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MEASURING THE IMPACT OF THE MONETARY MASS ON FDI FLOWS IN ALGERIA DURING THE PERIOD (1990-2020) USING THE ERROR CORRECTION MODEL (VECM)

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ABSTRACT:
This study aims to measure the impact of foreign direct investment on the money supply in Algeria during the period1990-2020 through the use of the error correction model (VECM),with the aim of testing the long-term causal relationship between promising foreign investment and the money supply , and the joint integration test. After testing the stability of time series, it was found that the study variables are stable in the first degree. The results of the estimates showed that there is no causal relationship between the two variables in both directions in the short term. After testing the significance of the parameters, it was found that the error correction coefficient (CointEq) is negative and moral. This explains the existence of a long-term equilibrium relationship between the study variables with a positive impact between all money supply and changes in foreign direct investment.

Keywords: foreign investment, money supply, monetary mass, joint integration.

INTRODUCTION:
Foreign direct investment is of great importance to developed and developing countries due to the developmental role it plays through the adoption of economic policies aimed at attracting it,as the monetary mass is one of the most important parts of economic policy.
In this context, Algeria, like other countries, has sought to attract foreign direct investment with the aim of achieving growth and economic development, through the adoption of a monetary policy aimed at reducing the exchange rate,controlling the money supply and reducing discount rates.

Hence, the importance of the research lies in highlighting the relationship between foreign direct investment and the monetary mass in Algeria by asking the following question:

What is the impact of the money supply on FDI flows in Algeria during the period1990-2020 ?

Hypotheses of the Study

Based on the problem of the study, the following hypotheses can be formulated:

- The existence of a short-term causal relationship between changes in the money supply and foreign direct investment flows.
- There is a positive impact of changes in the money supply on foreign direct investment flows.

Objectives of the study

This study seeks to achieve a number of objectives, which are as follows:

- Concepts about money supply and foreign direct investment
- Knowing the relationship between the money supply and foreign direct investment
- Attempting to model the relationship between changes in money supply and FDI flows

1. Theoretical aspect of the study:

- **Foreign Direct Investment:**

The International Monetary Fund defines foreign direct investment as the possession of permanent benefits in the institution that carries out its activities in the economic field outside the investor's field in order to have the ability to make actual decisions in the management of the institution. (Elias, 2020)

The United Nations Conference on Trade and Development defines it as that investment that involves a long-term relationship, through which permanent interests emerge and capable of administrative arbitration,between a company in one country of nations and a company that is a productive unit in another country. (Silo, 2014)

- **Principles of Foreign Direct Investment:**

The basic principles of FDI are: (Khamisi, 2015)

- The principle of transparency and consistency: This principle means the mandatory availability of information related to investment and its surroundings in a normal and absolute manner,without discrimination or cost to all investors, whether residents or non-residents, and until this principle is implemented, it requires countries to codify the work of the information system related to the promotion of investment in legal and legislative documents.
- The principle of capital movement: It is a principle related to the movement of capital and returns related to investments to the country of origin without prior license or authorization.
- The principle of automatic or automatic transfer: It guarantees the freedom of capital and returns related to foreign investments to the country of origin without prior license or authorization.

- The principle of free access to the foreign exchange market: This principle must be achieved in a country that knows the stage of transition to a market economy,through the development of mechanisms for the liberalization of the exchange market that encourages the achievement of full convertibility of currency.
- The principle of stability: This principle has a role in creating economic and political relations for a country with the outside world as a result of the existence of risks that could threaten stability,and thus prevent the promotion of foreign investment.

