Macroeconomic uncertainty and FDI in developing countries

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Abstract. *In this research analysis, the main aspect is to estimate the macroeconomic uncertainty and its impact on Foreign Direct Investment. Keeping in view of the rising importance of developing countries in attracting Foreign Direct Investment (FDI), this study has included 28 developing countries for the empirical analysis. At first, Macroeconomic uncertainty is measured with the help of conditional variance technique i.e. ARCH (GARCH). After measuring the macroeconomic uncertainty, impact of macroeconomic uncertainty along with other macroeconomic variables on the FDI flow is analyzed. Relying on the non-dynamic panel threshold model, the presence of single threshold value is found. The impact of macroeconomic uncertainty on FDI is found to be varied with the change in the level of income of the concerned host country. Others factors like GDP growth, Trade Openness and FDI stock are found to be statistically significant in influencing FDI flow towards an economy.*

Keywords: macroeconomic uncertainty, ARCH (GACRH), Foreign Direct Investment (FDI), developing countries.

JEL Classification: F23, D81.

1. Introduction

Investment kicks off the development process. For a country, the source of investment may be from domestic sources or from abroad. Foreign Capital bridges the gap between required capital and available domestic saving of a country. Foreign Direct Investment (FDI) is one of the major forms of foreign capital. The Organization for Economic Co-operation and Development (OECD) defines FDI as the reported amount corresponding to cross-border equity transactions between residents and non-residents which qualify as FDI (i.e. ownership of at least 10 percent of voting power). It is a form of investment in which business ownership in one country is controlled by the entity in another country. The country from which investment originates is known as home country and the country where the investment settles in is known as host country. FDI being a non-debt form of international capital, has several advantages vis-à-vis the other forms of international capital. FDI involves active participation in management, joint-venture, transfer of technology and expertise. The role of FDI is tremendous in terms of capital stock, employment generation, productivity and technological transfers as emphasized by Bénassy-Quéré, Fontagné and Lahrèche-Révil (2001), Goldberg and Klein (1997) and Kiyota and Urata (2004). FDI is found to be less volatile than portfolio investment in the study carried out by Albuquerque (2003). Since FDI is a stable form of international capital it is preferred over Foreign Portfolio investment. Due to the characteristics of a stable international fund it is welcomed by the policy maker and government.

The reason to invest away from the home country is not unique. Some decisions are influenced by the availability of natural resources of the host country while some others are intended to avoid high tariff rate. Some studies disaggregate the FDI into different types like horizontal and vertical FDI and analyze them as such. In this research analysis, no distinction is made regarding the types of FDI and hence aggregate FDI inflow is taken into consideration.

The world is becoming more integrated than before. The need of FDI is more in countries with developing nature. Developing countries, which are more desperate to achieve higher growth rate are following policy framework so as to provide enough competitive advantage for multinationals. Capital inflow is viewed as the as the solution to various problems that developing countries often encounter.

Historically, developed countries were the major recipients of FDI inflow. The trend has changed and developing countries have been attracting a big chunk of FDI share. The United Nations Conference on Trade and Development (UNCTAD) report of 2013 confirms the fact that more than half of the global FDI is shared by the developing countries.

Over the years many theoretical developments have taken place in the field of international capital. The most popular theoretical approach is OLI or eclectic approach. Dunning (1973, 1980) developed OLI approach. The Ownership, Location and Internalization advantages are the factors why a country invests away from home country. Ownership advantages comprise of factors like firm specific assets, patent as well as

sophisticated management skills. Locational advantages are the host country specific advantages. Internalization benefit is reaped if a firm saves cost of transportation.

