The impact of Public Expenditure on Inflation Rate in Algeria during the period 1986- 2016

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Summary: This study aimed to measure the impact of public expenditure on inflation rate in Algeria during the period 1986- 2016. It builds on the tests used and applied in modern econometrics to analyze the properties of time series in terms of stationary property and rely on standard tests that fit with these properties, as well as on the Johansen co-integration method; where after confirming the lack of a co-integration, we estimate the vector autoregressive model .With the help of the econometric analysis program (EVIEWS-9), we proceed to the analysis and measurement of the impact of public expenditure on inflation rates in Algeria.

The estimation of the vector autoregressive model and the results obtained have shown the presence of a negative impact of management expenses and a positive impact of processing expenses respectively on inflation rates in Algeria.
Keywords: inflation rate, public expenditure, co-integration, vector autoregressive (VAR) model.
Jel Classification Codes : C22; E31; E62.

Résumé : Cette étude visait à mesurer l'impact des dépenses publiques sur le taux d'inflation en Algérie entre 1986 et 2016. Elle s'appuie sur les tests utilisés et appliqués en économétrie moderne pour analyser les propriétés des séries temporelles en termes de propriété stationnaire des tests standard qui correspondent à ces propriétés, ainsi que sur la méthode de cointégration de Johansson ; où, après avoir confirmé l'absence de cointégration, nous estimons le modèle vectoriel autorégressif. Avec l'aide du programme d'analyse économétrique (EVIEWS-9), nous procédons à l'analyse et à la mesure de l'impact des dépenses publiques sur les taux d'inflation en Algérie.
L'estimation du modèle vectoriel autorégressif et les résultats obtenus ont montré la présence d'un impact négatif des frais de gestion et d'un impact positif des frais de traitement sur les taux d'inflation en Algérie.
Mots - clés : taux d 'inflation, dépenses publiques, cointégration, vecteur autorégressif (VAR) modèle.
Jel Classification Codes : C22; E31; E62.

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I- Introduction :

Most of the world's economies have experienced several economic shocks that have led to new problems, such as depression, unemployment and inflation. The latter is in an unsatisfactory situation for both developed and underdeveloped economies. Economic policies have had an important focus on these ideas, making them subject to change and development by economists of different denominations, and highlighting the great importance of these policies through the objectives that seek to achieve them, and also through their effectiveness in addressing these economic problems.

Financial policy has an important place among the various economic policies, because it can play a greater role in achieving the multiple objectives of the national economy. The most prominent of these schools is the Keynesian school of "John Maynard Keynes", who considered fiscal policy as more effective than the monetary in order to face the economic imbalances, because of its varied instruments which are among the most important tools of economic management in achieving economic development and eliminating the problems that impede economic stability. In addition to the distributional and specialized effects, the exclusive role of government spending and taxes has an effect on the aggregate demand, and then on the macro-economic variables.

Algeria, like other developing countries, has expanded the use of fiscal policy tools to promote the achievement of the objectives of its economic policy within the framework of the various legislation of the Finance Ministry.

In light of the previous presentation, we highlight the problematic aspects of this study, which can be framed in the following question:

1. The Problematic of the Study: **What is the effect of public expenditures on inflation rate in Algeria during the period 1986-2016?**

To answer the problem, we put together a set of sub-questions which are as follows:

-What is the role of public expenditure in the treatment of inflation?

-Is there a relationship between public expenditure and inflation rate?

-What is the nature of the relationship between public expenditure and inflation rate?

2. Hypothesis of the study: To study subject problematic, we set the following set of hypothesis:

- There is a concurrent correlation between public expenditure and inflation rate in Algeria during the study period.

- There is a statistically significant relationship between public expenditure and inflation rate in Algeria during the study period.

3. **The objectives of the study:** The study aims to highlight the effect of public expenditure on inflation rate in Algeria, using the descriptive and quantitative methods in order to show the effect of capital expenditures on inflation rate.

• To highlight the relationship between public expenditure and inflation rate in Algeria during the study period.

• Clarify the impact of public expenditures on inflation rate in Algeria during the study period.

• To highlight the role of quantitative methods in measuring public expenditure on inflation rate in Algeria during the study period.

4. Scope of the study:

-Spatial framework: This study was conducted at the level of the Algerian economy.

- **Time frame**: The study period (1986-2016) has been determined.

5. Methodology: To address this issue, we use the statistical methods necessary to study and analyze the effect of public expenditures on the inflation rate in Algeria and to reach results through the implementation of standard model steps.

I.1.First: Statistical analysis of the effect of public expenditures on inflation in Algeria during the period 1986-2016:

1-The role of fiscal policy in the treatment of inflation: When governments fail to counter inflationary pressures through monetary policy measures, they are obliged to use fiscal policy. The latter is a set of methods, rules, procedures and measures taken by public authorities to manage

financial activity as efficiently as possible, through the definition of a set of economic, social and political goals over a specified period of time. Among the means used to treat inflation are public expenditure.

***Policy of control over public expenditure:** The increasing pace of public expenditure is a phenomenon observed in most countries in different systems and economic conditions, where we find that public expenditure is increasing and, therefore, it is an obligation to establish limits and controls in order to put an end to the expansion of public expenditure.

