of each of the four countries China, India, Malaysia and Singapore. (Minjung (2004) reported that inconsistent causal relationship exists between FDI inflow and GDP growth. It is found that FDI cannot be considered as an independent variable for GDP growth ignoring other important factors that contributes to economic growth in the long run and shocks in GDP are tend to be explained by its own shocks, which mean that FDI has a little effect on variance of GDP. Impulse response function depicts that response of FDI to a shock in GDP is not significant. As far as the case of Pakistan is concerned Khan (2007); Falki (2009) and Mahmud (2009) investigated the impact of FDI on GDP and found it a significant factor along with other factors. Ghumro and Hakro (2007) reported that the stability of macroeconomic indicators, country's risk profile, improved environment for investment and cost related factors are the real determinants for attraction of FDI.

Non-Democratic regimes are likely to reduce the capital formation and domestic saving ratios, foreign direct investment and the pace of economic growth. Moreover, the share of Government Expenditures in the GDP, monetary growth and the inflation rate tend to rise. Non-Democratic regimes generally worsen the balance of payments and the current account deficit (Odedokun, 1995).

Foreign exchange rate uncertainty and its volatility can also play a significant role in determination of FDI inflows. Although it is a controversial subject in literature but it can have a negative impact on FDI inflows. Nominal exchange rate uncertainty mainly obstructs FDI inflows in accession countries (Brzozowski, 2003). Similarly Hara and Razafimaheefa (2005); Aqeel and Nishat (2004) and Kyereboah-Coleman and Agyire-Tettey (2008) have also reported that exchange rate has a significant impact in determination of FDI inflows.

Price moments (CPI), wage rate, skilled and educated labor can also be a significant factor for attracting FDI inflows in developing countries like Pakistan. Usually CPI is very high in developing countries and it attracts the foreign investors to invest (Hara and Razafimaheefa, 2005 and Jaumotte, 2004).

**2. Methodological Framework and Data**

The variables; foreign direct investment (FDI), foreign exchange rate (EXR), consumer price index number (CPI) and two dummy variables, one for the incidence of September 11, 2001 incident and there after war on terror ( $D_1$ ) and other for Democratic or Non-Democratic rule ( $D_2$ ) are used in this study. Quarterly based data over the period of 1976Q1 to 2006Q4 for the variable FDI, EXR and CPI is obtained from International Financial Statistics (IFS) CD-ROM 2008. This study is divided into two parts to investigate the pattern of FDI, one is scenario of pre-September 11, 2001 and the other is post September 11, 2001 scenario (including pre-September 11, 2001 observations). At first, a well known econometric technique, Step wise regression is employed to get an idea about the relationship between the variables. Then more advanced techniques, like ARIMA models and GARCH models are employed to estimate the mean as well as variation in FDI.

*2.1 Pre September 11, 2001 Scenario*

Along with Step-wise regression we have employed Box and Jenkins (1970) methodology for pre September 11, 2001 scenario by including explanatory variables along with the conventional AR and MA terms.

$$\left.\begin{aligned} \Delta^2 FDI = \varphi_0 + \varphi_1 \Delta^2 FDI_{t-2} + \varphi_2 \varepsilon_{t-1} + \varphi_3 \Delta CPI + \varphi_4 \Delta EXR + \varphi_5 D_2 + \varepsilon_t \\ \text{Where } \varepsilon_t / I_{t-1} \sim N(0, h_t) \end{aligned}\right\} \quad (1)$$

$\Delta^2 FDI$ is 2nd order stationary series of FDI; $D_2$ is the dummy variable for Democratic / Non-Democratic rule. $\Delta EXR$ represents the 1st difference series of foreign exchange rate (EXR) where as $\Delta CPI$ represents the 1st difference series of CPI. $\Delta^2 FDI_{t-2}$ is the AR(2) term whereas $\varepsilon_{t-1}$ is the MA(1) term included in the model.

