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THE IMPACT OF EXCHANGE RATE VOLATILITY ON FOREIGN DIRECT INVESTMENT: ARDL TESTING BOUND

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ABSTRACT

Promoting sustainable development is one of the main objectives in emerging nations. In actuality, these nations desperately require significant investments. Exchange rate volatility is one of the many dangers foreign investors face. This volatility is an essential element that could restrict trading volume and reduce investment. Such fluctuations, which arise in industrialized nations, lead to instability on a worldwide scale. The present article studies the relationship between absolute exchange rate volatility and foreign direct investment (FDI). This study covers 13 developing countries over the period 1980–2022. The model used in this work is an Auto Regressive Distributed Lag (ARDL) to estimate the impact of the Real Exchange Rate and its Volatility on FDI. Our results indicate that the exchange rate volatility hurts FDI both in the short and long term. A positive relationship between FDI and REER has also been approved. The findings of this study suggest that developing countries must implement monetary policies to ensure a stable exchange rate that attracts more foreign direct investment.

INTRODUCTION

Foreign Direct Investment (FDI) corresponds to the net inflow of foreign investments into a country. In developing countries, the most crucial goal is to promote sustainable development. High investments are strongly needed in such countries. That is why the latter continues to look at FDI. Accordingly, global FDI flows to developing countries experienced a 14% decrease during 2017-2018 and 2016. Concerning the value of FDI entry in host countries, empirical studies have shown a strong positive impact of the influx of foreign capital on the supply of investment funds, which increases capital development in that country. Developing countries are usually exposed to various challenges, the most important of which is limited financial resources. Through the years, we have noticed that investment requires additional exigencies, such as capital inflow from industrialized countries to less developed ones. This would be crucially done in the guise of aid or FDI (Ellahi, 2011). It is known that FDI is an essential source of capital influx. It helps in transferring technological and managerial expertise to the least industrialized countries. In addition, it introduces better production methods.

Therefore, a flow of direct investment in such countries is strongly recommended. Factors that may disrupt the stability of these FDIs should be well-managed. International traders and FDI investors are exposed to various risks, such as exchange rate volatility, which is a central factor that might limit trade volume and decrease investment. Such volatility occurs in developed countries and causes global instability. The uncertainty of exchange rates in the Least Developed Countries (LDCs) is a central factor that might lead to economic instability worldwide. In addition, Exchange rate volatility hurts FDIs because it results in the depreciation of the host country's currency compared to the national currency, increasing foreigners' relative wealth. This increases the attractiveness of FDIs.

Consequently, the depreciation of the host country's currency might deepen FDI inflows when it is supposed to appreciate its currency and decrease in FDI (Froot et al., 1992). Recent studies have focused on the channels that might affect FDI because of exchange rates. Accordingly, if the national currency appreciates, two reasons explain why FDIs can attract domestic business. First, exports are more expensive in foreign markets because appreciation and production units'

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interest launched in the host country are more attractive in international markets. Secondly, the appreciation of the national currency would decrease the initial production cost in the foreign market. Earliest studies, such as that of Cushman (1988), proved that currency appreciation reduces FDI inflows.

In contrast, Goldberg and Klein's (1996) results revealed that depreciation FDI inflows increase. Therefore, currency appreciation, compared with its depreciation, influences countries' capital on both accounts. Currency appreciation indicates a country's economic fundamentals; accordingly, a better return on investment is highly predicted. The current account balance is considered as a critical factor in macroeconomic management quality, and the relationship between FDI and the current account balance is positively expected.

LITERATURE REVIEW

According to previous empirical studies that dealt with the relationship between exchange rate volatility and Foreign Direct Investment FDI), we cannot give unified results. The latter are contrasting, especially with various techniques and tests yielding divergent outcomes.

Furceri and Borelli (2008) studied the role of exchange rate volatility in explaining the evolution of FDI flows in countries near the Economic and Monetary Union (EMU). Due to an empirical model, they found that the impact of exchange rate volatility on FDR is related to a first step to the country's degree of openness. Consequently, exchange rate volatility positively or neutrally affects relatively closed economies but negatively affects open economies.

On the other hand, some researchers like Sharifi-Renania and Mirfatah (2012) focused on the relationship between exchange rate volatility and FDI. Through their study, they tried to evaluate the basis of incoming FDI, particularly exchange rate volatility in Iran. To do so, they used the Johansen and Juselius co-integration model. Quarterly data from 1980Q2 to 2006Q3 proved a positive correlation between Gross Domestic Product (GDP), the degree of openness, and the exchange rate with FDI. In contrast, global crude oil prices and exchange rate volatility revealed a negative relationship with FDI. The authors recommended that Iranian policymakers implement macroeconomic policies to reduce exchange rate volatility and attract more foreign investments.