The general budget is exerting its influence on controlling inflation and deflation by impacting government expenditures, either consumption or investment by raising or lowering its rates according to the economic situation of the country. The expansionary situation, characterized by the emergence of inflationary forces that hinder monetary stability, and creating a surplus in the general budget of the state by reducing the elements of this spending and there are two types of public expenditure: consumption and investment. It should be mentioned that consumer expenditure should be reduced as much as possible. The effect of investment expenditure on controlling inflation has a significant impact on economic development, especially in underdeveloped countries, which makes it undesirable.

2-Public expenditure division in Algeria: Public expenditure in the Algerian budget is divided into two parts: current expenses and capital expenses, where similar and homogenous expenditures are collected in terms of their nature, role, impact and objectives to be achieved by each type of expenditure.

2-1-Current Expenses: Current expenses are defined as those allocated for the normal and natural functioning of the State, which allows the management of the State's activities and the proper application of the current tasks. According to Article 24 of Law No. 84-17, the expenses of management are divided into four sections:

2-1-1- Public debt burdens and deductions from income: This section includes the appropriations necessary to cover public debt burdens in addition to the various charges deducted from income;

2-1-2-The allocations of public authorities: This section includes the expenses of running political and other public institutions (National People's Assembly, National Assembly, the Constitutional Council, National Economic and Social Council, etc.). These expenditures are inter-ministerial;

2-1-3-Expenditures of services means: include the set of appropriations that provide for all departments the personnel and management tools;

2-1-4- Public interventions: related to transfer costs, which in turn are divided between different types of transfers according to the different objectives of their operations such as educational and cultural activity, economic activity, social activity associated with aid and solidarity operations.

2-2-Capital expenses: The economic nature of the processing expenses is different from the nature of the administrative expenses. The processing expenses lead to the expansion of the public wealth and the improvement of the processing of the local communities. These expenses consist of investments in basic economic, social and administrative establishments which are not considered direct productively. These expenses include investment subsidies granted to some public institutions.

In accordance with article 35 of Act No. 84.74, open appropriations for the general budget and in accordance with the annual development plan, to cover investment expenditures of the State, are grouped into three sections:

- Investments executed by the State;
- Investment subsidies granted by the State;
-Other capital expenses.

I. 2. Second :Analyzing the evolution of the rate of inflation and public expenditure in Algeria during the period (1986-2016)

1..Analysis of the evolution of inflation in Algeria: Analysis of the evolution of the inflation rate in Algeria The appendix illustrates the evolution of inflation rate in Algeria during the period 1986-2016:

We observe from appendix (1) that the period (1986-1995) witnessed the largest national economy of inflation due to the devaluation of the currency and the increase in the cost of both imports and external debt service. The inflation rate was 31.7% in 1992, 29.00% and 29.79% in 1994 and 1995, respectively. However, in the years from 1996 to 2000, inflation rates declined significantly, reaching 0.3% in 2000, which is the lowest value of inflation in the Algerian economy, mainly due to the control of the monetary mass by avoiding excessive cash issuance, and good yields of petroleum revenues, where most of these revenues were directed to the payment of external debt and the establishment of infrastructures.

Between 2001 and 2016, the analysis is as follows:

- In 2001, the inflation rate rose significantly compared to 2000, mainly due to the growth of the monetary mass by 22.3%, as a consequence of the economic recovery program. In 2002, the decline was due to the decrease in the M2 growth rate to 1.3%. Some analysts argue that the most important factors that generate inflationary pressures in Algeria can be summed up as follows: expansion of total spending, increase in production costs such as the mass of salaries and wages, increase in monetary mass.
- In 2003 and 2004, the rate of inflation increased again, due to the growth of the banking surplus liquidity at 36.29% compared to 25.13% in 2002.
- In 2005, the rate of inflation was marked down to 1.4% due to the decrease in current expenditures compared to investment expenditures.
- Inflation in the period (2006-2008) witnessed an increase due to the expansion of fiscal policy, the launching of the economic growth support program, as well as the rise in salaries and wages without a corresponding increase in productivity and the rise in M2 and surplus liquidity.
- The rate of inflation rose sharply in 2009 to 5.7%, mainly due to imported inflation. In 2010, the decline was seen despite the expected recovery of monetary growth due to the orderly management of monetary policy, which led to the containment of inflationary pressures during the year.
- In 2012, the inflation rate recorded the highest value since 1996, at 8.9%, due to internal inflation on a very limited number of fresh products such as sheep meat and others, which recorded a sudden and strong rise and in January 2012 where the average annual inflation recorded during this month is 4.4%, which is equivalent to half the average annual inflation for the year 2012, and then to decline in the years 2013 and 2014 by the control of monetary policy, and increased by 4.78% and 6.4% in 2015 and 2016 respectively.

2. Analysis of Evolution of Public Expenditure in Algeria: the appendix illustrates the evolution of public expenditure in Algeria during the period 1986-2016.

Appendix (2) shows that the budget expenditure of both types has been steadily increasing, except in some years that registered a slight decrease. This period can be divided into two stages:

First stage (1986-2000): This stage witnessed the implementation of the structural adjustment program. This stage was known as the government's control of budget expenditure due to the budget deficit that occurred during the period under the reforms implemented by the International Monetary Fund. An improvement has been seen from 1996, which means that the Algerian government has financed its expenditures with its revenues in this period without resorting to cash issuance.