However, Locational factors of the host country have been the most important aspects and also the center theme of many empirical works over the years. Stable macroeconomic scenario reduces production and transaction cost of multinationals and act as an incentive to operate in the host country. Macroeconomic factors are the Locational factors of the host country and they do matter for the investment decision, macroeconomics uncertainty and macroeconomic variables need a revisit in describing the FDI flow towards developing countries. To assess the impact of potential variables on FDI in developing countries, 28 developing countries are selected for the purpose. These countries come under the developing country classification of UNCTAD. The inclusion of these countries is due to the availability of required data and off course the developing nature of the economy. Countries selected for the study are Algeria, The Bahamas, Bahrain, Bangladesh, Bolivia, Brazil, Burkina Faso, Cambodia, Costa Rica, Guatemala, Honduras, India, Jordan, Kuwait, Laos, Malaysia, Mauritania, Mongolia, Niger, Nigeria, Pakistan, Paraguay, The Philippines, Saudi Arabia, Singapore, Togo, Trinidad and Tobago and Turkey.

In this study an attempt is made to measure the macroeconomic uncertainty of the each host country. After measuring the macroeconomic uncertainty, the impact of macro-economic uncertainty along with GDP growth, trade openness, FDI stock position and exchange rate of the host country on Foreign Direct Investment are analyzed. To measure the macroeconomic uncertainty, conditional variance technique is used. And to assess the impact of variables on Inward Foreign Direct Investment non-dynamic panel data technique is used.

2. Review of literature

There is plethora of research work which focuses on the reason behind the inflow of FDI towards a particular economy. In this section, earlier works related to macroeconomic uncertainty and other macroeconomic variables on FDI inflow are analyzed.

Xing (2006) in his seminal work has concluded the very fact that real exchange rate is one of the significant variable determining the FDI in Chinese manufacturing sectors from 1981 to 2002.

Klein and Rosengren (1994) find a significant correlation between FDI towards the USA and its real exchange rate. Their study proves a point for seven industrial countries and the period spanning 1979-1991. Their work also points out that the relative wage does not have a significant impact on the determinants of United States' FDI.

Baek and Okawa (2001) investigate the appreciation of yen against the Asian currencies and the US dollar significantly increases Japanese FDI in Asia. They found that high wage rate and import tariff rate in the host country negatively affect Japanese FDI in Asia.

Frenkel et al. (2004) make use of Panel data approach and consider both host and home country factors which play important role in deciding both the amount of capital flow as well as the destination of foreign capital. Home GDP growth is found to be positive and significant in explaining FDI inflow from home to host country. Business cycle of the home country also matters on the decision to invest fund away from home country.

Asiedu (2002) assesses the importance of return on capital along with other determinants that explains capital flow towards different economies. Return on capital is measured as the inverse of the per capita real GDP. This basically implies that other things being equal countries with lower per capita income will yield a higher return and vice versa.

Taking Cambodia as the sample country, Cuyvers et al. (2011) find larger market size at home tends to expand FDI flows towards Cambodian economy. The argument for this is that larger country likely to have more number of firms and those firms expand its business into the international market.

Billington (1999) argues that high GDP, as well as economic growth, positively influence FDI inflows.

Sharifi-Renani and Mirfatah (2012) have investigated the determinants of inward FDI, especially volatility of exchange rate and suggest better measures for attracting FDI in Iran. Their work concludes that GDP, trade openness and exchange rate to have positive relationship with FDI, but volatility of exchange rate and world crude oil prices negatively affect the FDI.

Takagi and Shi (2011) critically survey the link between exchange rate movements on the quantum of FDI. Depreciation of exchange rate impacts positively to the inward FDI movement, however, exchange rate volatility discourages FDI inflow.

Bozozowski (2003) clearly shows the relevance of the size of the host country and the previous level of FDI in affecting the FDI inflow. However, the result finds no evidence of the effect of exchange rate uncertainty on FDI inflow.

Oluseye (2010) concentrates on the factors like policy uncertainty and macroeconomic environment and its bearing on FDI inflow in the case of Nigeria by employing time series data from 1970 to 2010. The author finds negative influence of exchange rate variability on Inward Foreign Direct Investment (IFDI). Lag exchange rate variability and inflation variability are also found to be statistically significant and deter IFDI.