Wang's (2013) research focused on the relationship between exchange rate volatility and FDI in certain developed economies, especially in Brazil, Russia, India, and China (BRIC). Referring to data collected from 1994 to 2012, the study used the standard deviation of monthly exchange rate variations to determine the impact of exchange rate volatility on FDI. Accordingly, results revealed a long-term negative relationship between exchange rate volatility and FDI for India and Russia. In contrast, short-term links were observed in China, India, and Russia, but no relation was observed between Brazil's variables.

Dhakal (2010) utilized panel data to study the influence of exchange rate volatility on FDI in six countries: China, Indonesia, Malaysia, the Philippines, South Korea, and Thailand.

By theoretical predictions, results revealed that exchange rate volatility positively affects FDI across the entire sample.

In his article entitled "Exchange Rate Volatility and Foreign Direct Investment (FDI) Behavior in Pakistan: A Time Series Analysis with Auto Regressive Distributed Lag (ARDL) Application," (Ellahi, 2011) dealt with the impact of exchange rate volatility on FDI in Pakistan during the period 1980 to 2010. This study used the auto-regressive distributed lag (ARDL) method for short-term and long-term assessments. Findings proved that exchange rate volatility negatively affects short-term FDI entries. In contrast, it has a positive impact in the long term. That is why the researcher recognized that adjustment and liberalization programs affected favourably short-term outcomes for Pakistan.

The focus on the short- and long-term relationship between exchange rate volatility and FDI in Pakistan is limited despite the viable attention paid to it. Hence, the present study intent to remediate this problem by testing the relationship. The significant current account balance was the primary determinant of a country's currency value. When it deteriorates, the current account balance might lead to a degradation of the foreign country's currency. This would undoubtedly cause inflation and, therefore, significant exchange rate changes. Consequently, FDI inflows will be reduced because of the increase in the current account deficit.

MATERIALS AND METHODS

We aim to study the relationship between exchange rate volatility and Foreign Direct Investment (FDI) in some emerging countries. Concerning the literature review we have just mentioned, we noticed that the variables that can be involved in the equation to be estimated in our model are as follows: Foreign Direct Investment, real exchange rate, exchange rate volatility, trade openness, and the current account balance.

All founded variables cover the period from 1980 to 2022 and are extracted from the World Bank's database (WDI), with the exchange rate variable taken from the International Financial Statistics database (IFS). Actual exchange rate volatility is defined by frequent and non-persistent fluctuations in the exchange rate (Sekkat & Varoudakis, 2000). To calculate the annual data for the exchange rate volatility, we first computed the moving standard deviation of the monthly relative changes in the real exchange rate over 12 observations. Then, we calculated the average of standard deviations for each year using the following formula.

$$S.D = \sqrt{\sum (X_i - \overline{X})^2 / n}$$

Model Specification

The model we used during our present study is inspired by the theoretical and empirical framework previously presented. It is a regression model presented as follows:

$$FDI = \alpha_0 + \alpha_1 ER + \alpha_2 GDP + \alpha_3 VER + \alpha_4 OPEN + \alpha_0 CAB + e$$

Where :
E.R.: Exchange rate
GDP: GDP growth (annual %)
VER: Exchange rate volatility
OPEN: Trade openness (sum of exports and imports divided by GDP)
CAB: Current account balance
FDI: Foreign direct investment, net inflow (% of GDP)

Descriptive statistics and Correlation matrix

We present the descriptive statistics of the different variables in the following table.

Table 1. Descriptive Statistics of the Sample

Variables	FDI	ER	GDP	VER	OPEN	CAB
N	559	559	559	559	559	559
mean	3,616	123,862	3,725	8,435	0,935	-0,252
SD	4,970	183,037	4,113	83,904	0,875	7,601
min	-13,605	53,790	-20,730	0,256	0,105	-20,805
p25	0,877	90,961	1,982	1,600	0,385	-4,443
p50	2,227	101,580	4,106	2,632	0,633	-1,911
p75	4,284	119,969	6,060	4,266	1,043	1,931
max	33,566	3448,324	17,013	1935,059	4,416	27,419
skewness	2,795	14,165	-1,016	21,889	2,095	1,285
kurtosis	13,360	228,859	6,899	499,737	6,889	5,006
CV	1,374	1,478	1,104	9,947	0,936	-30,138
Jarque-Bera (JB)	3228	1.2e+06	450.2	5.8e+06	761.1	247.5
Probabilité JB	0.000	0.000	0.000	0.000	0.000	0.000
Born-Breitung (BB)	5.95	11.81	31.61	18.78	9.94	7.09
Probabilité BB	0.051	0.003	0.000	0.000	0.007	0.029
Correlation (p-value)	**FDI**	**ER**	**GDP**	**VER**	**OPEN**	**CAB**

Source: Author's estimation

According to Table 1, the FDI variable has an overall mean of 3.616, a standard deviation of 4.970, and a median of 2.227. In addition, the variable's minimum and maximum values are -13.605 and 33.566, respectively. Additionally, the distribution is highly right-skewed (Skewness=2.795>0) and strongly leptokurtic (Kurtosis=13.360>0), mainly for 559 observations.