Second phase (2001-2016): We note in this period the following:

The managing and processing expenditures increased significantly during the period 2001-2008, a significant increase compared to the first stage. This increase is mainly due to the programs that the State has set for the revival of economic activity and growth support, through various public expenditure programs.

The expenditures on investment have grown faster compared to the expenditures of management. We note the strong increase in the expenses of processing through this period due to the high expenditure of economic and administrative infrastructure, and this increase in investment

expenditure is the most important element in the high level of economic activity in the construction sectors, civil engineering and services sector.
- In 2009 and 2010, processing expenses were reduced due to the impact of the external shock caused by the sharp decrease in oil prices.
- In 2013, management expenses decreased from BD 4782.60 billion in 2012 to BD 4204.3 billion in 2013. This decrease is due to the decline in current transfers and to a lesser extent to the decrease in other expenses. These expenditures included a retroactive effect on several years of wage increases. The processing expenses decreased while increases in management expenses were recorded in 2015 and 2016.

II– Methods and Materials:

First: Display variables and data and study the stability of the series.

1 - Presentation of variables and data: Tthe applied study needs data. We have obtained the annual data (1986-2016) from the World Bank, and the central bank of Algeria. Through this axis, we will use the following symbols for the variables in the econometric program and the time series (eviews 9.): - logarithm of inflation (lninfl). - Logarithm of current expenses (lndges). – Logarithm of capital expenses (lndequi). Before estimating the autoregressive model, it is necessary to examine whether the previously mentioned series are stable or not in order to avoid the occurrence of the Spurious Regression problem. This term refers to the regression with good results in terms of t (F), But they do not give real meaning to the results, and do not provide a meaningful economic explanation. In other words, the use of the OLS method gives false results in the case of string instability.

2) Series stability study: For stationary testing, the time series of the variables of the study model in terms of the monolithic root unit test, DF (Dickey and Fuller: 1979) and Dickie Fuller (ADF), Augmented Dickey-Fuller test. These tests demonstrate the nature and characteristics of the time series of the variables under study. Before applying the Dickie Fuller test, the delay of the series must be determined to determine the type of test used to detect the monotony in the series. The appendix shows the results of the dormancy test for the study variables by applying the Extended time studying.

Appendix (03) shows that the variables of the study are non-stationary at the non-stationary level, while the two variables reached the stage of stillness and stability at the level of 1%, 5% and 10%, after taking the first difference in the 1st difference. Thus, the time series is integrated with the first class CI ~ (1), which allows us to conduct co-integration tests.

Second: Estimating the VAR model: After studying the time series in terms of stability, we found that the time series are stable after the first-order differences, i.e. they are integrated from the first order I(1), indicating the possibility of a common integration. According to this method, the estimation process is as follows:

1- Co-integration Test by Johansen-Juselius method:

1-1- Determine the degree of path delay VAR: Before testing and estimating, the VAR delay should be determined. This is based on the Akaike and Schwarz criteria. Using the statistical program (Eviews), the results are as shown in appendix (04):

Note from appendix (04) we find that the optimum delay and approval for the smallest values of the criteria are P = 1.

1-2- Co-integration Test by Johansen-Juselius method: The results are as shown in the following table: co-integration is tested according to the Johansen- Juselius method according to the following assumptions:

$$i / H_0 : r = 0 / H_1 : r > 0$$
$$ii / H_0 : r = 1 / H_1 : r > 1$$
$$iii / H_0 : r = 2 / H_1 : r \succ 2$$

The results of this test, shown in appendix (05), lead us to accept the alternative hypothesis because the calculated values of the Statistic Trace are less than the values of the statistical significance of 5%: Number of vectors), which means that there is no synchronous integration relationship between the variables studied. In this case, we estimate a direct regression model without any differences.

The results of the Max-Eigen Statistic test were also supported by the results of the impact test. The fact that the calculated value of this test is less than the value of the test at 5%, which means acceptance of the zero hypothesis.

1-3- Granger Causality test: Since there is no integrative vector, based on the results of the JOH, we are able to use an autoregressive vector methodology to test the Granger causality so that we can see the short-term kinetic relationship.

The causal test showed a causal relationship, according to Granger, which is the result of variable current expenses to the variable inflation rate at a significant level of 5%, IE (Prob = 0.0113 < 0.05). This means that the current expenses contribute significantly to improving the predictive capacity of the variable inflation rate, at a confidence level of (95%).

The causal test showed a causal relationship, according to Granger, which is the variable of the variable current expenses to the variable inflation rate at a significant level of (5%), IE (Prob = 0.0113< 0.05). This means that the capital expenses contribute significantly to the improvement of the predictive capacity of the variable inflation rate at a confidence level of (95%).

We noticed also the existence of a causal relationship - according to the concept of Granger - moving from the variable processing expenses to the variable inflation rate at a significant level of (5%), IE (prob=0. 0136< 0.05), which means that the capital expenses contribute significantly to improve the predictive capacity of the variable inflation rate at the level (95%). appendix (06) shows the results of the Granger's causality test.