In an analysis of 19 Latin American and Asian countries, Al Nasser (2007) finds macroeconomic stability as one of the variables that affect FDI inflow. Aizenman and Marion (1995) find a negative relation between economic instability and private investment.

Serven and Solimano (1993) made use of panel data technique to ascertain the linkage among different measures of variability and investment. Standard deviation of inflation and real exchange rate were used to measure the variability. These variability measures were found to affect investment negatively.

Solomon and Ruiz (2012) find negative impact of inflation on inward FDI. Openness is found to be positive and significant in explaining the inward FDI. Exchange rate uncertainties, measured by the GARCH variance equation and political risk have negative bearing on the capital flow. One year lag FDI is also found to be positively significant in describing the present FDI flow.

The nature of FDI is still unanswered due to various reasons. The reasons are: the nature of data, country differences or due to less time series observation. There are various factors that tend to attract FDI into an economy. Many studies concentrate on the factors that drive FDI into an economy. However, Factors related to disfavor or undesired situation in the host also have an impact in the degree and dimension of international capital flow, in the form of FDI. Study of Dunning (2009) pointed out lack of research attention on the macroeconomic factors of the host country. The aim of the study is to assess the importance of macroeconomic factors and its influence on FDI decision.

3. Methodology

First of all, macroeconomic uncertainty of the concerned host countries is measured by the ARCH (GARCH) model followed by the assessment of its impact along with other relevant variables on Foreign Direct Investment with the help of non-dynamic panel estimation.

3.1. Measurement of macroeconomic uncertainty

Since two countries are involved in the process of Foreign Direct Investment, investment flows are sensitive to exchange rate movement and believed to influence the investment between countries. Considering exchange rate as the most important macroeconomic variable with respect to FDI decision, a variation of the same is taken as the proxy to measure macroeconomic uncertainty.

Most early literature work used standard deviation or variance as a measure to approximate uncertainty which assumes the unconditional measure of volatility. An unconditional measure of volatility like variance or rolling variance has its own disadvantage to gauge uncertainty as pointed out by Solomon and Ruiz (2012). Conditional variance is preferred to unconditional variance due to its capability to capture unexpected volatility (Diebold and Nerlove, 1989; Bera and Higgins, 1993; Carruth et al., 2000) and hence ARCH (GARCH) model is used for measuring exchange rate uncertainty which is the proxy for measuring macroeconomic uncertainty. To measure the conditional variance of exchange rate monthly exchange rate data from 1996:M1 to 2013:M12 is taken into consideration. During the period of study, each country is believed to operate under flexible exchange rate system. After calculating the monthly conditional variance with the help of ARCH (GARCH) models they are averaged to form the annual series so as to match with annual data series for further econometric exercise.

Augmented Dickey-Fuller (ADF) test confirms that the Exchange rate change which is the percentage change of REER index is found to be stationary at level with an intercept

at 1 percent level of significance in all the country cases. The lag length of the ADF test is determined by the Schwarz Information Criterion (SIC).

3.2. ARCH (GARCH) model

ARCH (GARCH) models deal with conditional variance measurement. ARCH (GARCH) models deal with the volatility of time series data. Many time series follow a pattern in which large variation is followed by large variation and vice versa.

ARCH models suggest that variance of the residual at a given time period depends on the squared error terms from past period. If the possibility of constant variance is limiting then it is better to model the mean and the variance equation simultaneously.

Conditional mean of the time series is estimated by the mean equation. Mean and variance equations are simultaneously estimated by the process of iteration. Mean equation can be modelled by an autoregressive (AR) process or pure time series process that is Autoregressive Integrated Moving Average (ARIMA) or AR process with the option of including other explanatory variables. In this case, mean equation is modelled by an ARMA process. Following Lemi and Asefa (2001), after obtaining the monthly ARCH (GARCH) variance series they are averaged annually to make annual frequency for further econometric analysis.

