

The effect of exchange rate on foreign direct investment in Algeria (1980-2021) , using Vector autoregressive VAR model and Granger causality

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Received date: 18.04.2025, Accepted date, 20.04.2025, Publication date: 01.06.2025

Abstract :

this study uses the granger causality test and the vector autogressive model var to examine and evaluate the link between algerias currency rate and foreign direct investment from 1980 to 2021 fdi inflows into the algerian economy are not caused by the exchange rate according to the granger causality test results and the pp test of stationarity test shows that all time series are integrated for order one i1 according to the var models estimations there is no statistically significant relationship between the exchange rate and foreign direct investment

Keywords: :, Foreign direct investment , exchange rate, VAR model , Granger causality test

Jel Classification : C32 F21 F31

INTRODUCTION

Exchange rate fluctuations significantly affect the real values of various foreign currency assets, as well as the real value of profits when it comes to foreign investments. This underscores the importance of exchange rate policies and systems in building confidence among foreign investors through several indicators, such as exchange rate volatility and the buildup of foreign exchange reserves (FER). Properly managing the exchange rate policy can

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enhance foreign investment flows. An economy's exposure to nominal shocks, such as rising interest rates and expanding money supply, can be transmitted to changes in the exchange rate, leading to fluctuations. This can be mitigated by a fixed exchange rate regime that is linked to a single currency or group of currencies, thus insulating the economy from such shocks. Furthermore, an economy's exposure to real shocks, such as those affecting the current account, can lead to a decline in competitiveness and a sharp decline in foreign demand for domestic goods. In such cases, it is necessary to abandon the fixed system, as a liberalized exchange rate (flexible exchange rate) is better suited to insulating the economy from real shocks. Through this approach, it is possible to conclude that choosing an exchange rate regime is of great importance in improving macroeconomic performance and isolating it from various shocks.

Several theories have emerged to establish a set of determinants for choosing the ideal exchange rate regime, such as the currency optimum area theory and the corner hypothesis for the exchange rate regime. We shall try to clarify the matter of selecting an exchange rate regime from the standpoint of drawing in foreign direct investment through this study. This will be accomplished by looking at Algeria's economic situation

Since it shows the value of the local currency mirrored in a foreign currency, the exchange rate is regarded as one of the economic indicators that shows how effectively the government is managing the economy. This indicator occupies great importance in terms of evaluating both assets and liabilities expressed in foreign currencies, and its fluctuations are also considered calculating the risk's magnitude

Interest in exchange rate policies and systems grew at the macroeconomic level following the 1973 Bretton Woods system and the implementation of the floating currency system, particularly from the standpoint of luring direct foreign investment and enhancing its environment. According to D. Cushman (1985) and Froot Stein (1991), the study of this relationship is regarded as one of the more ancient problems in international finance.

By examining the case of the Algerian economy, which is regarded as one of the economies where the exchange rate policy has seen numerous significant reforms and developments, we hope to provide some insight into the problem of selecting the exchange rate system from the standpoint of luring foreign direct investment.

Research problem

One could suggest the following as the main problem of the study:

Does the quantity of foreign direct investment coming into the Algerian economy depend on the exchange rate?

Research hypothesis

- The foreign direct investment in Algeria is greatly impacted by the exchange rate.

- Exchange rate policy is one of the elements affecting foreign direct investment in Algeria's economy.

1. A REVIEW OF LITERATURE AND FDI THEORIES

The following table displays the most important previous studies on the relationship between foreign direct investment and the exchange rate.

Table 1 : previous studies

Autors (year)	Sample	Econometric method	Results
D.O.Cushman (1985)	United States	OLS estimation Regression model	negative relationship between exchange rate and FDI
Blonigen A. Bruce (1997)	United States	Maximum Likelihood Regression model	negative relationship between exchange rate and FDI
Kozo Kiyota, Shujiro Urata (2002)	Japan and the United States	OLS estimation Regression model	exchange rate fluctuations negatively affect foreign direct investment flows
Eric Kehinde OGUNLEYE (2006)	Nigeria and South Africa	the two-stage ordinary least squares method (TS-LS), (GARCH) model	negative impact of exchange rate fluctuations on foreign direct investment flows
Christian W Schmidt and Udo Broll (2008)	United States	method for cross-section times series data	Foreign investments in the sample nations are adversely affected by changes in the real currency rate and an increase in risk.
OSINUBI, Tokunbo.S and A AMAGHIONYEODIWE (2009)	Nigerian economy	Error correction model and OLS technique of estimation	a strong and favorable correlation between the currency rate and foreign direct investment flows
Signe Nelgen, Carsten Hefeker (Mathias Busse 2010)	sample of developed and developing countries	Panel data econometrics	In the case of industrialized nations, foreign direct investment

