MPRA

Munich Personal RePEc Archive

Measuring the effect of foreign exchange reserves on foreign direct investment in Algeria during the period 1990-2020 using the ARDL model

BOURENANE, Bouzid and REZIG, Kamel and DJORFI, Zakaria

University of Algiers 3, Algiers, Algeria, University of Algiers 3, Algiers, Algeria, University Center Tipaza, Algeria

4 June 2022

Measuring the effect of Foreign Exchange Reserves on Foreign Direct Investment in Algeria during the period 1990-2020 using the ARDL model

Bouzid BOURENANE	Kamel REZIG	Zakaria DJORFI[*]
bourenanebouzid@yahoo.fr	kamel_rezig@yahoo.fr	zakodjorfi@gmail.com
Economic and Human Development Laboratory Algeria 3 University (Algeria)	Economic and Human Development Laboratory Blida 2 University (Algeria)	University Center Tipaza (Algeria)

Abstract:

This paper aims to examine the impact of foreign exchange reserves on foreign direct investment in Algeria during the period 1990-2020 by applying the Auto-Regressive Distributed Lag model (ARDL). The model showed that the current variables are co-integrated. Also, the results indicate that foreign exchange reserves have a positive impact on foreign direct investment in the long term only, at a rate of 44%.

Key words: Foreign exchange reserves, foreign direct investment, ARDL Model, Algeria

JEL Classification Codes : F31, F21, C51, O55.

---

[*] Corresponding author

Introduction:

Investment law can be considered for the age1993 A major turning point in the course of the Algerian economy, as the law included a set of tax, tax and customs incentives and exemptions that attract foreign investors to invest in Algeria, because of the protection and freedom offered by this law and the subsequent legislative and regulatory reforms that helped attract investors. Algeria has known significant flows of foreign investment, especially in the oil sector Which flourished with the rise in oil prices starting in the year 2000, when its prices exceeded $100 during the period 2008-2014, led to the accumulation of foreign exchange reserves, which is a safety valve for the foreign investor.

Where international reserves play an important role in providing a stable economic environment and enhancing the confidence and confidence of foreign creditors and investors in the national economy regarding the fulfillment of its external financial obligations, as countries seek to accumulate their international reserves with the aim of being able to face the shocks produced by the sudden movement of international liquidity, where developing countries have witnessed an increase Important in the share of foreign direct investments in the total net flows, in light of the accompanying changes in the international economic and political environment, especially with the increase in the volume of oil exports concurrent with the rise in oil prices at the beginning of the new millennium until 2014, where this increase contributed to the accumulation of huge foreign exchange returns for The Bank of Algeria, which exceeded $190 billion in 2012 and 2013, after it did not exceed $1 billion in the nineties, made Algeria attract about 900 Project during the period 2002-2017 Teach Its cost was 2519,831 million Algerian dinars, and 1333583 jobs were created. This is followed by the services sector with a value of 130,980 million dinars, at a rate of 5.2%, then the tourism sector with a value of 128,234 million Algerian dinars, at a rate of 5.09%, and then the communications, construction, transport and agriculture sector with weak rates.

Therefore, in this paper we will try to study the short and long-term relationship between foreign exchange reserves and foreign direct investment, and this is an answer to the following question:

- ⊹ **To what extent did the foreign exchange reserves contribute to attracting foreign direct investment to Algeria during the period 1990-2020?**
- ☛ **Study hypothesis:** In order to answer the research problem, the following hypothesis was formulated**:**

    "The accumulation of foreign exchange reserves has attracted many foreign investors"
- ☛ **The Objectives And Importance Of The Study :**

Algeria, like other rentier countries, and in order to take advantage of the high oil prices and in light of the high balance of international reserves, which is a safety valve for the investor, has endeavored to put in place a set of incentives and tax exemptions

that attract foreign investors to invest in the oil sector, so we will try to highlight the role of foreign exchange reserves in attracting investment. Foreign direct to Algeria.

☛ **Study Methodology :**

We will rely on the quantitative approach in order to measure the impact of foreign exchange reserves on foreign direct investment in Algeria in the long and short terms according to the ARDL model and using the EViews 12.