Mean and variance equation of ARCH (1) Model

$$Y_t = \alpha + \beta' X_t + \varepsilon_t \tag{3.1}$$

Where X_t is a vector of n × k dimension and β' is a k ×1 vector of coefficient.

$$\varepsilon_t \sim iid\ N(0, \sigma^2)$$

Error term is assumed to be independently distributed with a zero mean and constant variance.

$$\varepsilon_t | \ \Omega_t \sim iidN\ (0, \delta^2{}_t)$$

Where Ω_t is the set of information.

Engle modeled the variance of residual (σ^2) in the following way:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 \tag{3.2}$$

The equation (3.1) is called mean and (3.2) is called variance equation. Equations of ARCH (1) model clearly reveals that a big shock at past error term likely to influence the present error term. ARCH estimation is done by the method of iteration.

GARCH Model

Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is an extension of ARCH model.

The GARCH (1, 1) model:

$$Y_t = \alpha + \beta'X_t + \varepsilon_t \qquad (3.3)$$

Where, $\varepsilon_t | \Omega_t \sim iidN(0, \delta_t^2)$

$$\delta_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \delta_{t-1}^2 \qquad (3.4)$$

Mean and variance equation

Depending on the nature of each time series different ARMA specification is used to model the mean equation of exchange rate change. GARCH (1, 1) model is found to be fit in most of the country cases. In a few country cases, the ARCH model is found to be the best fit. According to Bollerslev et al. (1992), conditional variance is well represented by the GARCH (1,1). The presence of ARCH effect in the residual of the each time series is confirmed by ARCH LM test. The significance of Mean equation specifications as well as the variance equation coefficients is reported in Table 1.

Table 1. *Variance equation coefficients of ARCH (GARCH)*

Country	ARMA Model	ARCH (GARCH) Specification	Variance Equation Coefficients		
Algeria	C AR(1) AR(3)	GARCH (1,1)		Coefficient	P-value
			α_1	0.297403	0.0339
			$\delta 1$	0.491327	0.0082
The Bahamas	C AR(1)	GARCH (1,1)		Coefficient	P-value
			α_1	0.050400	0.1029
			$\delta 1$	0.826470	0.0000
Bahrain	C AR(1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.035040	0.3091
			$\delta 1$	0.853906	0.0000
Bangladesh	CAR(1) AR (2)	ARCH 2		Coefficient	P-value
			α_1	0.022448	0.7511
			α_2	0.188471	0.0661
Bolivia	C AR(1) AR(2)	ARCH1		Coefficient	P-value
			α_1	0.181411	0.0015
Brazil	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.285303	0.0353
			$\delta 1$	0.489610	0.0151
Burkina Faso	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.144137	0.0668
			$\delta 1$	0.273171	0.5563
Cambodia	C AR(1) AR(2)	GARCH(1,1)		Coefficient	P-value
			α_1	0.143534	0.0309
			$\delta 1$	0.756257	0.0000
Costa Rica	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.116104	0.1110
			$\delta 1$	0.759287	0.0000
Guatemala	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.220662	0.0006
			$\delta 1$	0.741857	0.0000
Honduras	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.194874	0.0027
			$\delta 1$	0.707146	0.0000
India	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.048574	0.2566
			$\delta 1$	0.651790	0.0000