2- Estimating the VAR Model: After determining the appropriate delay for the one-year VAR model (P = 1) and applying the OLS method to estimate each equation of the model separately, we obtained the results shown in the appendix (07) below**:**

***Evaluation of the results of the VAR model (1):** The results of the test showed the existence of three equations shown in the form of columns and read each column in the table, equation regression of the dependent variable, and as we are studying the measure the impact of Public expenditure (management expenses and processing expenses) on inflation rates, the inflation equation Lninf and discussed:

***Assess the inflation equation life through the following points:** Assuming that the inflation rate is the dependent variable, s this equation explains the inflation rate in terms of its previous values and the delayed values of the current and capital expenses variables. :

- The significance of the previous value of the inflation variable (the first delay period Lninf (-1)), the previous value of the capital expenses (the first delay period Lndges (-1)), and the previous value of the capital expenses Lndequi (-1), where the statistical values are greater than the critical value, at a significant level of 5%.

- We note that the value of the coefficient of selection is acceptable, indicating that the expenditure of current and capital expenses explain the inflation rate by 55.06%, IE, the inflation rate is explained by its previous observations and the delayed values of the current and capital expenses variables. The rest is due to errors or other variables not included in the model.

- The model is generally significant, according to Fisher statistics: IE, the acceptance of the inflation equation statistically at a level of 5%.As for the elasticities, we note the following: The

elasticity of Lninf (-1) was positive, IE, there is a positive relationship between the current inflation variable and the one-time slowdown of inflation. The increase of Lninf (-1) by 10% will increase Lninf by 5.33%.

- The elasticity of Lndges (-1) was negative, IE, there was an inverse relationship between the one-time delay of the variability of the current expenditure and the current inflation rate. The increase of Lndges (-1) by 10% would result in a decrease in Lninf by 13.95%.

- The elasticity of Lndequi (-1) was positive, IE there is a positive correlation between the one-time delay of the variable of capital expenses and the current inflation rate. The increase of Lndequi (-1) by 10% will increase Lninf by 10.83%.

3-Study the validity of the model VAR:

3-1-Study the autocorrelations to residual the equation VAR: After we introduced the of vector autoregressive model, we test the validity through: To Study the autocorrelations to residual the equation VAR (1), use the LM TEST and Box-Pierce / Ljung-box probes to ensure that there is no autocorrelation between residuals in time series, the appendix shows:

We see from the appendix above (08) and (09), the probability value prop is greater than the critique level of 5% and ,therefore, we accept the null hypothesis that there is no autocorrelation between equation residuals.

3-2-VAR model stability study: To examine the stability of the model was employed the polynomial roots test, and according to this test, the results of vector autoregressive are stable if there is no roots equal to one, and the appendix shows the results of this test:

Note from appendix (10) that all the roots are less than one and therefore the vector autoregressive is stable.

4- Structural Study of the VAR Model: In order to assess the nature of the relationship between variables in the short term, variance decomposition and impulse response function are used. Using the Cholesky criterion, the order of the variables is assumed to be in order, where each variable is simultaneously affected by its previous variables in order but not by the following variables. The results of the variance analysis and pulse response functions are sensitive to the way in which variables are arranged. Sometimes, Granger's causality is used to determine the direction of the relationship between variables and the variables are then arranged on this basis.

4 -1- Shock Analysis (Pulse Response Functions): Pulse response is the behavior of the internal variables in the model due to the various shocks that the system may experience. This test is intended to demonstrate the ability of the variables involved in the model to interpret each other's behavior by knowing the impact of a variation on the rest of the variables. During our study of response functions, we will apply shocks in the first period, and then study their effect on the remaining variables over 10 years. according to the results, the responses of each of the variables examined for the various innovations can be monitored as follows:

* **Response variable inflation rate for various renovations**: appendix (11) shows that a sudden shock and one standard deviation of the change in management expenditure will be accompanied by a negative response to the inflation variability during the 10-year response period, with a response of (-5.87%), continuing to increase at rates Decreasing to the end of the tenth period recording a response (-5.29%).

A sudden shock and one standard deviation of the capital expenses variable will be accompanied by a positive response into the inflation variability during the 10-year response period, with a response of (22.24%), and continuing to decline until the end of the tenth period, (3.77%).While the inflation variable responds to the unexpected shocks, which has been positively and negatively affected since it started to decline since the first period recording a response of

(73.25%), and continuing its downward trend at increasing rates until the fifth period with a decrease of (-4.34%),
followed by the inflation rate variable at a decreasing rate until the end of the tenth period (-2.7%).

4-2- Analysis of the variance of the forecast error: Variance decomposition analysis is the knowledge of the ratio of variation caused by a variable in itself and in other variables. In this case, it is not assumed that shocks to the variable are occurring, but rather we examine the relationship between variables.

In order to determine the amount of the variance error of the Lninf variable to the prediction error in the same variable, and the amount due to the prediction error in the other variables, so that there is no serial correlation between the random errors, the importance of this test is that it gives the relative effect of any sudden change (shock) In each variable of the study of all other variables, as shown in appendix (12):

Appendix (12) shows that the standard error of the forecast error of the inflation variable in the first period is 73.25% and then increases with time to 103.26% in the tenth year. The increase in the standard error value is attributed to the uncertainty of the periods prior to the inflation rate variable.

We note that the variance of the forecast error of the change in the first-quarter management expenditure of 0.483% over its previous value in the short term is due to the same variable and then increases to 4.23% in a forecast period of 10 years in the future. Therefore, shocks in variable current expenses explain variance In the error of predicting the same variety of current expenditure in the short term than in the long run.

We also note that the variance of the forecast error of the change in the capital expenses in the first period of (6.92%) over its previous value in the short term is due to the same variable and then increases to (30.82%) in the forecast period of 10 years in the future. Therefore, shocks in variable processing expenses are explained The variance in the forecast error for the variable of the same capital expenditures in the short term is less than in the long run.