			is significantly impacted by currency rates.
Hosein Sharifi-Renani, Maryam Mirfatah entitled (2012)		cointegration and OLS estimation	exchange rate fluctuations had a negative impact on foreign direct investment investment flows
David O. Cushman, Glauco De Vita (2012)	(70) developing countries	panel data	Significant impact of exchange rate regime on FDI inflows

Source : Authors Collection

2- Foreign Direct Investment Theories

(Olin 1933) was the first to provide an explanation for the movements of international capital, which showed that the most important element driving the export and import of capital is certainly due to the difference in interest rates. Assuming the existence of a perfectly competitive market, capital will move freely from one market to another. because each country has a different interest rate of return. According to the traditional theory of capital flow, the main driver of this kind of investment is the disparity in interest rates on capital, which is explained by the availability or existence of capital or the productivity of capital in different nations.

Cohen (1985) focused on the concept of risk distribution in order to explain why foreign direct investment occurs. The process of creating new products and breaking into new markets are both part of the risk distribution process., or imitating the products of other companies (Bennett 1992). Cohen emphasized that his approach has a strong explanatory power for the explanations of why foreign direct investment occurs.

Rugman (1981–1982) clarified that the process of establishing the company's domain in the global market and that transnational firms cross borders to exploit their advantages in the form of large size and protection of their secrets through foreign direct investment rather than granting licenses to use their patents, because they will be misused.

According to Alber, transnational companies in countries with strong currencies have an advantage and encourage investment in countries with weak currencies. He explained that the imperfect financial markets are the reason for the occurrence of direct investment, as some companies from the home country are more able to maximize their returns at a higher price than companies operating in the host country Hymer S. 1960. Hymer's theory was based on the oligopoly theory of the market. Monopolistic firms can set a high price because they deal with a large number of

unorganized investors. In order to establish a company abroad, it must first have a technological or organizational advantage over its competitors in the host country, but this advantage alone was not enough s.

Product life cycle theory: Without a doubt, this theory can explain why foreign investments are occurring all over the world, but especially in emerging nations. Additionally, it clarifies the reasons why multinational corporations make global investments and why innovative technologies proliferate outside national boundaries.

3. MODEL SPECIFICATION AND EMPIRICAL RESULTS

3.1. VAR MODEL specification

The autoregressive vector model Modeling stationary time series, where the model is estimated using the lag periods of the dependent variable and additional endogenous variables, forms the basis of VAR.. Criteria like the Akaike information criteria are used to determine the lag periods. The shock response functions and variance analysis are where the model excels. The vector of endogenous variables contained in vector autogressive mode can be expressed as:

$$X_t [Fdi_t, EXR]$$

Consequently, the VAR model can be described as follows:

$$X_{it} = \sum_{i=1}^P A_i X_{it-i} + C_{it} + Ut \dots \dots \dots (1)$$

$$FDI_t = \sum_{i=1}^P \alpha_{i1} FDI_{t-i} + \sum_{i=1}^P \beta_{i1} EXR_{t-i} + U_{it1} \dots \dots (2-1)$$

$$EXR_t = \sum_{i=1}^P \alpha_{i2} EXR_{t-i} + \sum_{i=1}^P \beta_{i2} FDI_{t-i} + U_{it2} \dots \dots (2-2)$$

Where:

FDI: foreign direct investment inflows % of gdp

EXR: official exchange rate

P: the optimal lag,

U_{it} : white noise

Figure 1 : Exchange rate and FDI % (1980 – 2021)