*2.2 Post September 11, 2001 Scenario*

Along with Step-wise regression we have used GARCH model introduced by Bollerslev (1986) for post September 11 scenario. Taking into consideration the high volatility after the September 11, incident and to see whether Democratic/Non-Democratic regimes have any influence on FDI dummy variables $D_1$ and $D_2$ have been introduced in the variance equation along with $\Delta CPI$ and $\Delta EXR$ on the pattern of Muhammad Kashif (Shah et al., 2009). Thus the specification of GARCH-X model is as under:-

$$\left.\begin{aligned} \Delta^2 FDI &= \varphi_0 + \varphi_1 \Delta^2 FDI_{t-2} + \varphi_2 \varepsilon_{t-1} + \varphi_3 \Delta EXR + \varphi_4 D_1 + \varphi_5 D_2 + \varepsilon_t \\ \varepsilon_t / I_{t-1} &\sim N(0, h_t) \\ h_t &= \delta_0 + \delta_1 \Delta EXR + \delta_2 \Delta CPI + \delta_3 D_1 + \delta_4 D_2 + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \end{aligned}\right\} \quad (2)$$

Where $\Delta^2 FDI$ is 2nd order stationary series of FDI. $D_1, D_2$ are the dummy variables for September 11, 2001 incident and thereafter war against terror and Democratic / Non-Democratic rule respectively. $\Delta EXR$ represent the 1st difference series of foreign exchange rate (EXR) where as $\Delta CPI$ represents the 1st difference series of CPI. $\Delta^2 FDI_{t-2}$ is the AR(2) term whereas $\varepsilon_{t-1}$ is the MA(1) term included in the model. $I_t$ is representing the information set through time $t-1$; $\varepsilon_t$ is the error term. Model-2 consists of 3 equations, equation (1) of the model (the "mean" equation) analyzes $\Delta^2 FDI$ as a function of exchange rate effect (EXR), dummy variables $D_1, D_2$ effect and also the effect of MA(1) and AR(2); equation (2) explains that the residuals of the fitted regression will be modeled as a GARCH process; and equation (3) models the conditional FDI volatility, $h_t$, as a function of ARCH and GARCH effects, dummy variables, exchange rate and CPI. The parameters of the fitted model will be estimated by using the Quasi-Maximum Likelihood (QML) approach developed by Bollerslev and Wooldridge (1992), which provides standard errors which are robust to non-normality in the density function that underlying the residuals.

**3. Empirical Results**

In this section we will discuss in detail the results obtained after the analysis of the data by employing the methodological framework explained in Section-2.

*3.1 Pre September 11, 2001 Scenario*

Table-1 presents the ANOVA results of stepwise regression, while the estimated parameters (coefficients) of the model are presented in Table-2. The overall model is significant (Table-1). Table-2 shows that the variables like EXR, CPI have significant and positive impact on FDI while the non-democratic takeovers **(** $D_2$ ) have significant but negative effect on FDI. ($D_2$=1 represents presence of non-democratic Government).

**Table 1: ANOVA Table by Step-wise Regression Analysis (Pre September 11 Scenario)**

| Model | | Sum of Squares | df | Mean Square | F-value | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 78004.349 | 1 | 78004.349 | 3370.035 | .000 |
| | Residual | 2337.792 | 101 | 23.146 | | |
| | Total | 80342.141 | 102 | | | |
| 2 | Regression | 79037.479 | 2 | 39518.740 | 3029.041 | .000 |
| | Residual | 1304.662 | 100 | 13.047 | | |
| | Total | 80342.141 | 102 | | | |
| 3 | Regression | 79092.305 | 3 | 26364.102 | 2088.311 | .000 |
| | Residual | 1249.836 | 99 | 12.625 | | |
| | Total | 80342.141 | 102 | | | |

**Table 2: Coefficients of model selection by Step-wise Regression (Pre September 11 Scenario)**

| Model | | Un-standardized Coefficients | | Standardized Coefficients | t-value | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.547*** | .919 | | 1.684 | .095 |
| | exchange rate | 1.898* | .033 | .985 | 58.052 | .000 |
| 2 | (Constant) | 1.940* | .691 | | 2.807 | .006 |
| | exchange rate | 1.714* | .032 | .890 | 53.482 | .000 |
| | consumer price index | .061* | .007 | .148 | 8.899 | .000 |
| 3 | (Constant) | 3.321* | .949 | | 3.498 | .001 |
| | exchange rate | 1.716* | .032 | .891 | 54.401 | .000 |
| | consumer price index | .054* | .008 | .130 | 7.016 | .000 |
| | dummy Democratic/Non-Democratic | -1.762** | .846 | -.032 | -2.084 | .040 |

Note: *, ** and *** shows the significance at 1%, 5% and 10%level of Significance respectively.

