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Econometrical study of the impact of the exchange rate on the balance of payments in Algeria during the period (1990-2023)

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Abstract:
This study aimed to analyze the relationship between the Algerian dinar exchange rate, the price of oil, and their impact on the balance of payments. We defined both the exchange rate and the balance of payments. Among the most important findings is a direct positive relationship between the Algerian dinar exchange rate and the balance of payments in both the short and long term at a significance level of 5%. Similarly, a positive relationship exists between the price of oil and the balance of payments in the short term, which becomes an inverse and statistically insignificant relationship in the long term at a significance level of 5%.

Keywords: Exchange rate, Balance of payments, national currency, foreign currency
Jel Classification Codes : C87, F30, F32.

Introduction:

The balance of payments is considered the definitive statement of the various economic relations between a country and the rest of the world, providing a clear picture of the different policies implemented. Transactions between countries are conducted according to the exchange rate, which acts as a link between these relations and is a fundamental element in guiding any country. It is a tool connecting the domestic economy with other economies and is considered one of the most important monetary policies for protecting the national economy from external shocks. Therefore, countries adopt various policies to promote economic growth. If the adopted exchange rate policy aims to achieve external balance (balance of payments balance) by increasing exports and reducing imports, the potential relationship between the exchange rate and the balance of payments arises to achieve the desired external balance.

The Algerian economy has undergone different stages of development. Since the 1990s, Algeria has implemented a series of reforms affecting various sectors under the supervision of international bodies. This followed a shift towards a market economy to address the problems it faced as a result of the collapse of oil prices in the global market in 1986 and its negative consequences for the Algerian economy, such as increased external debt and higher prices for consumer goods. Like other

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countries around the world, Algeria pays great attention to studying this relationship between the exchange rate and the balance of payments in order to determine the value of the national currency in foreign currencies, to explain the decline in the value of the dinar against foreign currencies, and to measure the extent of the impact of this decline on the balance of payments and its repercussions.
Every country has its own currency used for internal payments. The need to use foreign currencies arises when commercial or financial relations are established between companies operating within the country and companies operating outside it. Importing companies need the currency of the exporting country to pay for imported goods, and thus they are forced to go to the exchange market to buy the currency of the exporting country in order for this transaction to take place. In fact, it is not only companies that trade with foreign countries that need international currencies, but every person who travels outside the country in which he resides needs the currency of the country he wishes to go to, even if he is a tourist, and then finds himself forced to carry out exchange transactions.

The exchange rate is a crucial tool for influencing resource allocation across economic sectors, the profitability of export industries, and the cost of imported resources. As a link between domestic and global commodity prices, the exchange rate directly impacts the price of goods. A trade deficit inevitably leads to a depreciation of the exchange rate. Furthermore, the importance of these balances is amplified by their relationship to inflation and interest rates. Countries with high inflation face significant challenges in exporting their products and influencing their trade balance. Interest rates also govern capital flows in both the short and long term.

Research Question : We will pose the following problem:
What is the impact of the exchange rate on the balance of payments in Algeria?
To answer it, we have divided the study into:
1. Exchange rate
2. Balance of payment..
3. A standard study of the impact of the exchange rate on the balance of payments in Algeria during the period (1990-2023).

1 Exchange rate :

The exchange rate expresses the number of units of one currency that must be paid to obtain one unit of another currency. The exchange rate is considered one of the most important topics that all countries pay great attention to because of its effects on various economic indicators.