Country	ARMA Model	ARCH (GARCH) Specification	Variance Equation Coefficients		
Jordan	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.035856	0.2465
			$\delta 1$	0.845724	0.0000
Kuwait	C AR(1) AR(2)	GARCH(1,1)		Coefficient	P-value
			α_1	0.055772	0.0956
			$\delta 1$	0.865881	0.0000
Laos	C AR(1) MA (5)	GARCH(1,1)		Coefficient	P-value
			α_1	0.262593	0.0001
			$\delta 1$	0.733008	0.0000
Malaysia	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.378816	0.0000
			$\delta 1$	0.574101	0.0000
Mauritania	C AR(1) AR(2)	GARCH(1,1)		Coefficient	P-value
			α_1	0.082372	0.0639
			$\delta 1$	0.709979	0.0005
Mongolia	C AR(1) MA(1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.232521	0.0095
			$\delta 1$	0.763488	0.0000
Niger	C AR(1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.090247	0.1267
			$\delta 1$	0.741981	0.0000
Nigeria	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.237065	0.0003
			$\delta 1$	0.728387	0.0000
Pakistan	C AR(1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.124119	0.0342
			$\delta 1$	0.762193	0.0000
Paraguay	C AR(1) MA (1)	ARCH1		Coefficient	P-value
			α_1	0.269281	0.0103
The Philippines	C AR(1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.141534	0.0000
			$\delta 1$	0.798016	0.0000
Saudi Arabia	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.031582	0.3254
			$\delta 1$	0.900025	0.0000
Singapore	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.083215	0.0725
			$\delta 1$	0.772834	0.0000
Togo	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.062272	0.0374
			$\delta 1$	0.884559	0.0000
Trinidad and Tobago	C AR(1) MA (1)	GARCH(1,1)		Coefficient	P-value
			α_1	0.147726	0.0081
			$\delta 1$	0.762396	0.0000
Turkey	C AR(1) AR(2)	GARCH(1,1)		Coefficient	P-value
			α_1	0.190766	0.0036
			$\delta 1$	0.802401	0.0000

All ARCH (GARCH) parameters are found to be positive. The sum of variance equation coefficients which represents the shock to conditional variance is less than one in all the country cases.

After estimating the macroeconomic uncertainty the next step is to assess the impact of macroeconomic uncertainty along with other relevant variables on FDI flow. To serve the purpose non-dynamic panel estimation of Bruce E. Hansen is carried out. This estimation

is panel data estimation and tries to ascertain the number of threshold in the threshold variable. In order to look at how FDI responds to change in income level, Gross Domestic Product per capita at Purchasing Power Parity (PPP) is the threshold variable of the study.

4. Estimation

To assess the influence of macroeconomic uncertainty and other macroeconomic variables on FDI Hansen's (1999) non-dynamic panel data model is used. Basically this analysis makes use of "pdR" package in R software which is an extension of Hansen's original model.

4.1. Bruce E. Hansen's non-dynamic panel estimation

Hansen's non-dynamic panel estimation is a threshold regression model. Fixed effect transformation is used to estimate threshold value and regression slope coefficients. Threshold regression technique is useful in cases where a sample fall into discrete classes. It means the regression function is not identical across a sample. In the threshold regression observations are classified into different groups depending on the threshold value. Confidence interval of the parameter is derived from asymptotic distribution theory. Bootstrap technique is used to test the statistical significance of threshold value. In this research analysis, threshold model is estimated to investigate whether income level which is the per capita GDP at PPP terms of corresponding host country affect the inward FDI inflow.

4.2. "pdR" package in R

This analysis has made use of "pdR" package in "R" software which is an extension of Hansen's non-dynamic panel model. Explanatory variables can be classified as regime-dependent and regime-independent variables. If an explanatory variable is assumed to be regime- dependent it means the variable influence the dependent variable differently in each regime. In each regime the regression slope coefficients are different. If an explanatory variable is classified as regime-independent variable it means the influence of the explanatory variable does not change throughout the regimes. The "ptm" function in this "pdR" package allows incorporating more than one regime-dependent independent variable unlike the Hansen's original code which allows only one regime-dependent variable. Two regime-dependent variables are taken into consideration for the analysis. In this analysis, GDP per capita at Purchasing Power Parity (LnGDPPPP) and Macroeconomic uncertainty (Garchvar) are considered as the regime-dependent variable. It means depending on the regime both variables will have a different influence on the dependent variable.

The sample consists of 28 developing country and the time period for each cross section ranges from 1997 to 2014. The selection of time period is basically due to the emergence of World Trade Organization (WTO) as an international trade regulator.

4.3. Assessment of threshold effect

With the help of Hansen's (1999) non-dynamic panel data model, number of threshold is estimated. In this model, the whole sample can be divided into different subsamples depending on the value of a variable. The variable on the basis of which the whole sample can be divided is called the threshold variable. It is basically dividing individual observations on the basis of an observed variable. The division of sample into subsamples relies on whether the threshold variable is smaller or larger than the threshold value. Threshold variable is assumed to be time variant. If one threshold value is found to be significant then the sample is divided into two sub samples. If the presence of two threshold values are found then the sample is divided into three subsamples and so on. These subsamples are also called regimes.