The opposite is true for the inflation variable. Te current and capital expenses variables contribute to the interpretation of variance in the forecast error of the inflation variable by (92.58%). The ratio decreases over the forecast periods to the lowest level in the tenth year to explain (64.93%) Of the variance in the forecast error of the inflation variable. Therefore, the shocks in current and capital expenses variables contribute to the interpretation of variance in the forecast error of the short-term inflation variable in a larger than long-term role. This reflects the variable role of current and capital expenses in the interpretation of the volatility of the inflation rate variable.

However, the variance components of the inflation rate variable are affected by varying current and capital expenses, so that any sudden random change or shock in this variables will affect the inflation variable.

III- Conclusion and recommendations:

First: Results:

In this study, public expenditures (current and capital expenses) and their impact on inflation rate in Algeria during the period (1986-2016) were highlighted. In line with the nature of the subject, the descriptive data were analyzed. (current expenses, capital expenses) to set the nature of their relationship to inflation rates in Algeria, using modern standard techniques such as the analysis of co-integration and VAR models. The study concluded with a set of results summarized as follows:

* The use of the OLS method gives false results in the case of serious instability. The results of the estimation are good in terms of (t, F) and value but do not give real meaning to the results. They do not provide a meaningful economic explanation. (Spurious Regressions) ;

* All the results of the unit root tests showed that the study variables were at the root of the unit, that is, they are unstable at the non-stationary level, and stable at the 1st difference, meaning that they are first-class CI ~ (1) ;

*The results of the co-integration tests indicated rejection of the alternative hypothesis (there is a co-integration relationship between the variables) and acceptance of the null hypothesis (there is no co-integration between the variables), because the calculated value of the statistical effect is less than the critique value of 5%. which means that there is no co-integration relationship between the variables under study. In this case, we estimate the VAR model without any differences. The results of the Max-Eigen Statistic test were also supported by the results of the impact test. The fact that the calculated value of this test is less than 5% means acceptance of the null hypothesis ;

*The Granger concept is one of the most important uses of VAR models, and it is also the most important instrument of econometric analysis provided by this technique. The causal test showed a causal relationship, according to Granger, (5%). This means that the current expenses contribute significantly to improving the predictive capacity of the inflation variable at a confidence level of 95%. As well as the existence of a causal relationship - according to the concept of Granger - moving from the variable processing expenses towards the variable inflation rate at a significant level of (5%), which means that the processing expenses contribute significantly to improve the predictive capacity of the variable inflation rate at a confidence level of (95) %);

*The existence of a negative relationship between current expenses and inflation rates variables, as well as a positive relationship between the capital expenses variable and the inflation rate are the mean results obtained in the study ;

*Based on the results of the inflation rate variance prediction error, the results indicate that the components of the variance of the inflation rate are affected by the current expenses variable. Thus, any random change or sudden shock in this variable will negatively affect the inflation rate. In the same manner, a sudden random change or shock in the processing expenses variable will positively affect inflation.

Second: Recommendations:

*The necessity to increase the flexibility of the productive system by stimulating and strengthening the productive sectors such as agriculture, industry, small and medium industries and by working to achieve balance distribution of national economic resources across all economic sectors ;

* Public expenditure must be directed to the productive sectors that play a prominent role in economic development by increasing investment expenditures leading to the recovery of the national economy;

* Limit the increase in public expenditure on wages and salaries in order to reduce inflationary pressures;

* The need to reform the financial and banking systems and the emplacement of effective and developed financial markets.

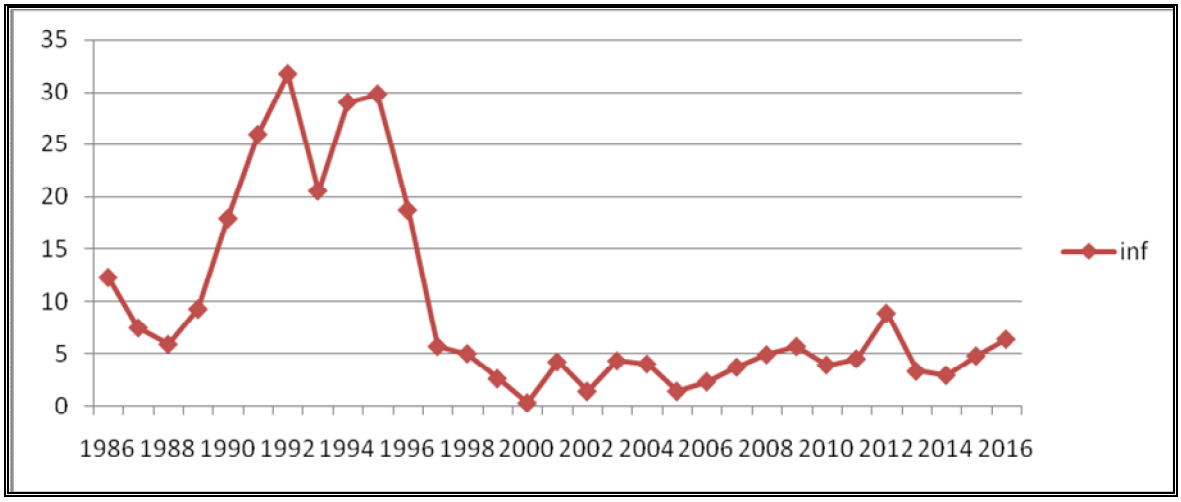
*The need of legislations and regulations aimed to stabilize and reduce inflation through the tools of fiscal and monetary policies ;

* The need for coordination between monetary and fiscal policies tools to reduce inflation rates, in line with the economic situation (stagnation, boom..) ;

*The Attempt to develop the study model by introducing the tools of fiscal and monetary policies together, in order to reflect the statistical and economic relationship in accordance with the economic theory principles.