- **Monetary mass**

The concept of cash mass is based on the use of cash as a store of value,where financial assets are held during the time gap between the acquisition of these assets and their use in payment.It is defined as the sum of the liabilities of demand deposits in commercial banks, and time deposits in commercial banks are included in the measures of cash mass. (بوقرة، 2021)

The monetary authorities attach great importance to the money supply and regulate its issuance in line with macroeconomic objectives,which requires the monetary authority to track the money supply and the factors that can affect it by increasing or decreasing its size. (Allal, 2019)

Thus, the money supply can be expressed in monetary supply, which is defined as: that amount of money available in a period of time, which is usually determined by the monetary authorities. (dJamea, 2021)

- **<u>The relationship between monetary mass and foreign direct investment:</u>**

The monetary mass is one of the most important tools through which the state can influence the various macroeconomic balances and direct them according to the objectives to be achieved. Among these objectives, we find an increase in the inflows of foreign investment to the state,because it has become today a prominent role in achieving economic development. It is worth mentioning that the more flexible,clear,efficient and effective these policies are and in line with economic changes and transformations at the macro level, the more effective they are in attracting foreign direct investment and vice versa.

If monetary policy tends to expand credit by lowering interest rates or any other means that leads to an increase in the money supply, this is an incentive for foreign investments.

In general, it can be said that an expansionary monetary policy would stimulate the attraction of foreign investment and vice versa. In the case of deflationary policies, it would negatively affect the flow of foreign investment into the country. (Bourousha, 2015)

From this, we conclude that the amount of money is directly related to foreign investment flows,as the high growth rate of the money supply in the host country contributes to stimulating loans,and thus attracting foreign direct investment. (Sharbi, 2021)

2. A standard study of the causal relationship between foreign direct investment and the money supply in Algeria during the period(1990-2020)

- **The model used and the study variables used :**

$$DFi = F(Ms)$$

$$id = \beta 0 + \beta 1 \inf + \varepsilon t$$

Where : GDP represents gross domestic product
DFi Foreign Direct Investment
: $\beta 0$ $\beta 1$ Represents the parameters of the model .
: εt Represents random error

Table:01 Study Parameters

Variable	Significance	Code	Data source
Bulk Cash	MONEY SUPPLY	MS	World Bank
Foreign Direct Investment	Total Inward Investments	DFI	World Bank

Source : Prepared by researchers based on the above

- Testing the stability of time series of study variables:

In order to identify the degree of integration of the time series of the study variables by verifying the absence of the single root, the Phillips-Perron test will be relied upon and the following table shows the results of the application of this test:

Table02 : Unit Root Test Results

1st Differences									Variabls
None			Trend and Intercept			حصر			
PROB	Level 5%	ADF	PROB	Level 5%	ADF	PROB	Level 5%	ADF	
0.0000	-1.953381	-6.655418	0.0001	-3.580623	6.44405	0.0000	-2.971853	-6.601116	MS
0.0000	-1.953381	-5.603527	0019	-3.580623	-5.034980	0.0004	-2.971853	-4.980390	DFI

Source : Prepared by researchers based on the outputs of Eviews10

Based on the results of the unit root test for the time series shown in the table above, it was found that : the series associated with the variable MS is stable at the first difference, that is, the value of 6.60= T-Statistic) in absolute value (which is greater than the tabular value of 2.97). This is shown by the probability of this test Prob=0.0000, which is less than 0.05. Therefore, through this model, it can be said that the series does not contain a unit root, and therefore it is stable, that is, it is integrated from grade 1, i.e. I(1)

- As for the series related to the variable DFi, it is stable at the first difference, that is, the value of 4.98= T-Statistic (in absolute value), which is greater than the tabular

value of 2.97, and this is shown by the probability of this test Prob=0.0004, which is less than 0.05. Therefore, through this model, it can be said that the series does not contain a unit root and therefore it is stable, that is, it is an integral of degree 1, i.e. I(1)

- Granger Causality Test:

The **Granger Causality Test** refers to the study of the trend of the relationship between GDP and tourism revenues and the following table shows this:

Table03 : Granger Causality Tests

Pairwise Granger Causality Tests
Date: 12/25/21 Time: 20:14
Sample: 1990 2020
Lags: 2

Null Hypothesis:	OBS	Statistic	PROB
DFI does not Granger Cause MS	29	0.03177	9688
MS does not Granger Cause DFI		0.58781	5633

Source: Prepared by researchers based on the outputs of Eviews10

Based on the results of Granger Causality Tests, it is clear that :