Threshold estimation

Single threshold Equation:

$$Y_{it} = \mu_i + \beta_1' x_{it} \, I(q_{it} \leq \gamma) + \beta_1' x_{it} \, I(q_{it} > \gamma) + e_{it} \tag{4.1}$$

Subscript i refers to cross section identity and t refers to time series; ($1 \leq i \leq n$, $1 \leq t \leq T$)
Y_{it} is the dependent variable that is FDI inflow in terms of percentage of GDP is a scalar.
q_{it} is the threshold variable.
x_{it} is a K vector regressor.
I(.) is an indicator function.
e_{it} is the error term.

The error term is assumed to be independent and identically distributed with zero mean and finite variance. The analysis is asymptotic with given T (time series) and infinite N (cross section). The assumption of independent and identically distributed error term excludes the possibility of inclusion of lagged dependent variable as an explanatory variable.

The equation (4.1) can be written as following:

$$Y_{it} = \begin{cases} \mu_{it} + \beta_1' x_{it} + e_{it,} \ q_{it} \leq \gamma, \\ \mu_{it} + \beta_2' x_{it} + e_{it,} q_{it} > \gamma, \end{cases}$$

The equation (4.1) can also be written in the following compact form.

$$x_{it}(\gamma) = \begin{pmatrix} x_{it} \, I \, (q_{it} \leq \gamma) \\ x_{it} I \, (q_{it} > \gamma) \end{pmatrix}$$

And $\beta = (\beta_1' \beta_2')'$ so that equation (4.1) becomes

$$Y_{it} = \mu_i + \beta_1' x_{it}(\gamma) + e_{it.} \tag{4.2}$$

The evidence of no threshold is same as the linear constraint $\beta_1 = \beta_2$. The null of no threshold effect is tested by bootstrap method. Bootstrap technique is asymptotically valid. In fact, bootstrap technique tests the statistical significance of LR statistics. Null hypothesis is rejected if the estimated p-value is smaller than the critical value.

5. Result

Relying on the non-dynamic panel estimation of Hansen following result is obtained.

Table 2. *Result of threshold effects*

Test for single threshold

Likelihood ratio test of first threshold	57.43
P- value	0.04
(10%,5% ,1% critical values	48.77, 56.48, 88.65

Test for double threshold

Likelihood ratio test of second threshold	15.55
P- value	0.76
(10%,5% ,1% critical values	32.07, 36.62, 60.30

The number of threshold is determined by moving sequentially from zero, one and two thresholds. Likelihood-ratio test for the single threshold is statistically significant with a bootstrap p-value of 0.04. It means the null of no threshold value is rejected at 5 percent level of significance. The null of no threshold effect is rejected after 100 bootstrap replications. The test for double threshold is statistically insignificant with a bootstrap p-value of 0.76.

From the above finding, presence of single threshold in the regression relationship is confirmed. Likelihood-ratio of single threshold is reported in Figure 1. The threshold value is found to be 8.8973. Since the threshold value is in natural logarithm, anti-logarithm of the same will provides the exact level of GDP per capita PPP level at which presence of threshold is found. The exact level of GDP per capita, PPP at 2011 international dollar is calculated to be 7312.2039. Due to the presence of single threshold value the whole sample is divided into two regimes and subsequently coefficients are estimated.