☛ **Literature Review :**

Over the years different scholars have researched different areas that relate this study, some domestic and some foreign. Among them: (Kaphle, 2021); This study primarily focuses on the analysis of the contributions of foreign exchange reserve to the economic growth of Nepal by using time series data obtained from the year 1975 to 2018 A.D. In order to assess a relationship between these variables, statistical procedure of unit root test, cointegration and Vector Error Correction Model (VECM) are applied. Johansen cointegration test indicates the existence of the long-run relationship among variables. The Vector Error Correction outcome and Wald statistics confirm that the past values of foreign exchange have a positive contribution to the economic growth; and foreign exchange reserve has contributed to the economic growth of Nepal, which led to an increase in the attraction of foreign investors to the country. (Hidehiko, 2019); This Paper develops a quantitative Small-open-Economy model to assess the optimal pace of foreign reserve accumulation by emerging and developing countries. In the model, reserve accumulation depreciates the real exchange rate and attracts foreign direct investment (FDI) inflows, which promotes productivity growth through endogenous firm dynamics. The model shows That two factors are the key determinants of the optimal pace of reserve accumulation : the elasticity of the foreign borrowing spread with respect to foreign debt, and the entry cost for FDI entry. (Bobenič Hintošová, Bruothová, Kubíková, & Ručinský, 2018); This study identifies the determinants of foreign direct investment inflows into Visegrad countries using the country level data from the year 1989 to the year 2016. Based on correlation and regression analyses (OLS and fixed-effect model), we have identified the level of gross wages and the share of educated labour force as the most significant determinants with positive effect on FDI inflows. On the other hand, corporate income tax rate, trade openness and expenditures on research and development have been detected as the determinants with negative impact on FDI. (Osigwe & Uzonwanne, 2015); This study scrutinized the Granger causality of foreign reserves, exchange rate (EXR) and foreign direct investment (FDI) in Nigeria. but become stationary after first differences. The Johansen co-integration test revealed long-run relationship among the variables. The results of the Granger causality test indicated unidirectional causality from EXR to foreign reserves. Consistently from lag one to lag two; unidirectional causality existed from FDI to foreign reserves. At lag three, bidirectional causality was discovered between foreign reserves and FDI. Evidence of unidirectional causality running from EXR to FDI in lags one and three, was revealed. No causality existed between the duos

at lag two. Based on the findings it is recommended that the policy makers establish the optimum EXR level that positively promotes foreign reserves and FDI. (Yasir, Shehzad, Kamran, Sehrish, & Saleem, 2012); This research study is aimed to empirically investigate the relationship among the broad macro variables such as Foreign exchange reserves, foreign direct investment and nominal exchange rate in Pakistan by testing annual data set of sample size 30 over the period of 1980 to 2010. results shows that exchange rate, FDI and foreign exchange reserves are stationary at 1st difference. For the investigation of long run relationship, Johnson co-integration is applied, the results of co-integration test show the long run relationship among the variables. Vector error correction method is used to investigate short run association of the variables. Results suggest that nominal exchange rate have a significant positive impact on foreign exchange reserves while FDI have insignificant impact on FER. (Yanjun, Liangying, & Zhong, 2011); This paper applies Co integration analysis and Granger causality test to obtain the relationship between FDI and foreign exchange reserve, using the annual data from 1982 to 2008. The empirical result indicates that there exists a long-run equilibrium tendency and significant bi-directional Granger causality between China' FER and its FDI. With further analysis, we know that a capital flow collateral relationship and financing mechanisms of U.S. current account exist between China and America. (Wenkai & Song, 2009); This paper points out that both effects, direct and indirect, should be considered when assessing FDI's contribution to foreign exchange reserves. Result shows that from 1986 to 2007, FDI contributed 50% to foreign exchange reserves and the direct effect dominant before 2003 was surpassed by indirect effect after 2004 as the major source of the contribution.

1. Terminology Of Study

1.1 Definition of foreign direct investment

There are many definitions of foreign direct investment according to different opinions and ideas regarding this type of investment that contributes to the process of capital formation and production efficiency in the countries hosting it.

- The International Monetary Fund defines foreign direct investment as "that type of international investment that reflects the objective of an entity residing in one economy obtaining a permanent interest in an enterprise residing in another economy. This interest implies the existence of a long-term relationship between the direct investor (the corporation), as well as to the direct investor enjoying a large degree of influence in the management of the institution (kedi, 2004, p. 251).

- Known balance of payments accountants It expresses every financial flow to a foreign institution, or every new acquisition of ownership share within a foreign institution, provided that the non-residents obtain an important share (the majority) in this institution, and this share varies in importance from one country to another, and it is sufficient to own a percentage of 10 % of the corporation's capital in some countries in order for the investment to be direct (Peter & Pugel, 1996, p. 822).