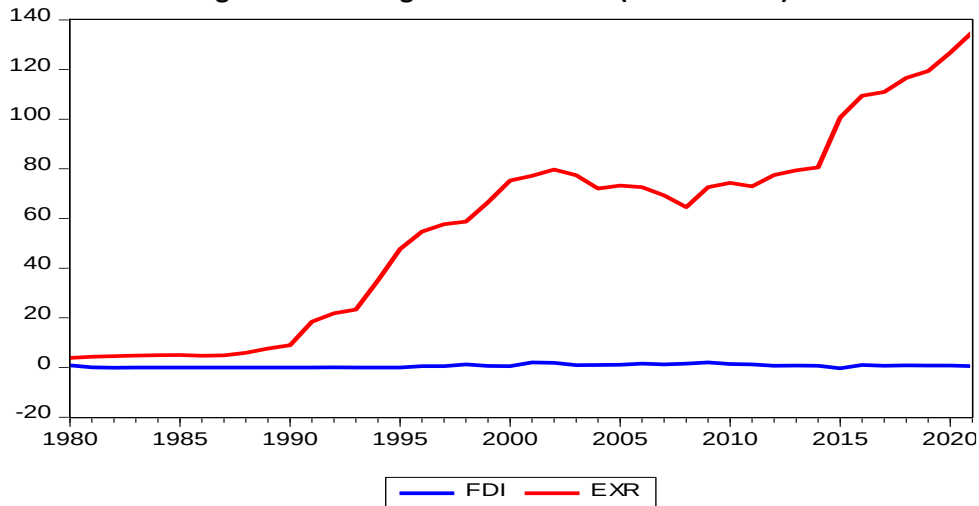


Table 2 : Descriptive statistics of variables

	EXR	FDI
<i>Mean</i>	56.70200	0.644374
<i>Median</i>	67.93314	0.651044
<i>Maximum</i>	135.0641	2.033266
<i>Minimum</i>	3.837450	-0.324012
<i>Std. Dev.</i>	39.71951	0.637294
<i>Skewness</i>	0.056703	0.491696
<i>Kurtosis</i>	1.945362	2.302603
<i>Jarque-Bera</i>	1.968965	2.543491
<i>Probability</i>	0.373632	0.280342
<i>Sum Sq. Dev.</i>	64683.22	16.65186
<i>Observations</i>	42	42

Source : Authors based on Eviews 12

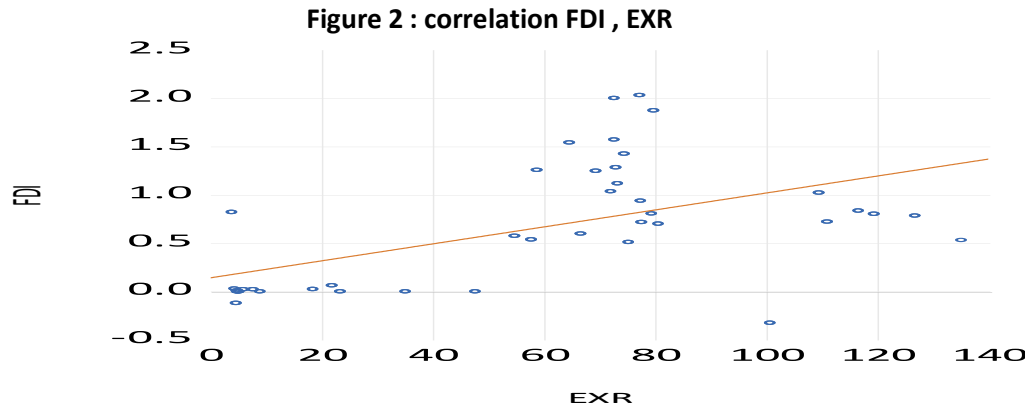
Table 3 : Correlation matrix

Correlation		
Probability	EXR	FDI
EXR	1.000000	

FDI	0.547534	1.000000
	0.0002	-----

*****significant at 1% level**

Source : Authors based on Eviews 12



We can observe from the correlation matrix between variables that: FDI and the exchange rate domestic product (EXR) have a positive correlation, which is statistically significant at the 5% and 1% levels.

3.2. Unit root test (PP test) , Johansen cointegration

To ascertain whether unit roots are present in the data set, the Phillips–Perron test (PP) is utilized.