Furthermore, the null hypothesis of normality is rejected by this distribution, giving a Jarque-Bera statistic value below 5% (P-value=0.000) for the whole sample. The probability of both Born and Breitung tests is less than 5% (p-value=0.051). This lets us reject the hypothesis of no autocorrelation and conclude that the distribution is non-normal. Consequently, autocorrelation is exhibited.

Table 2. Correlation matrix

FDI	**1.000**					
ER	-0.0798 (0.059)	1.000				
GDP	0.1895 (0.000)	-0.1556 (0.000)	1.000			
VER	-0.0504 (0.234)	0.8866 (0.000)	-0.1185 (0.005)	1.000		
OPEN	0.6892 (0.000)	-0.0445 (0.293)	0.1962 (0.000)	-0.0503 (0.234)	1.000	
CAB	0.4348 (0.000)	-0.0607 (0.152)	0.0515 (0.223)	-0.0409 (0.334)	0.5371 (0.000)	1.000

Source: Author's estimation

As Table 2 shows, there is no problem of multicollinearity among the variables used in our study based on the values of correlation mentioned above.

Unit Root Test

Table 3. Unit root test results

Variables	En niveau			En premier différence		
	LLC	IPS	Hadri	LLC	IPS	Hadri
FDI	-3.900***	-5.851***	32.117***	-14.869***	-15.588***	-3.115
ER	-8.243***	-2.504***	25.200***	-11.912***	-10.681***	-3.3645
GDP	-9.505***	-11.627***	4.861***	-18.027***	-17.166***	-3.471
VER	-9.816***	-10.395***	8.629***	-23.161***	-16.747***	-3.7273
OPEN	-0.607	-0.078	30.002	-10.466***	-13.251***	-0.911
CAB	-5.314***	-5.147***	28.085***	-16.070***	-14.349***	-1.467

Source: Author's estimation

Referring to the first-generation unit root tests by Levin (2002) in Table 2, we see that all variables in our model are stationary at the level or in first differences.

Cointegration Test

Tableau 4. Cointegration test

Tests	Value	Probability	Decision
Kao (1999)	-5.696	0.000	Cointégration
Pedroni (2004)	-7.488	0.000	Cointegration
Westerlund (2007)	2.674	0.004	Cointegration

Source: Author's estimation

The results in Table 3 present various cointegration tests, such as Kao's (1999). Results show that all probabilities are below the 5% threshold. Accordingly, we conclude that at least one cointegration relationship exists among the variables in our model.

Heteroscedasticity and Autocorrelation

Table 5. Heteroscedasticity and Autocorrelation test

Test	Chi-Square Statistic	p-value
Hétéroscédasticité	15770.19	0.000
Autocorrélation	263.135	0.000

Source: Author's estimation

When analyzing the results of the heteroskedasticity test, we found that the probability associated with the coefficients is below 5% (chi-squared statistic=15770.19), and it is significant (p-value=0.000). That is why we strongly reject the null hypothesis (H0) of homoscedasticity. The autocorrelation test also confirms the presence of a solid serial autocorrelation in our model.

RESULTS AND DISCUSSIONS

Table 6. The impact of exchange rate volatility on FDI: the ARDL model Long Run results

	Coefficient	Std. Err	t-statistic	prob
ER	1.833609	0.561637	3.264755	0.0013
GDP	-0.339209	0.073071	-4.642185	0.0000
VER	-0.062968	0.067072	-0.938816	0.3488
OPEN	0.404806	0.495194	0.817469	0.4145
CAB	0.118128	0.022095	5.346371	0.0000

Source: Author's estimation

Table 6 presents the long-run estimation. The ARDL results reveal a positive relationship between exchange rate and foreign direct investment (FDI) inflows. We estimate that the exchange rate coefficient is statistically significant with a value of 0.52. This explains that a one-unit increase in the exchange rate increases FDI by 0.52 units. Such results go with those of Ellahi (2011). A positive relationship indicates that an appreciation of the country's currency can increase foreign investors' returns and attract FDI to Pakistan. The current study also reveals that the primary variable of interest, exchange rate volatility, has a significant negative impact on FDI.