- The World Trade Organization defines foreign direct investment as: Any investment activity that is stable in a particular country (the country of origin) and that acquires or owns assets in another country (the host or future country) in order to manage these investments (Bertrand & Gouia, 1998, p. 3).
- As for the organization Cooperation and Economic Development so you know On It implies that the foreign investor owns a stake of no less than about 10% From Total capital or voting power, so the share, as defined by the Organization for Economic Co-operation and Development, is 10% so what above in order for his investment to be considered a foreign direct investment, and therefore if the foreign investor's share is less from 10%, in this case it is an indirect foreign investment (Fahmy, 1985, p. 956).

1.2 Definition of foreign exchange reserves

There are many definitions provided in order to define foreign exchange reserves, among which we mention:

- Foreign exchange reserves are defined as: "All generally accepted, available and unconditional international payment methods for settlement of international payments."
- It is also defined as: "the assets available immediately and subject to the control of the monetary authorities, for the purpose of direct financing of the imbalances of their external payments, or the indirect adjustment of these imbalances by influencing the exchange rate of its national currency through intervention in the exchange market, or to achieve other goals." (IMF, 2013, p. 3)
- It is also defined as: "all payment instruments most acceptable to fulfill international obligations, and used by the state in settling the deficit in its balance of payments."
- As defined by the International Monetary Fund as: "those external assets. "which are readily available and controlled by monetary authorities to achieve balance and meet the financing needs of payments and to intervene in currency exchange markets in order to influence the exchange rate of the currency or for other purposes." (mouakeni & zidane, 2020)
- As a comprehensive definition, foreign exchange reserves can be defined as: "a collection of liquid foreign assets that are used to settle international payments, and are owned by monetary authorities."

2. Methodology :

2.1 Model Specification and Description of the Data

The estimable model could be expressed as follows in equation 1; for examining the effect of the accumulation of foreign exchange reserves on foreign direct investment in Algeria.

$$LFDI_t = f(LRES_t) \ldots \ldots \ldots \ldots (1)$$

Where:

$LFDI_t$ is Logarithm of Foreign Direct Investment;

$LRES_t$ is Logarithm of Foreign Exchange Reserves;

2.2 ARDL Model Estimation

The ARDL modeling approach was originally introduced by Pesaran and Shin (1999) and later extended Pesaran et al. (2001). The ARDL co-integration approach has numerous advantages in comparison with other co-integration methods. Unlike other co-integration techniques, the ARDL does not impose a restrictive assumption that all the variables under study must be integrated of the same order. In other words, the ARDL approach can be applied regardless of whether the underlying regressors are integrated of order one [I(1)], order zero[I(0)] or fractionally integrated. Secondly, while other co-integration techniques are sensitive to the size of the sample, the ARDL test is suitable even if the sample size is small. Thirdly, the ARDL technique generally provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous (Odhiambo, 2009, p. 219). Assumption of ARDL model:

- ➢ All variables are stationary at level;
- ➢ All variables are stationary at first difference;
- ➢ All variables are stationary at level while few stationary at first difference;
- ➢ Data must be normally distributed;
- ➢ Data must be free from HSK;
- ➢ Data must be free from autocorrelation;

The ARDL model used in this study can be expressed as follows in equation **2:**

$$\Delta LFDI_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta LFDI_{t-i} + \sum_{t=0}^{q} \beta_2 \Delta LRES_{t-i} + \alpha_1 LFDI_{t-1} + \alpha_2 LRES_{t-1} + \varepsilon_t$$

Where:

Δ: is the first difference operator;

p, q,r..,z: are the lagged values of the dependent and independent variables to control for higher-order correlation;

$\beta_0, \beta_1, \beta_2$ ....: are coefficients correspond to the long-run dynamic relationship.re coefficients of short-run dynamics;

$\alpha_1, \alpha_2, \alpha_3$ ....: are coefficients correspond to the long-run dynamic relationship;

3. RESULTS AND DISCUSSION :

3.1 Unit Root Test

To test the stationarity on differenced variables, we use the Phillips-Perron test, which is presented in table 1. The result shows that after differencing in variables once, all variables were integrated on the first difference. That means all variables were confirmed to be stationary in this study.