1.1 Definition of exchange rate :

- The exchange rate refers to the price relationship between the national currency and another foreign currency (Nazali ,2023, p 08)
- The exchange rate of two currencies is the ratio of one country's currency to another, or the exchange rate of a country's currency to another country's currency (Rahali, Bouafia, 2019, p 113)

1-2 Exchange rate forms :

The definitions vary according to the references used, and the constant is always the exchange rate, which represents the value of one currency in exchange for

several units of local currency. The official exchange rate of the local currency against other currencies is considered parallel, in the event of the existence of a parallel domestic exchange market

1-2-1 Nominal effective exchange rate :

We arrive at the true exchange rate after we have determined the exchange rate which represents the exchange rate between two currencies

1-2-2 Effective exchange rate:

The exchange rate between the two currencies The exchange rate between the two countries is calculated by taking into account the rate of exchange and the difference between the exchange rates. the two countries aim to reach a state of equilibrium between their currencies. (Zaher Junaidi, 2024, p 61)

1-3Types of Exchange Rates systems :

The concepts of the exchange rate system that were developed by the group of exchange rates and the exchange rate system. (Hadef, 2019, p 33)

1-3-1 Fixed Exchange Rate System:

Monetary authorities set a fixed exchange rate for the national currency against foreign currencies. If the value of the national currency changes outside the established fluctuation limits, the central bank intervenes directly in the foreign exchange market by buying or selling the national currency against foreign currencies to limit its depreciation or appreciation. (hamrit ,2017, p 15)

1-3-2 A flexible or floating exchange rate system:

This may include a fully floating system where the currency's value is determined by free market forces, or a managed floating system where the supply or demand for foreign currencies changes to influence the currency. In this system, the monetary authority of the local government intervenes to achieve economic objectives by selling the national currency to increase its supply and decrease its value, thereby preventing capital flight. This can also involve reducing the prices of exports or purchasing foreign currency. (Kias, Bibi, 2022, p 439).

1- 4 Factors affecting the exchange rate

There are many factors that influence the rise and fall of the exchange rate:

Interest rate variations:

Interest is income in the form of a percentage given as a premium for lending money, the difference in interest rates between countries contributes to the flow of capital. If the interest rate falls, the value of the currency decreases, and consequently, the value of the local currency decreases. This leads to an outflow of capital, increasing the demand for foreign currency and increasing the supply of investment, savings, and the local currency, i.e., a rise in the exchange rate. The difference in interest rates, both locally and globally, affects the movement of foreign currency, which leads to a shortage in the local currency, and consequently to a decrease in production, thus impacting the local economy through an imbalance between supply and demand. (djeddi, gattaf, 2021, p 247)

2 Balance of payment:

2-1 Definition of the Balance of Payments :

1/ It is a documented statistical record that uses double-entry bookkeeping to record receipts and payments made by resident persons, both natural and legal, from a country to foreign entities as a result of economic exchanges and transfers from one party or several parties. (Ghatas, 2023, p 67)

2/ It is defined as a regular accounting record of all economic transactions that take place between residents of a country and non-residents in a time period, usually one year.(Zouad, 2020, p 748)

2-2 Importance of the Balance of Payments : (Haniffa, Radiff, 2024, p 51)

- ❖ The balance of payments reflects the economic conditions of a country, regardless of the time period the data covers. Therefore, recording the balance of payments reflects the strength of the national economy and its economic transactions.
- ❖ The balance of payments reflects the forces of supply and demand for foreign currencies.
- ❖ The balance of payments is an important tool that helps public authorities plan and direct the country's external relations as a result of its integration into the global economy.

2-3 Structure of Balance of Payments : (Djelti, 2021, p 320, 321)

2-3-1Current Account: This account includes all economic transactions, both credit and debit, and is divided into:

- ✓ **Visible Trade Balance:** Represented by imports and exports of goods only
- ✓ **Invisible Trade Balance:** Represented by imports and exports of services only

2-3-2 Capital Transactions Account: This account consists of credit and debit entries for non-productive financial assets and capital transfers

2-3-3 Official Settlements Account: This includes official international reserves used to settle deficits and surpluses in the balance of payments

2-4 Balance and imbalance in the balance of payments:

The balance sheet is always balanced from an accounting perspective, so what is meant by the existence of a deficit or surplus :