The diagnostic checks which are not reported here but can be made available on demand, shows the existence of the problem of auto correlation and hetroskedasticity. Moreover, the value of $R^2$ is also found to be greater than the value of Durbin Watson d-statistic which is an indication of spurious regression. Therefore, there is strong evidence for inclusion of some autoregressive terms in the model, which leads us to use well known Box and Jenkins (1970) methodology. The pre-requisite of Box-Jenkins methodology is the stationarity of the variables. The series FDI is stationary at second difference while EXR and CPI are stationary at first difference. We tried various models but only two models are being reported.

**Table 3: Results of ARIMA Models for FDI (Pre September 11 Scenario)**

| **Variables** | **Model -I** | | | **Model-II** | | |
|---|---|---|---|---|---|---|
| | **Coefficients** | **t-stat** | **P-value** | **Coefficients** | **t-stat** | **P-value** |
| *Constant* | 0.0836* | 5.9402 | 0.0000 | 0.0812* | 5.6579 | 0.0000 |
| $D_2$ | -0.0587* | -4.9845 | 0.0000 | -0.0577* | -4.7479 | 0.0000 |
| *D(EXR)* | -0.0976* | -5.7573 | 0.0000 | -0.0936* | -5.4774 | 0.0000 |
| *D(CPI)* | 0.0023** | 2.0053 | 0.0479 | 0.0021*** | 1.8744 | 0.0640 |
| *AR(1)* | 0.0874 | 0.3566 | 0.7221 | --- | --- | --- |
| *MA(4)* | 0.2994* | 3.566 | 0.0006 | 0.2655* | 3.1319 | 0.0023 |
| *MA(2)* | -0.4957** | -2.0770 | 0.0406 | -0.7135* | -7.3823 | 0.0000 |
| *MA(1)* | -0.7892* | -3.4644 | 0.0008 | -0.5366* | -4.1595 | 0.0001 |
| **Diagnostic Checks** | | | | | | |
| S.E. of regression | | 00.501 | | 00.498 | | |
| Log Likelihood | | -68.686 | | -69.296 | | |
| Durban-Watson Stat | | 01.978 | | 01.956 | | |
| Akaike info Criterion | | 01.534 | | 01.511 | | |
| Schwarz Criterion | | 01.742 | | 01.692 | | |
| F-Statistic | | 10.546 | | 12.343 | | |
| Probability | | 00.000 | | 00.000 | | |

| | | |
|---|---|---|
| Ljung–Box Q-stat[a]. | | |
| Q(5) | 03.298 | 03.521 (0.172) |
| | (0.069) | |
| Q(10) | 10.184 | 10.396 (0.167) |
| | (0.117) | |
| Q(15) | 15.036 | 15.457 (0.217) |
| | (0.181) | |
| $Q^2(5)$ | 03.836 | 03.485 (0.175) |
| | (0.050) | |
| $Q^2(10)$ | 13.331 | 14.339 (0.054) |
| | (0.038) | |
| $Q^2(15)$ | 15.349 | 16.671 (0.162) |
| | (0.167) | |
| Skewness | 0.236 | 0.250 |
| Kurtosis | 2.759 | 2.810 |
| Jarque–Bera test Prob. | 0.558 | 0.558 |

Notes: ( a ). Figures in parentheses are numbers of lags.

( b). *, ** and *** shows the significance at 1%, 5% and 10%level of Significance respectively.

From the results reported in Table-3 shows that in Model-I except the term AR(1), rest of the coefficients are statistically significant. The negative sign of $D_2$ shows the impact of non-democratic takeovers is severely bad on the FDI in Pakistan. Similarly the depreciation of the local currency also has a negative impact on FDI in pre September 11, 2001 scenario. However, the impact of CPI is positive which means that higher CPI will have a positive impact on FDI. The Ljung-Box (1978) Q-stats and the Breusch Godfrey Serial Correlation LM-Test, presented in Table-A1 in Appendix-A, shows the problem of autocorrelation which stimulates that we should improve our model

In Model-II, we have eliminated AR (1) term as it is insignificant in Model-I. All the variables in Model-II are also significant and the nature of impact of these variables on FDI is same as in Model-I. The S.E of regression, AIC and SBC have been improved as compared to Model-I. The problem of auto correlation has also been removed as indicated by the Ljung-Box Q-stats and Breusch Godfrey Serial Correlation LM-Test (Table A3). Moreover, the ARCH effect has also been removed as indicated by the ARCH-LM Test (Table-A4) and $Q^2$-Stats.