Table 1. Phillips-Perron Unit Root Test

series	degree of integration	Level			1st difference		
		intercept	Trend and intercept	None	Intercept	Trend and intercept	None
LFDI	I(1)	-1.78 (0.38)	-1.66 (0.74)	-0.82 (0.35)	-7.35 (0.00)	-7.52 (0.00)	-7.43 (0.00)
LRES	I(1)	-2.45 (0.13)	0.64 (0.99)	0.27 (0.75)	-4.75 (0.00)	-5.83 (0.00)	-4.51 (0.00)

Source: *Author's Computation Using Eviews 12*

3.2 Optimum Lag Selection

To select the number of lags required in the co-integration test, we use the Akaike Information Criterion (AIC) as shown in the following Figure 1. The results of AIC showed that the model (4,0) was the optimal lag lengths.

Fig.1. Results of Akaike Information Criteria
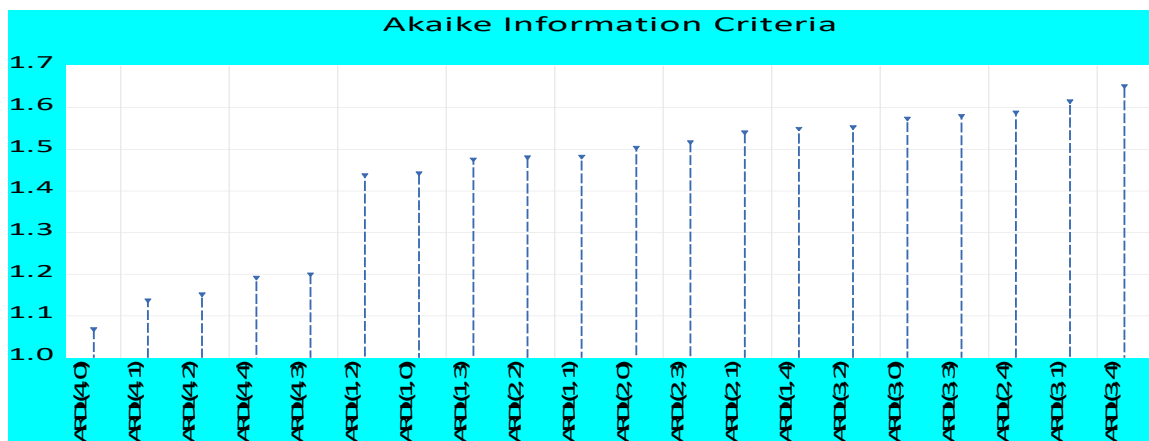
Source: *EViews 12*

3.3 F-Bound Tests

The results reported in Table 2 show that the F-statistic is greater than the upper critical bound at all level of significance and K =2, which means that the null hypothesis is rejected and confirms the existence of a long-run relationship between variables.

Table 2. The F-bound tests

| F-Bounds Test		Null Hypothesis: No levels relationship			
Test Statistic	Value	Signif.		I(0)	I(1)
			Asymptotic: n=1000		
F-statistic	5.044874	10%		3.02	3.51
k	1	5%		3.62	4.16
		2.5%		4.18	4.79
		1%		4.94	5.58
Actual Sample Size	27		Finite Sample: n=35		
		10%		3.223	3.757
		5%		3.957	4.53
		1%		5.763	6.48
			Finite Sample: n=30		
		10%		3.303	3.797
		5%		4.09	4.663
		1%		6.027	6.76

Source: *EViews 12*

3.4 Residual Diagnostics:

We should check the robustness of the optimal model by using the Residual Diagnostics and Stability Diagnostics Before estimating the ARDL model (4.0) in Long-run Coefficients and Error Correction Regression test.

3.4.1 The actual, fitted and residuals Graph

Through The results of Figure 2, we observing the approximation of the fitted values of the actual values for variables, this result indicates the quality of the estimated model, for that it is reliable to interpret and analyze the results.