- **In the case of a deficit,** where a country's payments exceed its receipts, if a country experiences a deficit in its current account, this deficit can be covered by the long-term capital account. Alternatively, if the deficit is covered by the short-term capital account, gold, and reserves, resulting from the current account and long-term capital accounts, then...
- **In the case of a surplus,** which is an economic imbalance, the same applies to the second scenario. Imbalance is a situation where a country's payments exceed its revenues. If a country experiences a surplus in its current account, the country eliminates this surplus, and economic equilibrium is achieved. However, if this surplus is external, and lending exceeds borrowing, the country is forced to send gold abroad. Since developing countries often suffer from balance of payments deficits due to imports

exceeding exports, this results in an economically imbalanced balance of payments. (Ghodban, Agoun,2020, P 1358)

3- A standard study of the impact of the exchange rate on the balance of payments in Algeria during the period (1990-2023):

We relied on a set of variables that, in our view, will determine the relationship between the independent variables: the dinar-to-dollar exchange rate (TC), the trade openness rate (OPEN), the oil price (OIL), and foreign direct investment (FDI). The dependent variable is the balance of payments (BP), statistics taken from the World Bank, excluding the OPEC oil price variable. Through this study, we attempt to obtain annual data for Algeria during the period (1990-2023). Therefore, the study model will be chosen as follows:

BP = (TC, OPEN, OIL, FDI)
BP: Balance of payments
TC: Exchange rate (dinar to dollar)
OPEN: Trade openness rate
OIL: Oil price
FDI: Foreign direct investment.

$$BP = \beta_0 + \beta_1 TC + \beta_2 OPEN + \beta_3 OIL + \beta_3 FDI + \mu_i$$

3.1 Stationarity Tests:

Before estimating the model, we test the stationarity of the time series. This is to ensure that all variables are stationary of degree zero (I(0) or first-order I(1)) and that there is no integrated time series of degree two. This is to verify the application of the ARDL model.

Table (1): Testing the extent of stationarity of time series

	Level		first difference		
	ADF	PP	ADF	PP	
BP	-2.43 0.14	-2.43 0.14	-6.08 0.00***	6.33 *** 0.00	(1)I
TC	-1.26 0.63	-1.26 0.63	-3.83 *** 0.00	-3.80 *** 0.00	(1)I
OPEN	-1.53 0.50	-1.53 0.50	-5.09 *** 0.00	-5.08 ***0.00	(1)I
FDI	-2.93 0.16	-2.82 0.19	-5.83 *** 0.0003	-8.01 ***0.00	
OIL	-1.34 0.59	-4.66 0.00	-1.41 *** 0.55	-4.62 *** 0.00	(1)I

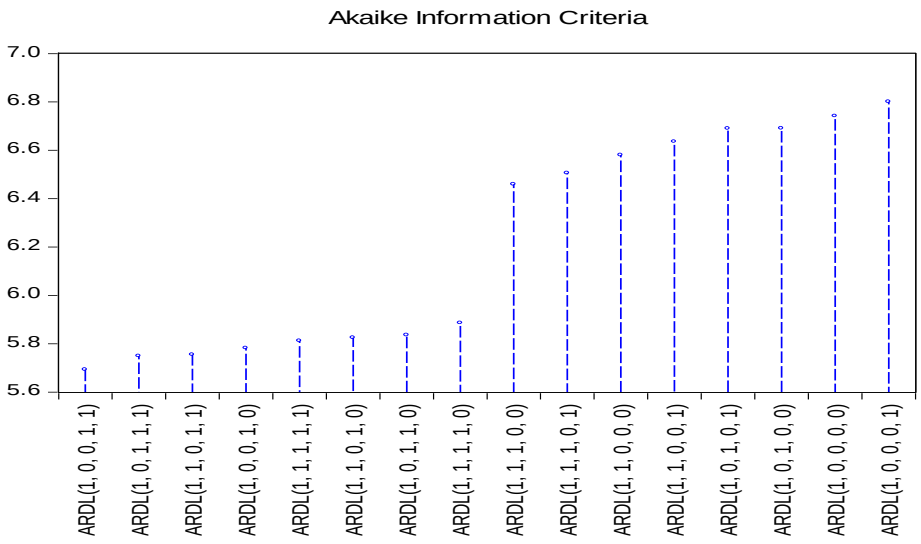
Source: Prepared by the researcher based on the eviews 10 program.