*3.2 Post September 11, 2001 Scenario*

In this part, the observations of after September 11, 2001 incident and subsequent war on terror period along with the pre-September 11, 2001 scenario are included to build a model for FDI. The same procedure has been adopted as of Pre-September 11, 2001 scenario. The results are reported in Table-4 and Table-5.

**Table 4: ANOVA Table by Step-wise Regression Analysis (Post September 11 Scenario)**

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 169117.014 | 1 | 169117.014 | 3725.180 | .000 |
| | Residual | 5538.599 | 122 | 45.398 | | |
| | Total | 174655.613 | 123 | | | |
| 2 | Regression | 172121.109 | 2 | 86060.554 | 4108.625 | .000 |
| | Residual | 2534.504 | 121 | 20.946 | | |
| | Total | 174655.613 | 123 | | | |
| 3 | Regression | 172365.166 | 3 | 57455.055 | 3010.157 | .000 |
| | Residual | 2290.447 | 120 | 19.087 | | |
| | Total | 174655.613 | 123 | | | |

**Table 5: Coefficients of model selection by Step-wise Regression (Post September 11 Scenario)**

| Model | | Un-standardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .092 | 1.145 | | .080 | .936 |
| | exchange rate | 1.977* | .032 | .984 | 61.034 | .000 |
| 2 | (Constant) | 2.289* | .799 | | 2.863 | .005 |
| | exchange rate | 1.781* | .027 | .886 | 64.864 | .000 |
| | consumer price index | .029* | .002 | .164 | 11.976 | .000 |
| 3 | (Constant) | 4.017* | .903 | | 4.447 | .000 |
| | exchange rate | 1.778* | .026 | .885 | 67.829 | .000 |
| | consumer price index | .030* | .002 | .168 | 12.803 | .000 |
| | dummy Democratic/Non-Democratic | -2.881* | .806 | -.038 | -3.576 | .001 |
| Note: * shows the significance at 1% level of Significance. | | | | | | |

The results show that the dummy variable for September 11, 2001 has been eliminated and the significance and nature of EXR and CPI is same as in the case in pre-September 11 scenario. However, there is also a problem of autocorrelation and presence of ARCH effect in this model and the value of $R^2$ is also found to be greater than the value of Durbin Watson d-statistic which is an indication of spurious regression We then tried ARIMA models (which are not reported in this paper) but the problem of ARCH effect could not be sorted out and finally the GARCH type models are employed to effectively overcome this problem. Various GARCH models were tried out but only two are reported here.

The results are reported in Table-6, the mean equation of Model-I show that all the parameters estimated are statistically significant at 5% level of significance. The variable $D_2$ has negative significant impact which means that the transition from Democratic to Non-Democratic government causes decrease in FDI. Same is the case with exchange rate. By increasing the EXR, depreciating local currency, the FDI is decreased. However, $D_1$ has a positive significant impact, which indicates that inflows of FDI in Pakistan have been increased due to the September 11, 2001 incident and on-going war against terrorism.

The variance equation of this model has some problems. The negative insignificant ARCH term indicates improper specification of the model and needs improvement. The low value of Durbin-Watson statistic (1.5362) and Ljung Box Q-statistic shows the presence of autocorrelation. Moreover, Table B-1 in Appendix-B shows significant ARCH effect at lag 2.