Figure 1. *Confidence interval construction in single threshold model*
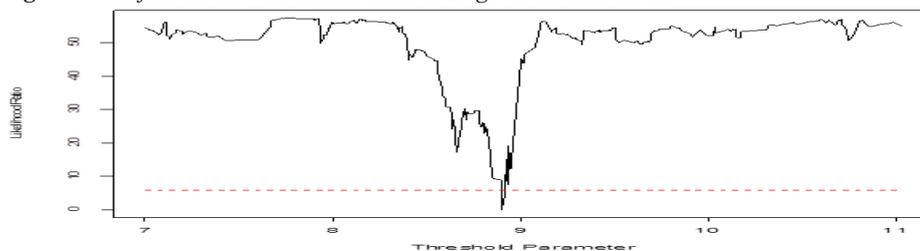
5.1. Impact of macroeconomic uncertainty and other macroeconomic variables on FDI

After finding out the number of threshold the next move is to analyze the macroeconomic factor and its influence on the inward Foreign Direct Investment (FDI).

Variables of the study

The dependent variable of the study is net FDI which is measured as the percentage of the corresponding GDP. Net FDI is defined as new investment less disinvestment.

Explanatory variables of the study are GDP growth, trade openness, exchange rate, FDI stock, macroeconomic uncertainty and Gross Domestic Product (GDP) per capita at Purchasing Power Parity (PPP).

Annual frequencies of variables are employed in the study**.** ARCH (GARCH) model is employed on Monthly change of REER index to find out the exchange rate uncertainty which is the proxy for macroeconomic uncertainty. After calculating the monthly variance of the ARCH (GARCH) model they are averaged annually to form annual macroeconomic uncertainty for further econometric analysis.

GDP growth is measured as the annual percentage change of GDP. GDP is defined as the sum of gross value added by the producer in the economy plus net taxes. It makes GDP at market price and is based on constant 2005 USD. Hence, GDP growth refers to real GDP growth. GDP growth is one of the important variables that have been used for years to explain the dynamics of Foreign Direct Investment. Growth of GDP is synonymous with market expansion. Market expansion creates additional opportunity for produced output. This is more important if the motive of the multinational to sell the produced output in the host economy. This has a direct link with the profitability and future course of action for the multinational. Market expansion not only influences the present business action but also the future business prospectus. Multinationals feel a sense of security if the host economy achieves market expansion.

Trade Openness which shows the quantum of trade linkage between countries is defined as the ratio of total trade to GDP. Trade is defined as the sum of exports and imports of goods and services. Investing firm may resort on the import of raw material and export of final commodity and hence amount of the flow of goods and services in and out of the host likely to influence investment decision. Percentage change of REER index is estimated as the measure of Exchange rate.

FDI stock is basically to reflect the previous level of FDI in a country. The previous FDI figures give the information regarding profit and risk situation of the destination country. It is also likely that if multinationals avoid crowded market then higher past FDI level may deter fresh FDI inflow. Macroeconomic uncertainty is measured by the ARCH (GARCH) variance series. Gross Domestic Product (GDP) at Purchasing Power Parity (PPP) is included in the analysis to measure the absolute market size of the corresponding economy. GDP per capita PPP is measured in 2011 international dollar. For scaling down, natural logarithm transformation of FDI inward stock and GDP Per Capita at Purchasing Power Parity (PPP) is carried out before moving for empirical estimation. FDI decision takes time and hence one year lag of explanatory variable is considered for further econometric estimation. Study of Cuyvers et al. (2011) also used one year lag of variables for empirical estimation.

Table 3. *Data source*

Variable	Data source
Net FDI (% of GDP)	World Development Indicator, World Bank
GDP growth (annual %)	World Development Indicator, World Bank
FDI inward stock	UNCTAD
Trade openness (X+M)/GDP	World Development Indicator, World Bank
REERchn	Bruegel data set
Garchvar	Estimated
GDP per capita Purchasing Power Parity	World Development Indicator, World Bank

Table 4. *Summary statistics*

Variable	Median	Minimum	Maximum	S.D.
Netfdigdp	2.7542	-2.4988	45.2732	5.4213
Gdpgrowth$_{-1}$	4.7362	-7.3594	33.7357	3.6765
Openness$_{-1}$	0.8262	0.1558	4.3965	0.6612
Reerchn$_{-1}$	1.5499	-75.1383	29.5683	7.0055
Lnfdistock$_{-1}$	8.7287	2.7628	13.6760	2.1066
Garchvar$_{-1}$	2.2668	0.3783	63.1178	7.2238
LnGDPPPP$_{-1}$	8.7138	6.6356	11.4695	1.2034

Net FDI (new investment less disinvestment) which is measured in terms of percentage of GDP is the dependent variable of the study. Other variables with a year lag are explanatory variables.