Table 4 : Test of the PP Unit Root

Variables	PP unit root test	
	Level	First difference
<i>FDI</i>	-3.228 (0.0931)	-10.294*** (0.0000)
<i>EXR</i>	-1. 7798 (0.696)	-4.3214*** (0.0074)

Source : Eviews 12

The PP test findings, which are displayed in Table 4, demonstrate that all series are integrated for order I and that it is not possible to rule out the null hypothesis that any series is non-stationary at level (1).

Table 5 : Johansen cointegration test

Hypothesis	Trace Statistic	0.05 Critical value
none	10,193	15,49
At most 1	0,32	3,84

Source : Eviews 12

We may observe that the trace statistic is below the critical values at 5% based on Johansen's cointegration test. At the significance level, We conclude that there is no cointegration between foreign direct investment and the currency rate.

Table 6 : Criteria for VAR Lag Order Selection

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Lag	LogL	LR	FPE	AIC	SC	HQ
0	-227.9028	NA	452.2146	11.78989	11.87520	11.82050
1	-133.9434	173.4636*	4.488137*	7.176583	7.432515	7.268409*
2	-132.0549	3.292617	5.012590	7.014869*	7.311423*	7.437913
3	-129.5518	4.107696	5.439788	7.361632	7.958808	7.575894

Source : EvIEWS 12

Based on the table, we determine that, in terms of the AIC criteria, the lag p=2 is optimal for estimating the autoregressive vector model.

$$\text{FDI} = 0.565324838796 \cdot \text{FDI}(-1) + 0.126002890303 \cdot \text{FDI}(-2) + 0.0181806040532 \cdot \text{EXR}(-1) - 0.0154355198141 \cdot \text{EXR}(-2) + 0.00947221357138 + U_t$$

$$\text{EXR} = -1.84424345472 \cdot \text{FDI}(-1) - 1.79007751792 \cdot \text{FDI}(-2) + 1.19270849214 \cdot \text{EXR}(-1) - 0.141395724815 \cdot \text{EXR}(-2) + 2.29486187152 + U_t$$

Table 7 : Diagnostic Tests of VAR residuals

Diagnostic Test	Chi-sq	Probability
VAR Residual Heteroskedasticity Tests :	34,77	0,7778
VAR Residual Serial Correlation LM Tests	4,184	0,3817

Source : EvIEWS 12

Based on the model's diagnostic test findings, we deduce that the residuals' variance is constant and they are not auto-correlated.

3.3. VAR estimation results

Table 8 : VAR (2) LS Estimation results

<i>Dependent Variable: FDI</i>				
<i>$FDI = C(1)*FDI(-1) + C(2)*FDI(-2) + C(3)*EXR(-1) + C(4)*EXR(-2) + C(5)$</i>				
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
C(1)	0.565325	0.178595	3.165404	0.0032
C(2)	0.126003	0.160309	0.785998	0.4372
C(3)	0.018181	0.016031	1.134063	0.2645
C(4)	-0.015436	0.017460	-0.884041	0.3827
C(5)	0.009472	0.128499	0.073714	0.9417
R-squared	0.589030	Prob(F-statistic)		0.000002
F-statistic	12.54109	Durbin-Watson stat		2.059202

Source : Eviews 12

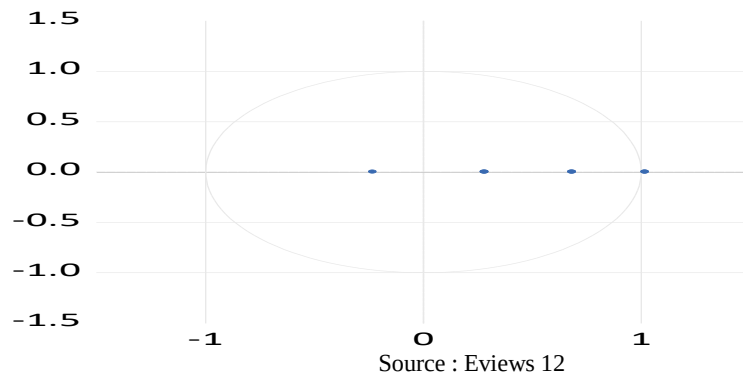
We observe that at the 1% and 5% significant levels, foreign direct investment with a single lag period increases foreign direct investment flows. These findings suggest that during the study period, the foreign direct investment variable is rising.