From Table (1), the ADF test indicated that all variables were stationary at the first level. Therefore, it can be said that all variables under study are integrated from (1) I. The PP test indicated that all variables were stationary at the first level. Therefore, it can be said that all variables under study are integrated from (1) I. Therefore, the ARDL model can be used.

3.2 Choosing the optimal lag intervals for variables to estimate the ARDL model:

Choosing the optimal lag interval according to the AIC criterion according to the following figure:

Figure (1): Results of choosing the optimal lag intervals according to the AIC criterion



Source: Prepared by the researcher based on the eviews 10 program.

From Figure No. (1), it is clear that the best model according to the criterion (AIC) is (1,0,0,1,1) ARDL.

3.3. Bounds Test:

Table (2) shows the results of the cointegration test using the bounds test methodology. The results indicate that the calculated value of the F-statistic is greater than the critical values of the upper bound at most significance levels (10%, 5%, and 1%). Therefore, we reject the null hypothesis "no cointegration" and accept the alternative hypothesis "there is a long-term equilibrium relationship" between the study variables.

Table (2): Bounds Test

F-statistic Calculated		
4.80		
Critical values	**Minimum limit I(0)**	**Maximum limit I(1)**
At a significance level of 10%	2.2	3.09
At a significance level of 5%	2.56	3.49
At a significance level of 1%	3.29	4.37

Source: Prepared by the researcher based on the eviews 10 program.

3.4. Estimation of the Autoregressive Distributed Lag (ARDL) Model:

Table (3): Results of testing the ARDL model

Dependent Variable: BP
Method: ARDL
Date: 03/21/25 Time: 12:06
Sample (adjusted): 1991 2022
Included observations: 32 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): TC OPEN OIL FDI
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(1, 0, 0, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
BP(-1)	0.752849	0.097628	7.711415	0.0000
TC	0.013522	0.030178	0.448073	0.6581
OPEN	0.150447	0.141598	1.062490	0.2986
OIL	0.246509	0.049556	4.974344	0.0000
OIL(-1)	-0.330623	0.045283	-7.301262	0.0000
FDI	-0.285721	0.336121	-0.850056	0.4037
FDI(-1)	0.636585	0.322247	1.975457	0.0598
C	-6.664670	7.142811	-0.933060	0.3601

R-squared	0.918684	Mean dependent var	2.159375
Adjusted R-squared	0.894967	S.D. dependent var	11.56984
S.E. of regression	3.749647	Akaike info criterion	5.693518
Sum squared resid	337.4364	Schwarz criterion	6.059952
Log likelihood	-83.09629	Hannan-Quinn criter.	5.814981
F-statistic	38.73503	Durbin-Watson stat	1.968716
Prob(F-statistic)	0.000000		

Source: Prepared by the researcher based on the eviews 10 program.

From Table (3), we note that the explanatory power (R2) of this model reached 92.86%, meaning that the independent variables explain 92.87% of the dependent variable, and the remaining percentage is attributed to factors outside the model or variables not included in the model.

3.5 Model Diagnostic Tests:

Before estimating the relationship in the long and short run, a test must be conducted to detect the presence of an autocorrelation problem between the estimated residuals (Serial Correlation LM Test). If autocorrelation exists between the residuals, the model being studied and proposed for studying the relationship between the research variables cannot be accepted. The autocorrelation test, the variance invariance test, the normal distribution test of the residuals, and the model description test also demonstrate the model's effectiveness.

A. Detecting the presence of an autocorrelation problem between the estimated residuals:

Table (4): Autocorrelation test between the residuals

Breush-Godfrey serial correlation LM Test			
F-statistic	0.248018	**Prob. F(2,17)**	0.7842
Obs*R-squared	1.071779	**Prob. Chi-Square(2)**	0.5851

Source: Prepared by the researcher based on the eviews 10 program.