**Table 6: Results of GARCH Models for FDI (Post September 11 Scenario)**

| Variables | Model -I | | | Model-II | | |
|---|---|---|---|---|---|---|
| | **Coefficients** | **Z-stat** | **P-value** | **Coefficients** | **Z-stat** | **P-value** |
| **Mean Equation** | | | | | | |
| Constant | 0.0562* | 3.1741 | 0.0015 | 0.0264 | 1.5861 | 0.1127 |
| $D_1$ | 0.0594** | 2.1018 | 0.0356 | --- | --- | --- |
| $D_2$ | -0.0369** | -2.1412 | 0.0323 | --- | --- | --- |
| D(EXR) | -0.0621* | -5.1402 | 0.0000 | -0.0476*** | -1.6199 | 0.1053 |
| AR(2) | -0.3785* | -4.1020 | 0.0000 | -0.4125* | -4.5828 | 0.0000 |
| AR(8) | --- | --- | --- | 0.3203* | 4.3577 | 0.0000 |
| MA(1) | -0.8849* | -16.775 | 0.0000 | -0.5164* | -5.6143 | 0.0000 |
| MA(3) | --- | --- | --- | -0.2511* | -3.5361 | 0.0004 |
| **Variance Equation** | | | | | | |
| Constant | 0.0533** | 2.2308 | 0.0257 | 0.0357 | 1.3577 | 0.1746 |
| $\alpha(ARCH)$ | -0.0294 | -0.6332 | 0.5266 | 0.1974** | 1.9704 | 0.0488 |
| $\beta(GARCH)$ | 0.9985* | 12.3582 | 0.0000 | 0.6611* | 3.8443 | 0.0001 |
| $D_1$ | 0.1495* | 2.6205 | 0.0088 | 0.2396** | 1.9395 | 0.0524 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $D_2$ | -0.0389** | -2.3297 | 0.0198 | --- | --- | --- |
| D(EXR) | -0.0418* | -2.6331 | 0.0085 | --- | --- | --- |
| D(CPI) | -0.0023* | -2.9843 | 0.0028 | -0.0016* | -4.8965 | 0.0000 |
| **Diagnostic Checks** | | | | | | |
| S.E. of regression | | 0.6454 | | 0.6104 | | |
| Log Likelihood | | -90.2642 | | -84.3670 | | |

**Table 6: Continued…**

| | | |
|---|---|---|
| Durban-Watson Stat | 1.5362 | 2.0578 |
| Akaike info Criterion | 1.7211 | 1.7183 |
| Schwarz Criterion | 2.0230 | 1.9868 |
| F-Statistic | 4.6055 | 6.0043 |
| Probability | 0.0000 | 0.0000 |
| Ljung–Box Q-stat[a]. | | |
| Q(5) | 8.8203 (0.032) | 2.9096 (0.088) |
| Q(10) | 18.629 (0.017) | 6.2737 (0.393) |
| Q(15) | 26.559 (0.014) | 14.371 (0.213) |
| $Q^2(5)$ | 07.957 (0.047) | 0.7788 (0.378) |
| $Q^2(10)$ | 12.814 (0.118) | 6.4423 (0.332) |
| $Q^2(15)$ | 16.203 (0.238) | 9.3774 (0.587) |
| Skewness | 0.292 | 0.268 |
| Kurtosis | 2.745 | 3.091 |
| Jarque–Bera test Prob. | 0.361 | 0.502 |

Notes: (a). Figures in parentheses are numbers of lags.

(b)*, ** and *** shows the significance at 1%, 5% and 10%level of Significance respectively.

All the above illustrations show that the model is to be re-specified. So, after some experimentation which is not reported here due to the length of the study, Model-II (Table. 6) has been fitted. The results show that the AR(2), AR(8), MA(1) and MA(3) are highly significant at 1% level while the D(EXR) is significant at 10% level of significance in mean equation. Negative sign of D (EXR) presents the inverse relationship of it with FDI. It means that if the Pak Rupee is depreciated by one unit there will be 0.047 million US $ less foreign investment in Pakistan. The model satisfies the diagnostic checks as shown in Table-6 and Table B-2 in Appendix-B.

In variance equation we see that all the variables are significant at 5% level of significance except the constant term. The variable $D_1$ indicates that due to September, 11

incident and on-going war on terror, the volatility in foreign direct investment is increased by 0.239. Moreover, negative sign of D (CPI) indicates that the volatility in foreign direct investment is decreases by 0.001 due to CPI.

The S.E of regression and the sum of squared residuals of this model is less than that of previous model-I. Moreover, AIC and SBC and Log Likelihood have also been improved. The ARCH and GARCH effects, both are positive and significant, indicating the satisfaction of standard test of robustness of the Model-II. The GARCH effect $(\beta = 0.661)$ is comparatively a bit higher than the ARCH effect $(\alpha = 0.197)$ which describes that the shocks to the conditional variances are quite persistent. Furthermore, the model is showing stability as the sum of ARCH and GARCH terms is less than one, that is $(\alpha + \beta \leq 1)$.