- Test (1) tests the causality of DFi on Ms, as we note that Prob= 0.9688 and therefore accept the zero hypothesis, which means that DFi does not cause Ms, and from it it can be said that there is no causal relationship for foreign direct investment on the money supply

- As for test (2), it tests the causality of Ms on DFi,we note from the results that Prob= 0.5633 and therefore accept the zero hypothesis, which is that Ms does not cause DFi and from it it can be said that there is no causal relationship to the money supply on FDI

Thus, we conclude that there is no two-way causal relationship between FDI and the money supply.

- **Johansson's test for determining the integration relationship:**

After verifying that the two chains are of the first degree I(1), we test **Jo*Hansen Juselius*** for joint integration, with the aim of ensuring that there is joint integration or not, with clarification if there is a long-term complementary relationship, and the following table shows this :

Table 04: Joint Integration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	PROB**
None	0.410677	23.92133	15.49471	0021

At most 1 *	0.256281	8.586668	3.841466	0034

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	PROB**
None	0.410677	15.33466	14.26460	0.0337
At most 1 *	0.256281	8.586668	3.841466	0034

Source: Prepared by researchers based on the outputs of Eviews10

Based on the results of the joint integration test **Johansen *Juselius*** , it is clear that :
- When None* and the result of the first test is significant, that is, the value of Prob=0.0021, which means that we reject the zero hypothesis (there is no long-term equilibrium relationship) and accept the alternative hypothesis, which is that there is a long-term equilibrium relationship.
-When Atmost 1 * We note that this test is not significant Prob=0.0034 It means that wereject the null hypothesis, that is, there is a long-term equilibrium relationship.
Thus we conclude that : having an equilibrium relationship means that we can estimate the VECM model.

- **Determine the delay scores for the model:**

In order to estimate the var model, the **AIC andSC** criteria will be used **,** with the aim of determining the optimal slowdown periods. The following table shows this:

Table05 : Model Delay Score Results

Lag	LOGL	LR	FPE	AIC	SC	HQ
0	-123.0862	NA	36.23258*	9.265645*	9.361633*	9.294187*
1	-119.2791	6.768147	36.81936	9.279935	9.567899	9.365562
2	-118.2509	1.675651	46.19897	9.500065	9.980005	9.642777
3	-116.0836	3.210731	53.74715	9.635825	10.30774	9.835621
4	-115.4056	0.904078	70.74642	9.881895	10.74579	10.13878

Source: Prepared by researchers based on the outputs of Eviews10

From the previous table, which represents the criteria for determining the delay periods of the model and according to the AIC and SC standards,it is clear that : The optimal number of delays for the study variables is equal to 0, that is, P=**0** .Thus, it can be said**:** we can estimate the VECM model with an equilibrium relationship (1) and a delay period (0).

- **VECM model estimation**

After confirming the stability of the time series and determining the degree of delay, we will estimate the VECM model through the co-integration test in order to verify the existence of co-integration in this study. The following table shows the results of applying this test:

Table 06: VECM Error Correction Model Estimation Results

Vector Error Correction Estimates
Date: 12/25/21 Time: 20:28
Sample (adjusted): 1991 2020
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
MS-1	1.000000	
DFI(-1)	-5.638572 (3.18018) [-1.77304]	
C	-8.655189	
Error Correction:	D(MS)	D(DFI)
CointEq1	-0.703754 (0.19713) [-3.56999]	0.020607 (0.01293) [1.59337]
C	-0.132333 (1.99091) [-0.06647]	0.026983 (0.13062) [0.20658]

Source: Prepared by researchers based on the outputs of Eviews10

- **Residual Self-Coherence TestLM Test :**

In order to verify that there are no problems with the self-correlation of the study model, we carry out this var Residual Serial Correlation LM Test. The following table shows this :

Table 07: Residual Self-Correlation Test ResultsLM Test

VEC Residual Serial Correlation LM Tests
Date: 12/25/21 Time: 20:31
Sample: 1990 2020
Included observations: 30