Exchange rate volatility increases exchange rate risk, discouraging FDI inflows to Pakistan. Accordingly, attracting more FDI needs exchange rate stability.

To calculate the market size, we used GDP and found that the latter has a positive and significant impact on FDI. A one-unit increase in GDP increases FDI by 0.41 units. These findings are consistent with the findings, meaning that market size can attract more FDI if larger. The coefficient of trade openness is also positive and significant. This helps to conclude that a one-unit increase in trade openness increases FDI by 0.66 units. Such a finding goes with those of Sharifi-

Renani and Mirfatah (2012). Trade openness is calculated by the degree to which a country's borders have no restrictions on imports and exports. Hence, trade liberalization can attract more FDI in developing countries like Pakistan.

Table 7. The impact of exchange rate volatility on FDI: ARDL model Long Run results

	Coefficient	Std. Err	t-statistic	prob
COINTEQ01	-0.329851	0.077489	-4.256766	0.0000
D(FDI(-1))	-0.126243	0.123007	-1.026305	0.3058
D(FDI(-2))	-0.214303	0.071228	-3.008694	0.0029
D(FDI(-3))	-0.112408	0.078718	-1.427975	0.1547
D(ER)	3.780565	1.904880	1.984673	0.0484
D(ER(-1))	-4.546801	2.428337	-1.872393	0.0624
D(ER(-2))	-5.398373	4.873299	-1.107745	0.2691
D(ER(-3))	11.49083	9.248735	1.242421	0.2154
D(VER)	0.114625	0.103836	1.103908	0.2708
D(VER(-1))	0.137156	0.115811	1.184311	0.2375
D(VER(-2))	-0.137156	0.156720	-0.884744	0.3772
D(VER(-3))	-0.228230	0.214915	-1.061955	0.2894
D(GDP)	0.057720	0.046845	1.232147	0.2192
D(GDP (-1))	0.065878	0.068295	0.964618	0.3358
D(GDP (-2))	0.017866	0.063563	0.281069	0.7789
D(GDP (-3))	0.004058	0.048981	0.082838	0.9341
D(OPEN)	4.487692	2.391174	1.876774	0.0618
D(OPEN (-1))	40443621	2.376726	1.869640	0.0628
D(OPEN (-2))	30431394	2.698640	1.271527	0.2048
D(OPEN (-3))	2.530637	1.745699	1.449641	0.1485
D(CAB)	-0.018398	0.068976	-0.266737	0.7899
D(CAB (-1))	0.010007	0.077918	0.128425	0.8979
D(CAB (-2))	0.004911	0.051396	0.095552	0.9240
D(CAB (-3))	-0.032527	0.058457	-0.556422	0.5785
c	-1.745731	0.396894	-4.398480	0.0000

Source: Author's estimation

ARDL short-run result for the impact of exchange rate volatility on FDI

Table 7 shows the short-run results of the ARDL model using the Schwarz Information Criterion (SIC) for lag selection. The lagged Error Correction Term (ECMt-1) coefficient is negative and highly significant. This leads us to conclude that the disequilibrium is either corrected or adjusted at a speed of 34% per year. The significance of the ECM (-1) coefficient confirms the presence of a long-run relationship among the variables, as previously estimated.

Concerning the short-run results, the exchange rate shows a positive relationship with foreign direct investment (FDI); in contrast, exchange rate volatility negatively affects FDI. This finding aligns with the study. The GDP coefficient is positive and highly significant at the 1% level, which indicates that it positively facilitates FDI. However, concerning the volatility of the exchange rate, it hurts FDI in the short run, which sees eye to eye with the findings of Wang (2013). Trade openness reveals a positive impact on FDI and suggests that when international trade is increased, it can attract more foreign direct investment.

Conversely, the current account balance negatively impacts FDI in the short run, which is in high accordance with the results. The Durbin-Watson statistic is applied, indicating the absence of serial correlation in the model. The F-statistic is highly significant, meaning our model is globally important.

CONCLUSIONS

This present study used the ARDL bound testing technique to test the impact of exchange rate volatility on foreign direct investment (FDI) in Pakistan from 1981 to 2015. The overall estimation findings go with our theoretical predictions. Our results reveal that exchange rate volatility has a negative effect on FDI inflows both in the short run and the long run. The increase in exchange rate volatility causes higher risk and uncertainty levels for foreign investors, thereby influencing FDI in Pakistan. These results call for urgent measures to be taken by policies aiming at attracting more FDI to developing countries. We recommend by the present study that the government implement monetary policies to guarantee a stable exchange rate. Additionally, GDP and trade openness are vital factors that might encourage FDI. Trade liberalization and trade barrier reduction should be basic economic policies for a developing country like Pakistan.

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