Table 5. *Regime-independent coefficients*

Variable	Coefficient	White Standard Error	t-stat
Gdpgrowth$_{-1}$	0.1194	0.0517	2.3110
Openness$_{-1}$	3.4357	1.6936	2.0285
Lnfdistock$_{-1}$	1.6126	0.2619	6.1572
Reerchn$_{-1}$	-0.0275	0.0190	-1.4471

Table 6. *Regime-dependent coefficients*

Variable and Regime	Coefficient	White Standard Error	t-stat
LnGDPPPP$_{-1}$(Regime 1)	-5.0513	1.3407	-3.7677
Garchvar$_{-1}$ (Regime 1)	-0.0762	0.0171	-4.4392
LnGDPPPP$_{-1}$(Regime 2)	-3.8682	1.3082	-2.9568
Garchvar$_{-1}$ (Regime 2)	0.0176	0.0177	0.9948

Regime-independent coefficients and its statistical significance

GDP growth, Trade openness and FDI stock are found to be positive and statistical significant in attracting FDI. Trade openness which is measured by the ratio of total trade of goods and services to GDP is found to have greater influence on FDI. Percentage change in the Real Effective Exchange Rate which is used for measuring exchange rate has no influence on FDI.

Regime-dependent coefficients and its statistical significance

GDP per capita at Purchasing Power Parity (lnGDPPPP) and Macroeconomic Uncertainty (Garchvar) series are considered as regime-dependent variables. A close look on the different regimes reveals that macroeconomic uncertainty has a negative impact on FDI inflow in the first regime. However, in the second regime, it is found to have no influence on inward FDI.

The argument for this is that after a country reaches a certain level of income negative impact of macroeconomic uncertainty fades away. Macroeconomic uncertainty deters FDI if the income level of a country is below a certain threshold. Once income level goes past the threshold level may be due to other factors the negative impact of macroeconomic uncertainty disappears.

6. Concluding remarks

There are many variables that may have an influence on FDI. The basic intention is to explore the linkage between macroeconomic factors and FDI. After measuring macroeconomic uncertainty, the impact of macroeconomic uncertainty along with other potential macroeconomic variables is analyzed.

Relying on the non-dynamic panel data technique presence of the single threshold is found. GDP per capita at Purchasing Power Parity (PPP) is the threshold variable of the study. Among the regime-independent variables, GDP growth, trade openness and FDI stock are found to be positive and statistically significant. However, exchange rate is found to have no influence on the Foreign Direct Investment.

 GDP growth indicates market expansion which is found to have positive influence on FDI. Openness has the greatest impact in attracting FDI. Higher FDI stock is found to be positive as past FDI flow ensures of the good business of earlier investment. Past FDI inflows signify the presence of multinationals in the host, reflects business prospect and also a proof for the earlier success story of multinationals. A better past record of capital inflow will increase present FDI flow.

Taking about the regime-dependent variable GDP per capita at PPP is found to be negative in both the regimes. However, the magnitude is low in the second regime. Macroeconomic uncertainty is found to have negative influence in the first regime. In a study on developing countries, Hausmann and Gavin (1995) also find a negative relation between an index of macroeconomic volatility and investment. Darby et al. (1999) by measuring separate real exchange rate variability for five OECD countries find negative link with investment either in the short-run or in the long-run or both.

In the second regime, the influence of macroeconomic uncertainty on FDI disappears. Countries below the income threshold level likely to suffer capital inflow if macroeconomic uncertainty prevails in the concerned economy. Once countries surpass a certain income level due to other favorable factors the negative impact of macroeconomic uncertainty vanishes.

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