Lag	LRE* stat	df	PROB	Rao F-stat	df	PROB
1	1.153472	4	0.8857	0.285935	(4, 50.0)	0.8857
2	2.885203	4	5772	0.727543	(4, 50.0)	0.5774
3	0.873465	4	9283	0.215928	(4, 50.0)	9284
4	0.794671	4	0.9392	0.196298	(4, 50.0)	0.9392
5	1.286322	4	0.8637	0.319285	(4, 50.0)	0.8637
6	2.634973	4	6206	0.662801	(4, 50.0)	0.6208

Source: Prepared by researchers based on the outputs of Eviews10

Based on the results of the LM Test shown in the above table, it is clear that :
All probabilities(Prob) are immaterial (greater than 0.05) and therefore we accept the null hypothesis that there is no self-correlation between errors(the rest are not self-correlated).

- **VECM Validity Test :**

-Homogeneity Test:

In order to find out whether the study model suffers from the problem of heterogeneity, the Heteroskedasticity Test was carried out

Table 08 : Heterogeneity Test Results

VEC Residual Heteroskedasticity Tests (Levels and

Squares)
Date: 12/25/21 Time: 20:40
Sample: 1990 2020
Included observations: 30

Joint test:

Chi-sq	df	Prob.
5.171008	6	0.5221

Individual components:

Dependent	R-squared	F(2,27)	Prob.	Chi-sq(2)	Prob.
res1*res1	0.045319	0.640856	0.5347	1.359584	0.5067
res2*res2	0.054467	0.777657	0.4695	1.634001	0.4418
res2*res1	0.006891	0.093673	0.9109	0.206727	0.9018

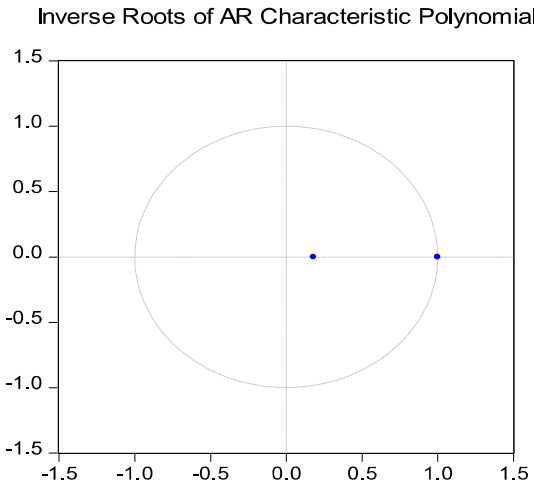
Based on the results of the heterogeneity test, it is found that :
- The prob value of Ch-Sq has reached 0.5221, which is greater than 0.05 (non-significant), and therefore we accept the zero hypothesis, that is, the chain of residues has a homogeneous variation.

So : it can be said that the estimated model has neither a heterogeneity problem nor a self-correlation problem.

- **Unit Root Test:**

We perform this test to ensure the stability of the model,as shown in the following figure:

Figure:01 Unit Root Test Results



Source: Prepared by researchers based on the outputs of Eviews10

Based on the results shown in the figure, it is found that the VECM model meets the conditions of stability, and since the roots have fallen inside within the critical limits, the model is stable.

- **Milestones Morale Test:**

Table09 : Study Milestones Significance Test Results

System: Untitled
Estimation Method: Least Squares
Date: 12/25/21 Time: 20:43
Sample: 1991 2020
Included observations: 30
Total system (balanced) observations 60

	Coefficient	Std. Error	t-Statistic	PROB
C 1	-0.703754	0.197131	-3.569986	0.0007
C 2	-0.132333	1.990913	-0.066469	0.9472
C 3	0.020607	0.012933	1.593369	1167
C 4	0.026983	130619	0.206581	8371
Determinant residual covariance		47.41358		

Equation: D(MS) = C(1) * (MS (-1) - 5.63857163563*DFI(-1) - 8.65518890118
C 2
Observations: 30

Source: Prepared by researchers based on the outputs of Eviews10

Through the results of the estimation shown in the above table, which shows the results of the estimation of the error correction model VECM It is clear: After estimating the error correction model CointEq It is negative(0.703754) and significant Prob=0.0007, and this is explained by the existence of a long-term equilibrium relationship between the variables under study, that is, in the long run foreign direct investment explains 70% of the changes in the money supply, and any imbalance that occurs at the level of one of the two variables will be corrected in this ratio in order to maintain the long-term equilibrium situation.