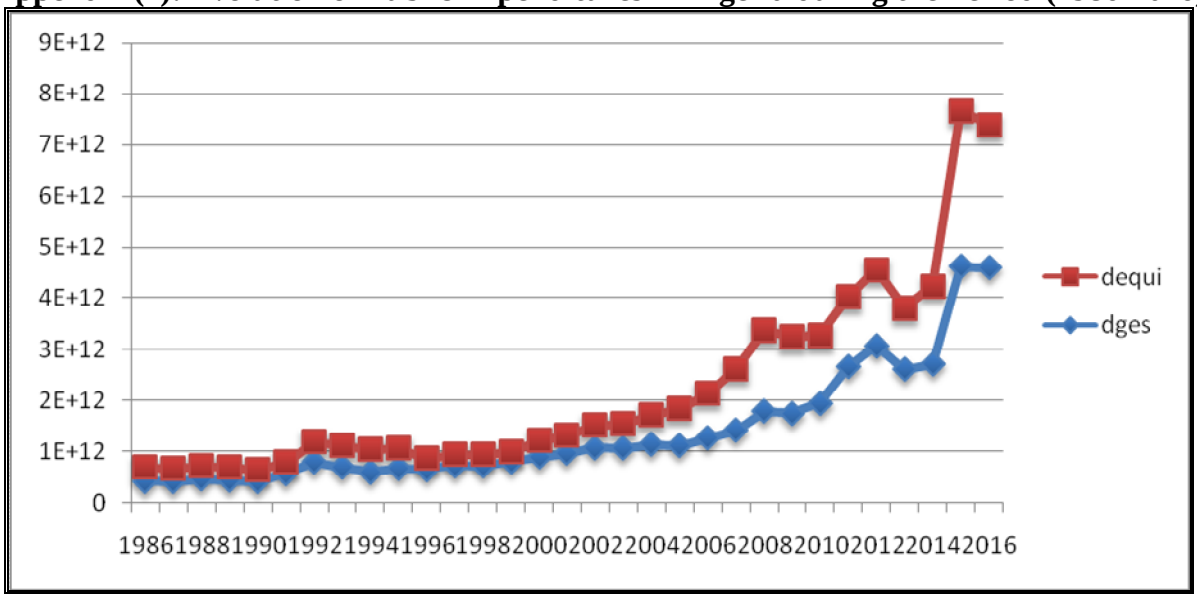
Appendices:

Appendix (1): Evolution of inflation rate in Algeria during the period (1986-2016)



Source: prepared by the researchers based On data of World Bank Open Data, - www.albankaldawli.org. on the outputs (EXCEL).

Appendix (2): Evolution of Public Expenditures in Algeria during the Period (1986-2016)



Source: prepared by the researchers based on data of Banque d'Algérie: Bank Of Algeria, www.bank-of-algeria.dz, **on the outputs (EXCEL).**

Appendix (03): Unit Root Test results for the study variables

UNIT ROOT TEST RESULTS TABLE (ADF)				
Null Hypothesis: the variable has a unit root				
At Level				
		LnINF	LnDGES	LnDEQUI
With Constant	t-Statistic	-2.4508	1.5697	0.0720
	Prob.	***0.1372***	***0.9991***	***0.9580***
		n0	n0	n0
With Constant & Trend	t-Statistic	-2.6332	-2.1636	-2.0008
	Prob.	***0.2694***	***0.4915***	***0.5773***
		n0	n0	n0
Without Constant & Trend	t-Statistic	-0.8727	4.2582	1.5954
	Prob.	***0.3294***	***1.0000***	***0.9700***
		n0	n0	n0

At First Difference				
		d(LnINF)	d(LnDGES)	d(LnDEQUI)
With Constant	t-Statistic	-7.7046	-6.7046	-4.9802
	Prob.	***0.0000***	***0.0000***	***0.0004***
		***	***	***
With Constant & Trend	t-Statistic	-7.5709	-7.2505	-5.0418
	Prob.	***0.0000***	***0.0000***	***0.0018***
		***	***	***
Without Constant & Trend	t-Statistic	-7.8452	-0.9499	-4.6504
	Prob.	***0.0000***	***0.2963***	***0.0000***
		***	n0	***

Notes: a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

Source: Prepared by researchers based on outputs .(E-views.9)

Appendix (04): Determining the degree of delay of the VAR path

VAR Lag Order Selection Criteria
Endogenous variables: LnINF LnDGES LnDEQUI
Exogenous variables: C
Date: 06/11/18 Time: 20:57
Sample: 1986 2016
Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-70.55450	NA	0.046652	5.448481	5.592463	5.491295
1	-10.35430	102.5633*	0.001058*	1.655874*	2.231802*	1.827128*
2	-3.433903	10.25245	0.001272	1.809919	2.817792	2.109612
3	5.935286	11.79824	0.001333	1.782571	3.222390	2.210705
4	11.78191	6.063161	0.001956	2.016155	3.887919	2.572729