We note from Table (4) that the results of the LM test show that the probability value of the Fisher statistic is 0.7842, which is greater than the 5% significance level. This means that the null hypothesis "there is no autocorrelation between the residuals" can be accepted, and thus the alternative hypothesis "there is autocorrelation between the residuals" can be rejected.

B. Test of Non-Constancy of Variance:

Table (5): Test of Non-Constancy of Variance

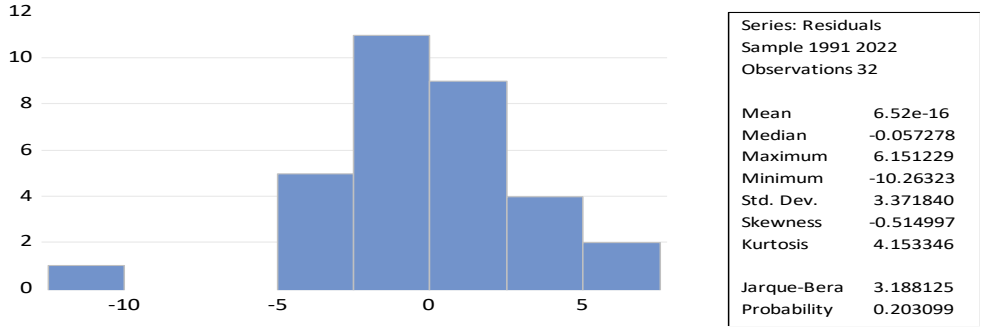
Heteroskedasticity Test ARCH			
F-statistic	0.330315	**Prob. F(1,25)**	0.5708
Obs*R-squared	0.704504	**Prob. Chi-Square(1)**	0.5524

Source: Prepared by the researcher based on the eviews 10 program.

We note from Table (5) that the probability value of Fisher's statistic is 0.5708, which is greater than the 5% significance level. This means that the null hypothesis (non-constant variance) can be accepted, and thus the alternative hypothesis can be rejected.

C. Testing the normal distribution among the residuals:

Figure (2): Testing the normal distribution among the residuals



Source: Prepared by the researcher based on the eviews 10 program.

We note from Figure (2) that the probability value (jarque-bera) is 0.20, which is greater than the 5% significance level. Therefore, the residuals of the regression estimate follow a normal distribution.

D. Model Description:

Table (6): Model Description

Ramsey RESET Test			
	Value	**Df**	**Probability**
t-statistic	0.478569	13	0.6402
F-statistic	0.229028	(1, 13)	0.6402

Source: Prepared by the researcher based on the eviews 10 program.