**4. Conclusion and Recommendations**

The step-wise regression is used to get an idea about the relationship between the variables and for the justification of using auto-regression models. We tried to overcome the problem of auto-correlation and hetroskedastic residuals that we face during fitting step-wise regression but the problem could not be fully resolved which stimulates us to use GARCH models.

The GARCH models resolve the problem and the findings suggest us that: (i) Foreign Exchange Rate have a negative impact on the foreign direct investment as reflected by the mean equation of the GARCH model. The impact of exchange rate on foreign direct investment is a controversial subject in literature but in our case the results support the theory that it has a negative impact. The reason of its negative impact could be the fact that in Pakistan the investment is not export oriented and if the local currency depreciates, the cost of production escalates which minimizes the profitability of the foreign investors. Moreover, the depreciation of currency gives rise to inflation and purchasing power of the buyers decreases that effects the selling and thereby the profits of the investors and they feel reluctant to further investment; (ii) Most of the investment is related to the past trends as indicated by the mean equation which includes a relatively higher order of autoregressive terms. So, the past investments trends does effect the future investments; (iii) The stability condition is also satisfied and the volatility shocks are quite constant; (iv) Higher value of GARCH coefficient as compared to ARCH coefficient term in variance equation indicates that the volatility shocks takes relatively a long time to die out; (v) September 11, 2001 and thereafter war on terror has increased the conditional volatility of foreign direct investment as indicated by the variance equation of the GARCH Model and it is also supported by the model fitted on the data before September 11, 2001 where we do not face the problem of auto-regressive conditional hetroskedasticity and ARIMA models are adequate; (vi) although CPI decreases the conditional volatility and has a highly significant impact but takes value close to zero.; (vii) one interesting finding of this study is the impact of Non-Democratic government before September, 11 scenario was severely bad on foreign direct investment but with the inclusion of data of post September, 11 the variable becomes insignificant and thus was eliminated from the mean and variance equation of the GARCH model. This might be due to the fact that in last Non-Democratic regime the foreign investors were attracted by the fast growth of some sectors like telecommunications, information technology etc. and the investment volume was increased substantially in these sectors.

There are some policy implications of this study which can be useful in attraction of foreign direct investment in Pakistan. The State bank of Pakistan should strictly monitor the foreign exchange rate and should take necessary steps to stop the depreciation and to stabilize the local currency against dollar in order to build the confidence of the foreign investors moreover, the continuous depreciation in local currency give rise to inflation. The non-democratic takeovers also increase the volatility in foreign direct investment therefore these should be avoided.

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## Appendix-A

**Table A1: Breusch Godfrey Serial Correlation LM-Test (Model-I) for pre-September, 11 Scenario**

| | | | |
|---|---|---|---|
| **Lags 1** | | | |
| F-Statistics | 0.377 | Probability | 0.540 |
| Obs* R-squared | 0.399 | Probability | 0.527 |
| **Lags 2** | | | |
| F-Statistics | 0.365 | Probability | 0.695 |
| Obs* R-squared | 0.790 | Probability | 0.673 |
| **Lags 3** | | | |
| F-Statistics | 0.281 | Probability | 0.838 |
| Obs* R-squared | 0.927 | Probability | 0.818 |
| **Lags 4** | | | |
| F-Statistics | 2.293 | Probability | 0.065 |
| Obs* R-squared | 9.427 | Probability | 0.051 |
| **Lag 5** | | | |
| F-Statistics | 2.172 | Probability | 0.064 |
| Obs* R-squared | 11.082 | Probability | 0.049 |

**Table A2: ARCH Test (Model-I) for Pre-September, 11 Scenario**

| | | | |
|---|---|---|---|
| **Lags 1** | | | |
| F-Statistics | 1.457 | Probability | 0.230 |
| Obs* R-squared | 1.465 | Probability | 0.225 |
| **Lags 2** | | | |
| F-Statistics | 1.433 | Probability | 0.243 |
| Obs* R-squared | 2.870 | Probability | 0.238 |
| **Lags 3** | | | |
| F-Statistics | 1.113 | Probability | 0.347 |
| Obs* R-squared | 3.364 | Probability | 0.338 |
| **Lags 4** | | | |
| F-Statistics | 0.895 | Probability | 0.469 |
| Obs* R-squared | 3.636 | Probability | 0.457 |
| **Lags 5** | | | |
| F-Statistics | 0.730 | Probability | 0.602 |
| Obs* R-squared | 3.747 | Probability | 0.586 |