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Prepared by researchers based on outputs (E-views.9)

Appendix (05): Results of the Cointegration Test

Date: 06/11/18 Time: 21:00
Sample (adjusted): 1988 2016
Included observations: 29 after adjustments
Trend assumption: Linear deterministic trend
Series: LINF LDGES LDEQUI
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.243997	13.91613	29.79707	0.8453

At most 1	0.158406	5.804553	15.49471	0.7185
At most 2	0.027320	0.803290	3.841466	0.3701

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.243997	8.111573	21.13162	0.8967
At most 1	0.158406	5.001263	14.26460	0.7417
At most 2	0.027320	0.803290	3.841466	0.3701

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Prepared by researchers based on outputs (E-views.9)

Appendix (06): Results of the Granger's causality test

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/11/18 Time: 21:09
Sample: 1986 2016
Included observations: 30

Dependent variable: LnINF			
Excluded	Chi-sq	df	Prob.
LDGES	6.414532	1	0.0113
LDEQUI	6.086530	1	0.0136
All	6.553387	2	0.0378
Dependent variable: LnDGES			
Excluded	Chi-sq	df	Prob.
LINF	0.441321	1	0.5065
LDEQUI	0.010525	1	0.9183
All	0.444427	2	0.8007
Dependent variable: LnDEQUI			
Excluded	Chi-sq	df	Prob.
LINF	1.514964	1	0.2184
LDGES	1.873888	1	0.1710
All	5.346584	2	0.0690

Source: Prepared by researchers based on outputs.(E-views.9)

Appendix (07): Results of model estimation VAR (1) using OLS

Vector Autoregression Estimates
Date: 07/11/18 Time: 05:49
Sample (adjusted): 1987 2016
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LnINF	LnDGES	LnDEQUI
LnINF(-1)	0.533883	-0.020608	-0.061667

	(0.14531)	(0.03102)	(0.05010)
	[3.67409]	[-0.66432]	[-1.23084]
LnDGES(-1)	-1.395729	1.001961	0.260101
	(0.55108)	(0.11765)	(0.19001)
	[-2.53269]	[8.51677]	[1.36890]
LnDEQUI(-1)	1.083591	0.009619	0.784609
	(0.43922)	(0.09376)	(0.15144)
	[2.46709]	[0.10259]	[5.18108]
C	10.14403	-0.197987	-1.191031
	(6.61950)	(1.41313)	(2.28233)
	[1.53245]	[-0.14011]	[-0.52185]
R-squared	0.550678	0.954519	0.918965
Adj. R-squared	0.498833	0.949271	0.909615
Sum sq. resids	13.95354	0.635914	1.658781
S.E. equation	0.732581	0.156391	0.252585
F-statistic	10.62165	181.8882	98.28299
Log likelihood	-31.08620	15.24017	0.858561
Akaike AIC	2.339080	-0.749345	0.209429
Schwarz SC	2.525906	-0.562519	0.396256
Mean dependent	1.752955	27.73292	27.07759
S.D. dependent	1.034819	0.694359	0.840155
Determinant resid covariance (dof adj.)		0.000548	
Determinant resid covariance		0.000357	
Log likelihood		-8.628706	
Akaike information criterion		1.375247	
Schwarz criterion		1.935726	
Number of coefficients		12	

Source: Prepared by researchers based on outputs (E-views.9)

Appendix (08): Results test: Box-Pierce/Ljung-box

VAR Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: No residual autocorrelations up to lag h
Date: 07/11/18 Time: 06:00
Sample: 1986 2016
Included observations: 30

Lags	Q-Stat	Prob.*	Adj Q-Stat	Prob.*	df
1	7.052912	---	7.296116	---	---
2	18.25836	0.0323	19.30196	0.0227	9
3	20.79942	0.2897	22.12536	0.2265	18
4	34.04056	0.1649	37.40360	0.0878	27
5	40.83705	0.2663	45.55937	0.1320	36
6	45.30242	0.4593	51.14110	0.2452	45
7	50.48085	0.6109	57.89557	0.3336	54
8	52.13478	0.8339	60.15093	0.5785	63
9	62.27885	0.7863	74.64246	0.3924	72

10	64.17425	0.9151	77.48555	0.5900	81
*Test is valid only for lags larger than the VAR lag order. df is degrees of freedom for (approximate) chi-square distribution					

Source: Prepared by researchers based on outputs.(E-views.9)

Appendix (09): Test Results of *LM TEST*

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 07/11/18 Time: 06:08
Sample: 1986 2016
Included observations: 30

Lags	LM-Stat	Prob
1	10.87297	0.2845
2	15.12895	0.0875
3	2.476987	0.9815
4	22.46407	0.0075
5	10.47409	0.3135
6	5.538964	0.7850
7	6.958396	0.6415
8	2.696585	0.9751
9	13.18518	0.1544
10	2.378263	0.9840
Probs from chi-square with 9 df.		

Source: Prepared by researchers based on outputs (E-views.9)

Appendix (10): Results stability of vector autoregressive model VAR(1)

Roots of Characteristic Polynomial
Endogenous variables: LnINF LnDGES LnDEQUI
Exogenous variables: C
Lag specification: 1 1
Date: 07/11/18 Time: 06:13

Root	Modulus
1.018375	1.018375
0.651039 - 0.160212i	0.670463
0.651039 + 0.160212i	0.670463
Warning: At least one root outside the unit circle. VAR does not satisfy the stability condition.	