At the significance level, the exchange rate's impact on foreign direct investment flows is not statistically significant. These findings support the notion that there is little correlation between the two factors. However, these findings suggest that the exchange rate strategy has little bearing on Algeria's ability to draw in foreign direct investment.

According to the coefficient of determination (R²), 58% of the variations in the dependent variable can be explained by the autoregressive vector model. However, Durbin Watson's statistic is 2.05, indicating that the regression model is not erroneous.

The regression model is statistically significant at the 1% and 5% levels, as shown by the F statistic test.

Figure 3 : VAR stability
Inverse Roots of AR Characteristic Polynomial



It is evident from the figure that VAR meets the stability requirement. Since each eigenvalue's modulus is strictly less than 1,

Table 9 : Granger Causality Tests

Lags: 2		Statistic <i>F</i>	Prob.
Null Hypothesis:	Obs		
FDI is not Granger Caused by EXR.	40	1.90499	0.1639
EXR is not Granger Caused by FDI		1.72091	0.1937

Source : Eviews 12

the Granger causality test results show that there is no causal association between foreign direct investment and the exchange rate in either direction because the F statistic is higher than the critical values at the 1% and 5% levels. These results imply that the flow of foreign direct investment into the Algerian economy is not significantly impacted by changes in exchange rates. This suggests that the exchange rate policy is not regarded as one of the factors influencing foreign direct investment in the Algerian economy during the study period.

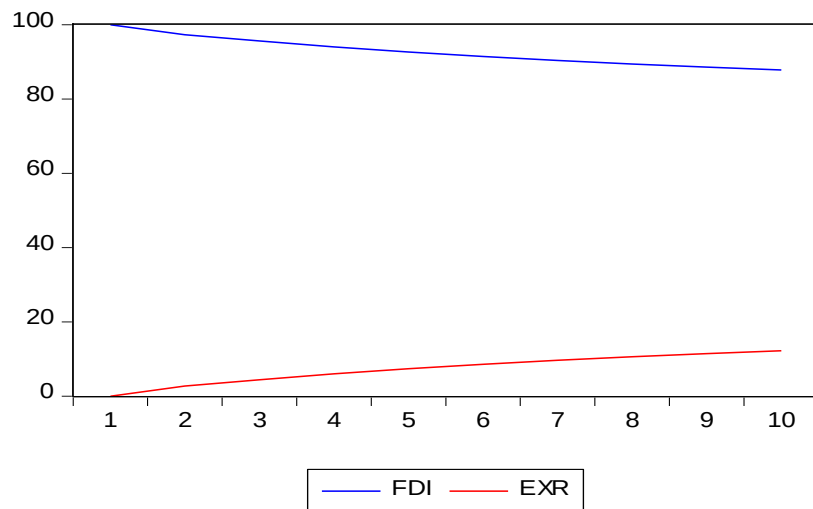
Table 10: Variance Decomposition of FDI:

Variance Decomposition of FDI:			
Period	S.E.	FDI	EXR
1	0.436645	100.0000	0.000000
2	0.493884	97.31020	2.689796
3	0.521960	95.60182	4.398183
4	0.532552	94.00425	5.995748
5	0.537477	92.63714	7.362856
6	0.541020	91.42988	8.570119