Wald's test

Through it, the significance of the landmarks is tested in the short term, that is, the possibility of the absence of the impact of tourism revenues on GDP is tested in one delay for the short term.

Table 10: WALD Results (Short-Term Significance of Milestones)

Wald Test:
System: %system

Test Statistic	Value	df	Probability
Chi-Square	15.28804	3	[0016]

Source: Prepared by researchers based on the outputs of Eviews10

Based on the above table, which shows the results of wald (the significance of the milestones in the short term), it is clear that :

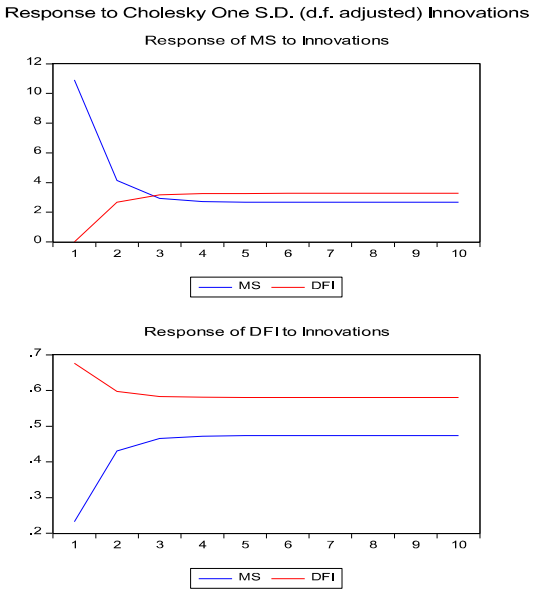
- The value of Prob=0.0016 is significant (less than 0.05), which means that the parameters of foreign direct investment cannot be absent in the money supply equation.

- **Trauma Analysis:**

In order to follow the timeline of the shocks that occur at the random error level and to which the study variables are exposed and how to respond to the latter,as the change in the value of the standard deviation to one , and the two following curves

show the results of applying this test after receiving both tourism revenues and GDP of the shock and the degree of response of each of them :

Figure:02 Shock Analysis Results



Source: Prepared by researchers based on the outputs of Eviews10

Through the previous two curves, it is clear that : any shock in foreign direct investment will affect the money supply and the amount of standard deviation 1. Thus :It was noted through curve 01: that the response of the money supply to the change in foreign direct investment was in fluctuation throughout the study period with stability in the field of confidence throughout the chain. As for the second curve, we note that the response of foreign direct investment to the change in the money supply has witnessed a decline in the first three periods to return to achieve stability during the next two periods. Therefore, it can be said that the response of both variables (FDi, Ms) has been achieved since the first period.

- **Variance Analysis:**

Variance analysis and segmentation is the measurement of the percentage of the interpreted variance of each internal variable compared to itself and to other variables, that is, knowledge of the degree of influence between variables(the independent variable and its interpreted variables).