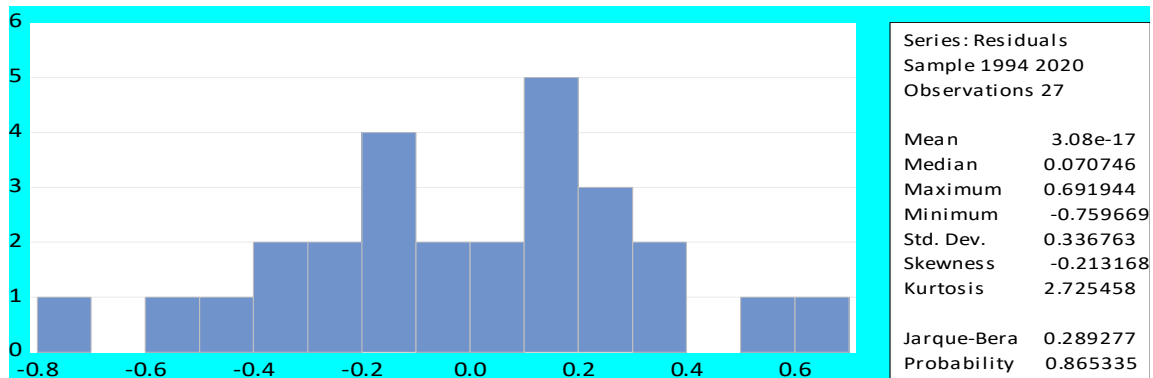**Fig.2.** The actual, fitted and residuals Graph
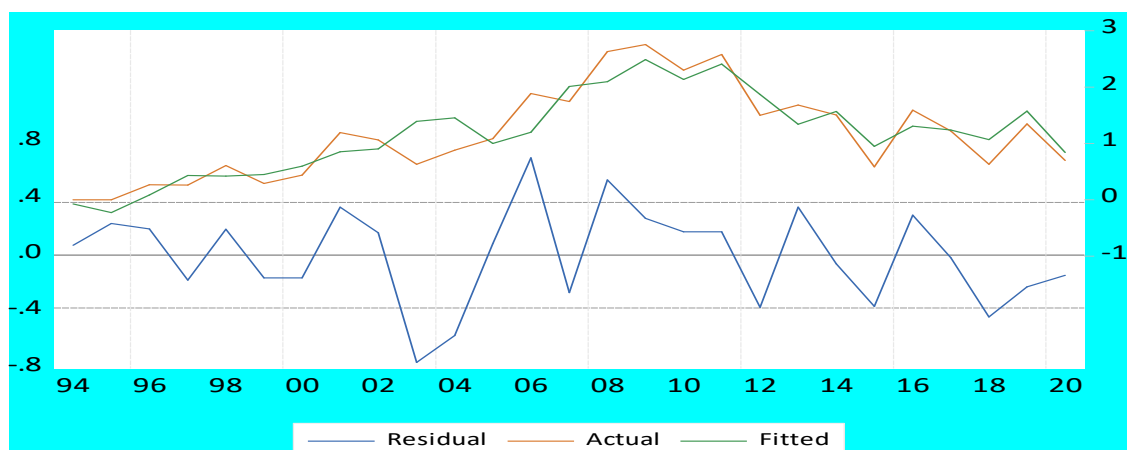
Source: *EViews 12*

3.4.2 Histogram and Normality Test

The result of the test was insignificant ($\alpha > 0.05$) and the value of J-B = 0.28 was less than $x^2 = 5.99$. This means accepting the null hypothesis, and residuals are subject to normally distributed residuals. As shown in the following Figure 3.

Fig.3. Normality Test Result

Series: Residuals	
Sample 1994 2020	
Observations 27	
Mean	3.08e-17
Median	0.070746
Maximum	0.691944
Minimum	-0.759669
Std. Dev.	0.336763
Skewness	-0.213168
Kurtosis	2.725458
Jarque-Bera	0.289277
Probability	0.865335

Source: *EViews 12*

3.4.3 Serial Correlation LM Test

For testing serial correlation, we use Autocorrelation, Breusch-Godfrey correlation LM test as shown in the following Table 3. According to the LM test, the Prob chi-square is greater than 0.05 and therefore we accept the null hypothesis there is no autocorrelation.

Table 3. Serial correlation LM test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.443725	Prob. F(2,19)	0.2608
Obs*R-squared	3.561912	Prob. Chi-Square(2)	0.1685

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 01/21/22   Time: 02:03
Sample: 1994 2020
Included observations: 27
Presample missing value lagged residuals set to zero.

Source: *EViews 12*

3.4.4 Heteroskedasticity Test

Through The results of Table 4, the f-statistic is insignificant, prob F is greater than 0.05, therefore accepting the null hypothesis (the variance of error terms is constant).