**Table A3: Breusch Godfrey Serial Correlation LM-Test (Model-2) for pre-September, 11 Scenario**

| | | | |
|---|---|---|---|
| **Lags 1** | | | |
| F-Statistics | 0.066 | Probability | 0.797 |
| Obs* R-squared | 0.049 | Probability | 0.823 |
| **Lags 2** | | | |
| F-Statistics | 0.161 | Probability | 0.851 |
| Obs* R-squared | 0.329 | Probability | 0.848 |
| **Lags 3** | | | |
| F-Statistics | 0.126 | Probability | 0.944 |
| Obs* R-squared | 0.395 | Probability | 0.941 |
| **Lags 4** | | | |
| F-Statistics | 2.235 | Probability | 0.071 |
| Obs* R-squared | 9.108 | Probability | 0.058 |
| **Lags 5** | | | |
| F-Statistics | 1.932 | Probability | 0.096 |
| Obs* R-squared | 9.872 | Probability | 0.078 |

**Table A4: ARCH Test (Model-II) for Pre- September, 11**

| | | | |
|---|---|---|---|
| **Lags 1** | | | |
| F-Statistics | 1.490 | Probability | 0.225 |
| Obs* R-squared | 1.498 | Probability | 0.220 |
| **Lags 2** | | | |
| F-Statistics | 1.296 | Probability | 0.278 |
| Obs* R-squared | 2.603 | Probability | 0.272 |
| **Lags 3** | | | |
| F-Statistics | 0.997 | Probability | 0.397 |
| Obs* R-squared | 3.024 | Probability | 0.387 |
| **Lags 4** | | | |
| F-Statistics | 0.815 | Probability | 0.518 |
| Obs* R-squared | 3.322 | Probability | 0.505 |
| **Lags 5** | | | |
| F-Statistics | 0.644 | Probability | 0.666 |
| Obs* R-squared | 3.318 | Probability | 0.6510 |

## Appendix-B

**Table B1: ARCH Test (Model-I) for Post-September 11, 2001 Scenario**

| | | | |
|---|---|---|---|
| **Lags 1** | | | |
| F-Statistics | 1.732 | Probability | 0.196 |
| Obs* R-squared | 1.736 | Probability | 0.187 |
| **Lags 2** | | | |
| F-Statistics | 2.713 | Probability | 0.070 |
| Obs* R-squared | 5.317 | Probability | 0.070 |
| **Lags 3** | | | |
| F-Statistics | 1.913 | Probability | 0.128 |
| Obs* R-squared | 5.707 | Probability | 0.126 |
| **Lags 4** | | | |
| F-Statistics | 1.423 | Probability | 0.231 |
| Obs* R-squared | 5.658 | Probability | 0.226 |
| **Lags 5** | | | |
| F-Statistics | 1.555 | Probability | 0.178 |
| Obs* R-squared | 7.656 | Probability | 0.176 |

**Table B2: ARCH Test (Model-II) for Post-September 11, 2001 Scenario**

| | | | |
|---|---|---|---|
| **Lags 1** | | | |
| F-Statistics | 0.0085 | Probability | 0.926 |
| Obs* R-squared | 0.0086 | Probability | 0.925 |
| **Lags 2** | | | |
| F-Statistics | 0.0397 | Probability | 0.961 |
| Obs* R-squared | 0.0817 | Probability | 0.959 |
| **Lags 3** | | | |
| F-Statistics | 0.0976 | Probability | 0.9611 |
| Obs* R-squared | 0.303 | Probability | 0.959 |
| **Lags 4** | | | |
| F-Statistics | 0.1067 | Probability | 0.979 |
| Obs* R-squared | 0.4459 | Probability | 0.978 |
| **Lags 5** | | | |
| F-Statistics | 0.1971 | Probability | 0.962 |
| Obs* R-squared | 1.0344 | Probability | 0.959 |