Table 11: Variance Analysis Results

Variance Decomposition of MS:			
Period	S.E.	MS	DFI

1	10.90468	100.0000	0.000000
2	11.97378	94.97286	5.027137
3	12.72949	89.35817	10.64183
4	13.41750	84.53608	15.46392
5	14.06798	80.52764	19.47236
6	14.68902	77.17280	22.82720
7	15.28474	74.32907	25.67093
8	15.85807	71.88886	28.11114
9	16.41139	69.77214	30.22786
10	16.94664	67.91861	32.08139

Variance Decomposition of DFI: Period	S.E.	MS	DFI
1	0.715427	10.57225	89.42775
2	1.026905	22.69042	77.30958
3	1.269805	28.30202	71.69798
4	1.474218	31.26190	68.73810
5	1.653720	33.04053	66.95947
6	1.815589	34.21816	65.78184
7	1.964168	35.05370	64.94630
8	2.102273	35.67702	64.32298
9	2.231848	36.15980	63.84020
10	2.354303	36.54476	63.45524

Cholesky Ordering: MS DFI

Source: Prepared by researchers based on the outputs of Eviews10

Based on the results of the analysis of variance, it can be said that : Shocks contribute effectively to the money supply variable by explaining the variance of the FDI variable in the long term more than in the short term, and the occurrence of any sudden changes(shocks) in the money supply will affect FDI.

- Shocks also contribute effectively to the FDI variable by explaining the variability of the money supply variable in the long term to a greater extent than in the short term, and any sudden changes(shocks) in FDI will affect the money supply.

Conclusion:

This research paper dealt with a standard study **measuring the impact** of **money mass on FDI flows in Algeria during the period (1990-2020) using the error**

correction model (VECM). By focusing on a set of variables, which were represented in foreign direct investment (FDi)and money supply (Ms) **(**Based on standard modeling and testing the stability of time series and determining the degree of integration of the variables under study, it was found that :
Both series (Ms) and **(**FDi**)** are complementary of the same degree and their degree of integration I(1), and based on the results of the test of the criteria for determining the delay periods of the model and according to the criteria of AIC andSC,it is clear that : The optimal number of delays for the study variables is equal to 0.
- Based on the results of the Granger Causality Tests, it was found that there is a two-way causal relationship between the money supply and foreign direct investment in the long term, and after conducting the joint integration test, it was found that there is a balance relationship, and this is what enables us to estimate the VECM model.
- Through the LM Test, it was found that there is no self-correlation between errors(the rest are not self-correlated).
- When conducting the validity tests of the VECM model, it was found that : the estimated model does not suffer from the problem of heterogeneity or the problem of self-correlation, and meets the conditions of stability.
- After testing the significance of the milestones, it became clear that the error correction coefficient CointEq is negative(0.703754) and moral Prob=0.0007, and this is explained by the existence of a long-term equilibrium relationship between the variables of the study , and through the results of the WALD test (the significance of the milestones in the short term), it was found that : The milestones of money offers cannot be absent in the equation of foreign direct investment. When analyzing shocks : We found that the response of both variables (Ms, FDi) was achieved from the first period.

References

[1] Allal, d. S. (2019). Studying the impact of the growth of a monetary mass on monetary stability in Algeria during the period 1990-2016. *Bashar's Annals of Economic Sciences, 05*(02), 82.
[2] bougera, f. l. (2021). The impact of changing the discount rate and the monetary supply on Algerian economic growth, an econometric study for the period 2000-2017. *Journal of Research in Finance and Accounting, 06*(01), 24.
[3] Bourousha, M. L. (2015). Bourousha, Muhammad Lahcen Allawi, Karim. *Ruaa Economic Journal, 05*(09), 39.
[4] dJamea, S. A. (2021). The impact of the increase in the size of the monetary supply on the Sudanese economy for the period 1990-2018. *Algerian Journal of Economic and Financial Research, 04*(01), 90.
[5] Elias, M. (2020). Modern trends in classifying foreign direct investment and methods of counting it. *Journal of Business Research and Studies, 04*(02), 37.

[6] Khamisi, s. M. (2015). The role of corporate governance in attracting foreign direct investment. *Journal of economic studies and research in renewable energies*(02), 88.
[7] Sharbi, A. A.-A. (2021). The impact of monetary variables on foreign direct investment in Algeria during the period 1990-2018. *Algerian Journal of Security and Development, 10*(03), 185.
[8] Silo, A.-A. J. (2014). Foreign direct investment and its impact on economic growth in selected developing countries for the period 1996-2010. *Studies Journal Economic Issue, 05*(01), 199.