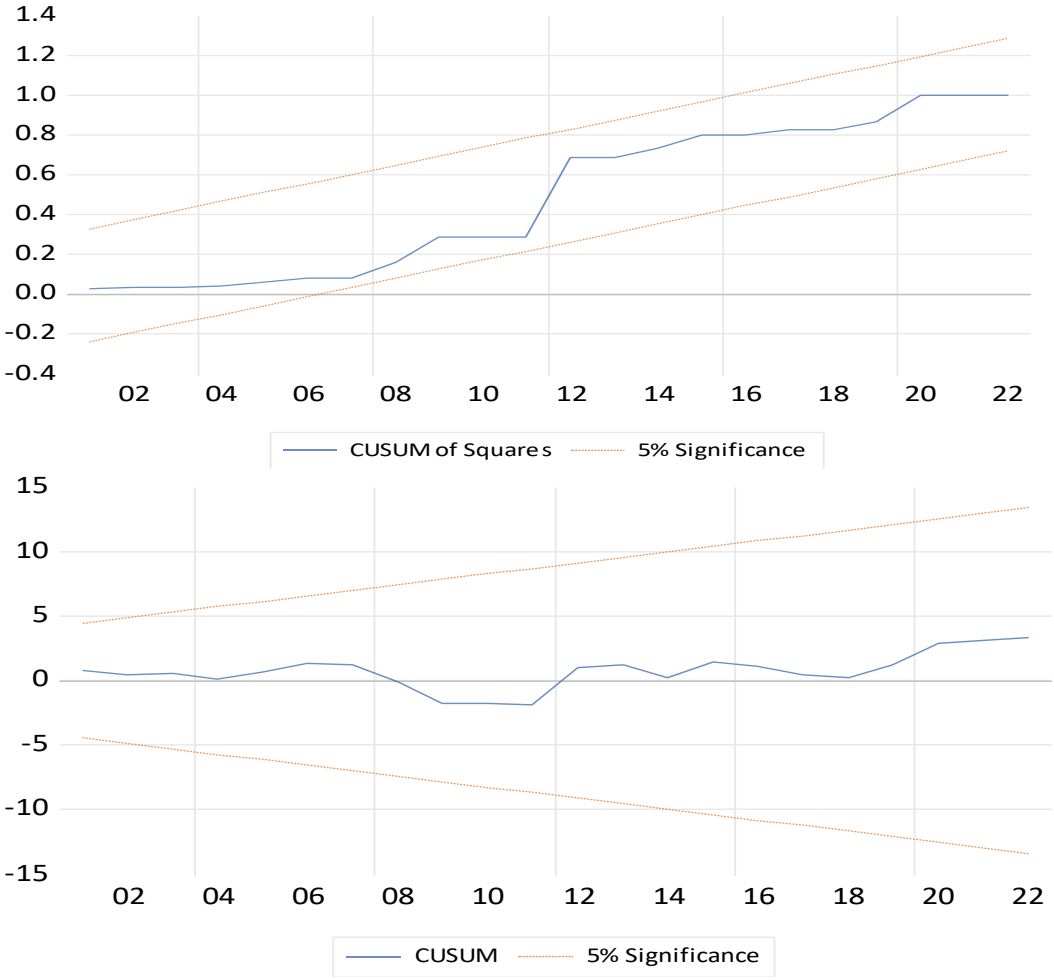
According to Table (6), the probability value is 0.6402, which is greater than the 5% significance level, confirming the acceptance of the null hypothesis "the model is adequately and correctly specified."

6.4. Asymmetry Test Results:

7.4. Model Stability Test:

To ensure that the data used in this study are free of any structural changes, one of the appropriate tests must be used, such as the cumulative sum of recurring residuals (CUSUM) and the cumulative sum of recurring residuals squared (CUSUM of Squares). Therefore, structural stability of the estimated coefficients of the error correction formula for the autoregressive distributed lag model is achieved if the graphs of both the CUSUM and CUSUM of Squares tests fall within the critical limits at the 5% level.

Figure (3): Model Stability Test



Source: Prepared by the researcher based on the eviews 10 program.

From Figure (3), we note that the cumulative sum of residuals (CUSUM) test and the cumulative sum of squares (CUSUM) test for this model cross a linear mean within the critical region, indicating a degree of stability in the model at a significance level of 5%. These two tests demonstrate stability in the model between the long-term and short-term results.

- Results of estimating the relationship in the long and short runs between the impact of exchange rate fluctuations on the balance of payments:

After ensuring that the model is free of structural problems related to serial correlation and stability, we will conduct a test for the long and short runs.

Table (8): Results of estimating the relationship in the short run

Cointegrating Form				
V ariable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob**
D(TC)	0.01	0.03	0.44	0.65
D(OPEN)	0.15	0.14	1.06	0.29
D(FDI)	-0.28	0.33	-0.85	0.40
D(OIL)	0.24	0.04	4.97	0.00

CointEq(-1)	-0.27	0.09	-2.53	0.01

Source: Prepared by the researcher based on the eviews 10 program.

Table (9): Results of estimating the relationship in the long run

Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob**
TC	0.05	0.13	0.40	0.68
OPEN	0.60	0.45	1.32	0.19
OIL	-0.34	0.18	-1.81	0.08
FDI	1.41	1.62	0.87	0.39
C	-26.96	24.62	-1.09	0.28

Source: Prepared by the researcher based on the eviews 10 program.