Table 4. Heteroskedasticity test

```
Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic              2.343472    Prob. F(5,21)           0.0771
Obs*R-squared            9.669752    Prob. Chi-Square(5)     0.0852
Scaled explained SS      5.046623    Prob. Chi-Square(5)     0.4102


Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/21/22   Time: 02:25
Sample: 1994 2020
Included observations: 27
```
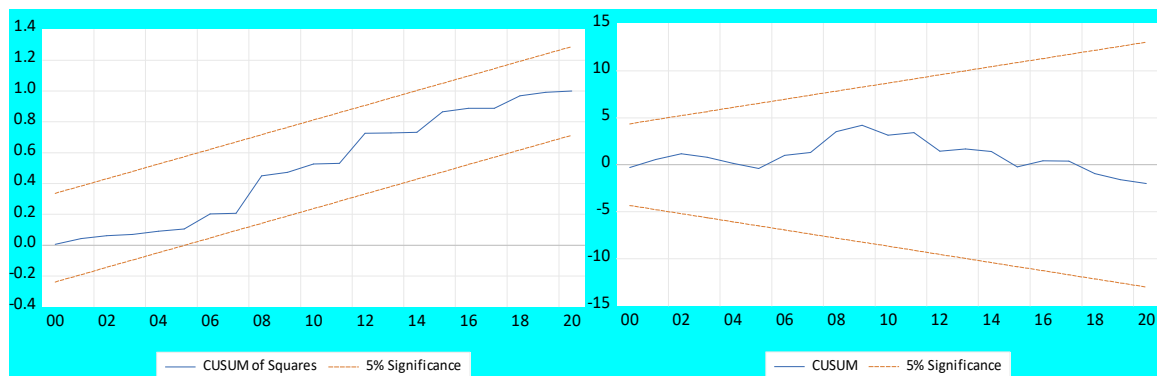
Source: *EViews 12*

3.4.5 Stability Diagnostics :

Through The results of Figure 4, we note all the plots of statistics CUSUM and CUSUMSQ are inside the critical bounds at 5% level of significance, which means that all the coefficients in the error correction model are constant, indicate that our ARDL model is stable.

Fig.4. Cusum Test and Cusum of Square Test

Source: *EViews 12*

3.5 ARDL Error Correction Regression Test

appendix 01 explains that the foreign exchange reserve does not contribute to attracting foreign direct investment in the short term, and this is because foreign investments are mainly long-term, and the investor cannot risk investing in developing countries unless he has sufficient guarantees related to payment. Especially since Algeria in the nineties was suffering from a large indebtedness without forgetting the

security and political situation in that period, and the exchange reserves did not exceed 1 billion dollars.

The results also showed there is a short-term dynamic relationship between the exchange reserves and foreign direct investment in Algeria, and this is due to the estimated negative statistically significant and moral error and its value was (CointEq(-1)=-0.8603), which measures the proportion of imbalance in the dependent variable that can be corrected From one time period to another at a rate of 86.03%, and the negative sign supports the existence of a long-term equilibrium relationship between the variables.

3.6 Estimated Long Run Coefficients

appendix 02 explains that there is a statistically positive and significant effect of foreign exchange reserves on long-term foreign direct investment at the significance level of 5%, which is consistent with economic theory, as the higher the foreign exchange reserve by 1%, the higher the foreign direct investment by 0.44%. With the rise in oil prices, the financial situation improved and international reserves exceeded $150 billion in the years 2008-2014, which allowed to attract more than 900 huge projects in various sectors, especially the oil sector, and to employ more than one million workers, this confirms what was stated by previous studies, which emphasized the importance of international precautions in attracting foreign direct investment as a safety valve for the investor.

Conclusion :

Countries whose environment is stable in their economic indicators are attractive to foreign direct investment, as international reserves are considered among the economic indicators that play a prominent role in meeting the periodic needs of the economy, and in the face of unexpected external shocks such as high import prices, lack of export earnings or the difficulty of external borrowing as well as strengthening and support the state's position in its dealings with abroad. This was confirmed by the econometric model about the impact of foreign exchange reserves on foreign direct

investment, about the existence of a positive relationship between them, as the increase in foreign exchange reserves by one unit leads to an increase in foreign direct investment by 44% in the long run.

Bibliography List:

Bertrand, B., & Gouia, R. (1998). *Foreign direct investment and Mediterranean industrial development.* paris: Economica.