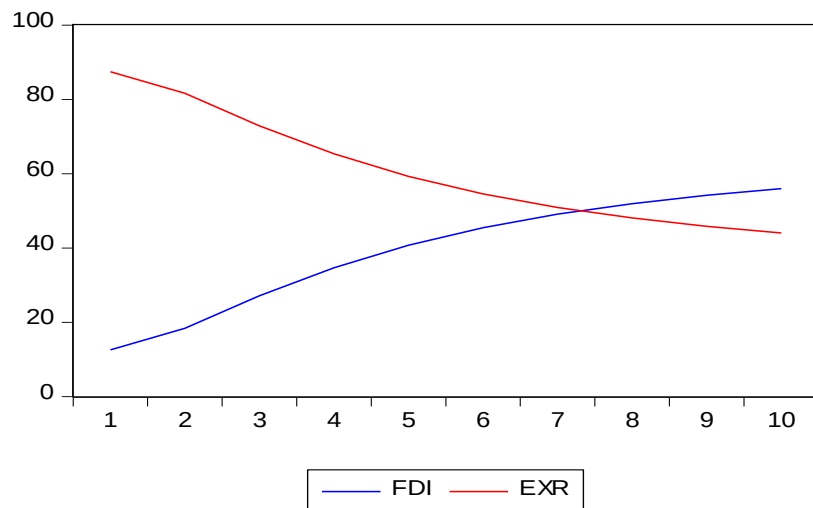
7	0.544905	90.36222	9.637776
8	0.549691	89.40960	10.59040
9	0.555452	88.55077	11.44923
10	0.562090	87.76678	12.23322

Source : Eviews 12

Figure 4 : Variance Decomposition of FDI and EXR :
Variance Decomposition of FDI



Variance Decomposition of EXR



Source : Eviews 12

. The variance decomposition results indicate that, over the long term, around 88% of the forecast error is attributable to FDI innovations, 12% is attributable to exchange rates, and 97.3 percent of the forecast error in FDI is explained by its own

historical values. These findings support the exchange rate's minor role in explaining the FDI forecast error.

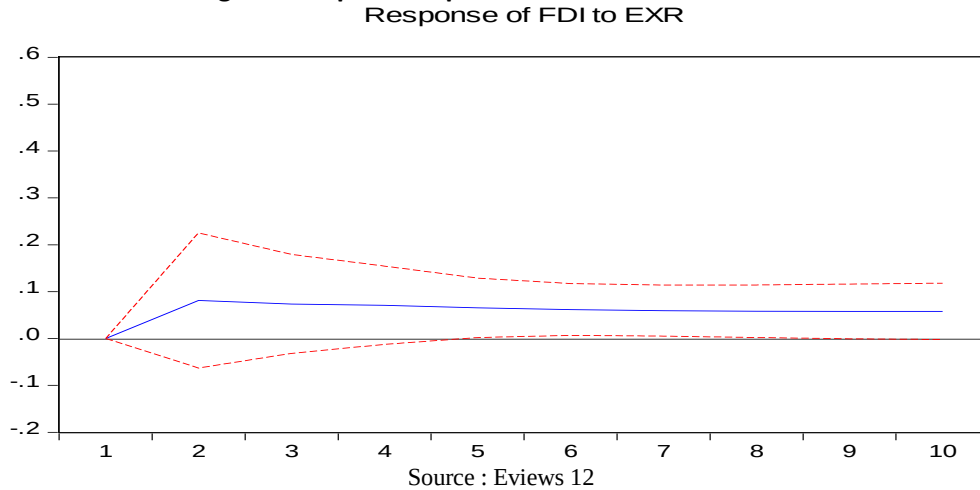
Table 11 : impulse responses function

Response of FDI:		
Period	FDI	EXR
1	0.436645	0.000000
2	0.216106	0.081000
3	0.151983	0.073631
4	0.078407	0.070867
5	0.031689	0.065309
6	-0.002483	0.061766
7	-0.026211	0.059428
8	-0.043080	0.058167
9	-0.055155	0.057653
10	-0.063971	0.057674