We note from Table (8-9):

- There is a positive, uncorrupted relationship between the dinar exchange rate and the balance of payments (a direct relationship) in the short and long term at the 5% significance level, such that a 1-unit increase in the dinar exchange rate will increase the balance of payments by 0.01 unit in the short term and by 0.05 units in the long term. However, the Algerian dinar exchange rate has undergone several gradual devaluations, the most important of which was a 40% devaluation in 1994. This was in accordance with the recommendations of the International Monetary Fund (IMF) within the framework of the structural reforms that Algeria underwent during that period, and the adoption of a policy of devaluing the national currency, which in turn led to stimulating exports and reducing imports. However, this requires the availability of certain conditions (the Marshall-Lehner condition, diversification of the production base, etc.). The devaluation of the currency did not have significant positive results on the national economy, particularly the balance of payments. There is a positive, insignificant relationship between trade openness and the balance of payments (direct relationship) in the short and long term at the 5% significance level, such that a 1-unit increase in trade openness will lead to an increase in the balance of payments by 0.15 units in the short term and by 0.60 units in the long term. This is probably due to the fact that most exports are rentier, leading to the depletion of hard currency and the erosion of foreign exchange reserves as a result of the decline in oil prices. This may indicate the weak ability of foreign trade to have an immediate impact on the balance of payments, and that openness was not accompanied by sufficient export competitiveness.
- There is a positive relationship between the price of oil and the balance of payments (direct relationship) in the short term, which turns into a negative and insignificant relationship in the long term at a significance level of 5%, such that a 1-unit increase in the price of oil will lead to an increase in the balance of payments by 0.24 units in the short term, and a decrease of 0.34 units in the long term. Any increase in oil prices will have a positive impact on the balance of payments (increased revenues from hydrocarbon exports), but these effects are only noticeable in the short term. In the long term, it is difficult to predict the price of oil in global markets due to its instability. -- There is a negative and insignificant relationship between foreign direct investment and the balance of payments (an inverse relationship) in the short term, which turns into a positive and insignificant relationship in the long term at a significance level of 5%. An increase of 1 unit in foreign direct investment will lead to a decrease in the balance of payments by 0.28 units in the short term, and an

increase of 1.41 units in the long term. This is due to the nature of foreign investment inflows into Algeria, which may be directed towards non-productive or non-exportable sectors (such as energy in the local market or services), and therefore does not directly contribute to boosting exports. The duration of the impact of foreign investment may be longer, especially if the projects are long-term and have not yet entered full production. - Regarding the error correction limit (CoinEp(-1), a negative and significant sign appeared (-0.2471) at a significance level of 5%, which confirms the existence of a long-term equilibrium relationship (the existence of joint integration) between the study variables, and which indicates that errors in the balance of payments balance are corrected in a period of time less than a year.

Conclusion:

The exchange rate is the number of units of one currency that must be paid to obtain one unit of another currency, the exchange rate is considered one of the most important issues for countries due to its significant impact on various economic indicators.

The state based its exchange rate on the proceeds of oil exports, and also among the influential factors.this shows us the extent of the fragility of the Algerian economic structure in the face of economic variables, and several interventions to correct imbalances. In Algeria, it is also linked to the inflation rate, the growth rate, and the unemployment rate, and these rates play an important role in the volatility of the Algerian dinar.

Results :

- The Algerian dinar exchange rate has undergone several gradual devaluations, the most important and the adoption of a policy of devaluing the national currency
- The devaluation of the currency did not have significant positive results on the national economy, particularly the balance of payments. There is a positive, insignificant relationship between trade openness and the balance of payments
- Any increase in oil prices will have a positive impact on the balance of payments (increased revenues from hydrocarbon exports), but these effects are only noticeable in the short term. In the long term, it is difficult to predict the price of oil in global markets due to its instability
- Most exports are rent-seeking, leading to a drain on foreign currency reserves and a decline in oil prices. This may indicate that foreign trade has a limited capacity to have an immediate impact on the balance of payments, and that liberalization has not been accompanied by sufficient export competitiveness.

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