Source: Prepared by researchers based on outputs (E-views.9)

Appendix (11): Estimation and Simulation of Pulse Response Functions

Response of LnINF:			
Period	LnINF	LnDGES	LnDEQUI
1	0.732581	0.000000	0.000000
2	0.352928	-0.058773	0.222410
3	0.130483	-0.082807	0.290490
4	0.011508	-0.087797	0.279174
5	-0.043408	-0.083608	0.233854
6	-0.061426	-0.076030	0.179946

7	-0.060197	-0.068168	0.130145
8	-0.050492	-0.061461	0.089550
9	-0.038403	-0.056389	0.059096
10	-0.027019	-0.052929	0.037710

Source: Prepared by researchers based on outputs.(**E-views.9**)

Appendix (12): Analysis of the variance of the forecast error of the inflation rate variable *Linf*

Variance Decomposition of LINF:				
Period	S.E.	LnINF	LnDGES	LnDEQUI
1	0.732581	100.0000	0.000000	0.000000
2	0.845076	92.58977	0.483694	6.926532
3	0.906874	82.47105	1.253785	16.27517
4	0.952995	74.69629	1.984114	23.31960
5	0.985779	70.00437	2.573676	27.42195
6	1.006825	67.48066	3.037452	29.48189
7	1.019266	66.19209	3.411031	30.39688
8	1.026280	65.53256	3.723218	30.74422
9	1.030241	65.16851	3.994220	30.83727
10	1.032642	64.93425	4.238378	30.82738

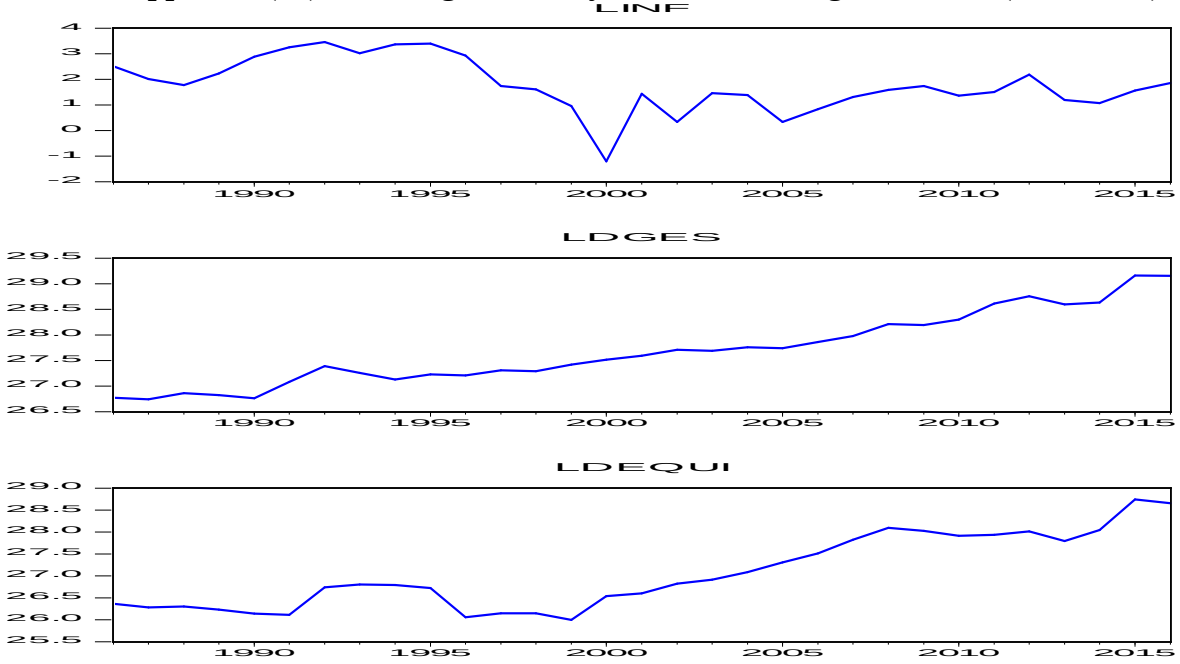
Source: Prepared by researchers based on outputs.(**E-views.9**)

Appendix (13): descriptive study of the variables of the study during the period (1986-2016)

	LnINF	LnDGES	LnDEQUI
Mean	1.777363	27.70196	27.05461
Median	1.609438	27.59398	26.80561
Maximum	3.456317	29.16077	28.74265
Minimum	-1.203973	26.74209	25.99847
Std. Dev.	1.026461	0.704112	0.835886
Skewness	-0.413719	0.524966	0.449951
Kurtosis	3.764169	2.311392	1.907678
Jarque-Bera	1.638620	2.036360	2.587198
Probability	0.440736	0.361252	0.274282
Sum	55.09826	858.7607	838.6929
Sum Sq. Dev.	31.60870	14.87323	20.96115
Observations	31	31	31

Source: Prepared by researchers based on outputs.(**E-views.9**)

Appendix (14): Drawing thevStudy Variables during the Period (1986-2016)



Source: Prepared by researchers based on outputs.(E-views.9)

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