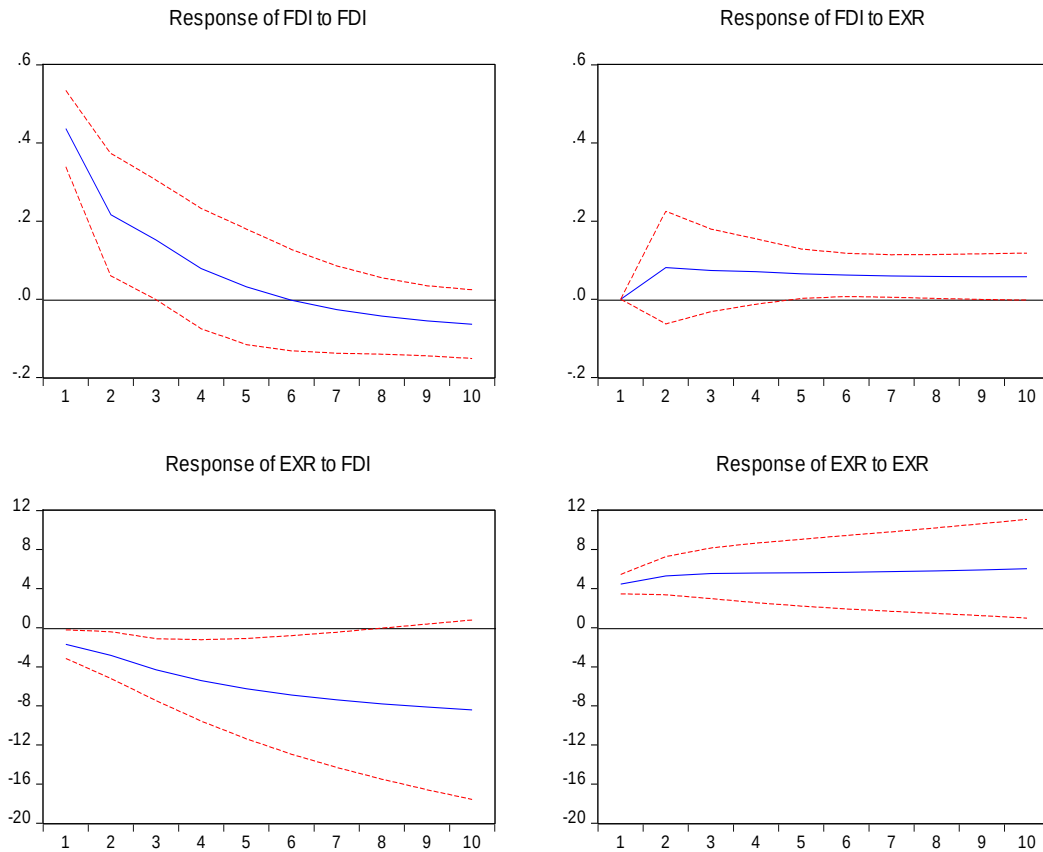
Source : Eviews 12

From the results of the impulse response functions e over 10 periods, we note that the occurrence of a shock of one standard deviation in the exchange rate will generate a very small positive effect between 0.08 and 0.57. This results indicates that the exchange rate policy does not affect foreign direct investment flows during the study period.

Figure 5 : Impulse responses function of FDI to EXR



Response to Cholesky One S.D. Innovations ± 2 S.E.



CONCLUSION

The primary goals of this study are to examine how the exchange rate system affects the ability of the Algerian economy to draw in foreign direct investment (FDI) and to try to regulate and examine how foreign direct investment behavior responds to changes in the Algerian dinar's exchange rate system between 1980 and 2021. with the aim of shedding light on the role that the exchange rate system can play in influencing foreign direct investment behavior and enhancing its levels, as the results of the applied study confirmed the relative ability of the exchange rate policy to influence foreign direct investment behavior, contrary to the economic literature, which emphasized that the currency devaluation policy enhances foreign direct investment flows. These results confirm that the Algerian dinar exchange rate is overvalued, and therefore the devaluation policy is nothing but an enemy to the equilibrium level of the national currency exchange rate.

We derived the primary findings from this study as follows:

Exchange rates do not, in the short term, lead to foreign direct investment, according to the Granger causality test results., and the vector autogressif model VAR estimation suggests that the impact of exchange rates on FDI is not statistically significant, confirming the small contribution of exchange rates on FDI in Algeria. Based on a variety of macroeconomic policies, the study demonstrates that the behavior of all macroeconomic factors The appeal of foreign direct investment (FDI) in Algeria is influenced by a number of factors, not only the exchange rate policy.

Foreign direct investment in Algeria is concentrated on the oil sector.; as a result, diversifying output and raising demand for the local currency are not feasible. We draw the conclusion that enhancing the investment climate is crucial for increasing exports, diversifying production as well as increasing the value of the home currency.

"-" The foreign direct investment amount is equal to roughly 2% of GDP. Given how little this contribution is, we infer that macroeconomic reforms are required to improve the business climate.

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