Bobenič Hintošová, A., Bruothová, M., Kubíková, Z., & Ručinský, R. (2018). Determinants of foreign direct investment inflows: A case of the Visegrad countries. *Journal of International Studies, 11(2)*, pp. 222-235.

Fahmy, H. (1985). *Encyclopedia of Economic and Statistical Terms, , 2nd Edition.* Lebanon: Dar Al-Nahda Al-Arabiya.

Hidehiko, M. (2019, march). *Foreign Reserve Accumulation, Foreign Direct Investment, and Economic Growth.* japan: BANK OF JAPAN, IMES Discussion Paper Series 2019-E-4.

IMF. (2013). *International Reserves and Foreign Currency Liquidity.* Washington: guidelines for a data template.

Kaphle, R. (2021). Impact of foreign exchange reserve on economic growth in Nepal. *Journal of Management and Development Studies, 30(1)*, pp. 14-23.

kedi, a. (2004). *Introduction to Macroeconomic Policies (Analytical Evaluation Study).* algeria: Office of University Publications.

mouakeni, s., & zidane, m. (2020). Determinants of demand for foreign exchange reserves in Algeria, A econometric study from 1994-2016. *Journal of North African Economics, 16(22)*, pp. 129-144.

Odhiambo, N. M. (2009). Energy consumption and economic growth nexus in Tanzania: An ARDL bound testing approach. *Energy Policy, 37*.

Osigwe, A., & Uzonwanne, M. (2015). Causal Relationship among Foreign Reserves, Exchange Rate and Foreign Direct Investment: Evidence from Nigeria. *International Journal of Economics and Financial, 5(4)*, pp. 884-888.

Peter, L., & Pugel, T. (1996). *Economie international, 10th ed.* paris: economica.

Wenkai, S., & Song, M. (2009). FDI's real impact on foreign exchange reserves: Evidence from China. *China Economist 1*, pp. 1-12.

Yanjun, H., Liangying, Q., & Zhong, L. (2011). The relationship between FDI and foreign exchange reserve and its underlying causes. *International Conference on Computer Science and Service System (CSSS), 27-29 june 2011* (pp. 1-3). Nanjing, China: IEEE.

Yasir, M., Shehzad, F., Kamran, A., Sehrish, S., & Saleem, F. (2012). Relationship among exchange rate, FDI and foreign exchange reserves: An empirical investigation in case of Pakistan. *Interdisciplinary Journal of Contemporary Research in Business, 4(5)*, pp. 225-232.

Appendices :

Appendix 1. Error Correction Regression test

ARDL Error Correction Regression
Dependent Variable: D(LFDI)
Selected Model: ARDL(4, 0)
Case 2: Restricted Constant and No Trend
Date: 01/21/22   Time: 02:02
Sample: 1990 2020
Included observations: 27

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDI(-1))	0.199327	0.196940	1.012119	0.3230
D(LFDI(-2))	0.384595	0.176205	2.182649	0.0406
D(LFDI(-3))	0.683089	0.158483	4.310169	0.0003
CointEq(-1)*	-0.860384	0.211326	-4.071365	0.0005

R-squared	0.604575	Mean dependent var		0.025926
Adjusted R-squared	0.552997	S.D. dependent var		0.535541
S.E. of regression	0.358053	Akaike info criterion		0.919684
Sum squared resid	2.948650	Schwarz criterion		1.111660
Log likelihood	-8.415735	Hannan-Quinn criter.		0.976769
Durbin-Watson stat	1.962858			

Source: *EViews 12*

Appendix 2. Long Run Coefficients Test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LFDI)
Selected Model: ARDL(4, 0)
Case 2: Restricted Constant and No Trend
Date: 01/21/22   Time: 02:01
Sample: 1990 2020
Included observations: 27

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.444962	0.262920	-1.692387	0.1054
LFDI(-1)*	-0.860384	0.227804	-3.776852	0.0011
LRES**	0.378894	0.123190	3.075687	0.0057
D(LFDI(-1))	0.199327	0.213485	0.933681	0.3611
D(LFDI(-2))	0.384595	0.188197	2.043572	0.0537
D(LFDI(-3))	0.683089	0.168205	4.061058	0.0006

 * p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRES	0.440378	0.060639	7.262334	0.0000
C	-0.517167	0.242359	-2.133894	0.0448

EC = LFDI - (0.4404*LRES - 0.5172)

Source: *EViews 12*