The Relationship between Public Spending and Inflation: An Econometric Study of Algerian Economy over the period 2001- 2017

العلاقة بين الإنفاق العام والتضخم:

دراسة قياسية على الإقتصاد الجزائري خلال الفترة 2001 –2017

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Abstract: This study aims to identify the relationship between public spending and inflation rates in Algeria from 2001 to 2017. At that time, the country experienced a new economy by adopting a Keynesian vision model represented as a series of programs called Economic Recovery Programs, whose fundamental principle is to stimulate local demand and domestic production by increasing public spending. We used the descriptive approach to identify this effect in addition to the quantitative statistical methods represented in an econometric study, using the Vector Error Correction Model (VECM). The results show that there is a positive short and long-term relationship between public spending and inflation rate. This indicates that these programs have not contributed to stimulating local production as much as they have helped to stimulate domestic demand, which in turn has contributed to increasing inflationary pressures.

***Keys words*: Public Spending, Inflation, Algeria, VECM.**

***JEL classification codes* :** C32; E31; E62 ; H11 ; H50

ملخص: تهدف هذه الدراسة إلى التعرف على العلاقة بين الإنفاق العام ومعدلات التضخم في الجزائر من 2001 إلى 2017. في ذلك الوقت ، شهدت البلاد اقتصادًا جديدًا من خلال تبني نموذج الرؤية الكينزية المتمثل في سلسلة من البرامج تسمى برامج الانتعاش الاقتصادي ، والتي مبدأها الأساسي هو تحفيز الطلب المحلي والإنتاج المحلي من خلال زيادة الإنفاق العام. استخدمنا المنهج الوصفي لتحديد هذا التأثير بالإضافة إلى الأساليب الإحصائية الكمية الممثلة في دراسة قياسية باستخدام نموذج متجه تصحيح الخطأ (VECM). تظهر النتائج أن هناك علاقة إيجابية قصيرة وطويلة الأجل بين الإنفاق العام ومعدل التضخم. هذا يشير إلى أن هذه البرامج لم تسهم في تحفيز الإنتاج المحلي بقدر ما ساهمت في تحفيز الطلب المحلي، الأمر الذي ساهم بدوره في زيادة الضغوط التضخمية.

الكلمات المفتاحية: إنفاق عام، تضخم، جزائر، نموذج متجه تصحيح الخطأ.

تصنيف JEL: C32، E31، E62، H11 ، H50.

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1-Introduction

To meet its clear macroeconomic goals, each economy needs to have strong and thoughtful guidelines. Thus, the macro-economic policy of any nation is of vital importance in the preparation of the direction that the economy can follow to achieve goals that cannot vary from one another, as essentially aspiring to economic stability. In this context, the role of fiscal policy is so effective for the government to achieve economic and social objectives that aim

to revive the economy over time. The government often seeks to increase public spending, which represents all financial sums that the government spends to finance public interest activities, including expenditures that have a strong impact on the economy and its activity level (such as infrastructure, construction, etc.). Although, this did not seem to be important before the 1930s crisis, the Keynes' analyses have changed this view by highlighting the impact of fiscal policy. As a result, most developed countries have applied financial incentives during the 1930s recessions.

However, several shifts in that view were noted in the aftermath of 1973 oil crises, in which liberal economists (neoclassical theorists) emphasized the limits of fiscal policy, in particular the negative impact of deficits and public debt. Since then, fiscal policies of the developed countries have centered as a priority for sustainable inflation management on monetary equilibrium and price stability, to retain the value and purchasing power of the currency and control Inflation, which is described as a continuous rise in the general price level.

In recognition of the need to foster social and economic growth and establish a competitive economy, the Algerian Government at the beginning of the 21st century was trying to pursue a new development strategy. The state then considered the adoption of the Keynesian premises and model of development of Harrod- Domar as necessary for economic and social development convergence. Its assumptions concentrate on the need to allow fiscal policy to play its role in the context of the so-called economic recovery plans and its accompanying plans. The government has approved several development programs with large amounts to revive the national economy, which allows the Algerian economy to experience a comfortable financial situation in the early third millennium. This could contribute to formulating a financial system based on the expansion of both public spending and money supply.

In this respect, it seems necessary to concentrate on the dimensions and the efficacy of these initiatives, because Algeria's real problem is that its local production facilities do not operate in response to domestic demand that is increasingly rising as society's growing needs increase.

In fact, the concrete impact of the economic recovery programs is not clear and would not have been so at the decline of purchasing power and the cost of living, which has become stifling, mainly, since the end of 2012. Ineffectiveness can be confirmed by the oil crisis that shook the world in mid-2014, exposing again the link between the Algerian economy and oil revenues as ever

This study seeks to determine the relationship between the expansion in public spending and the inflation evolution in the Algerian economy during the period 2001 to 2017, by answering the following problematic:

Is there a relationship between the expansion of public spending and the evolution of inflation rates in the Algerian economy over the period 2001-2017?

This main question stimulates the following sub-questions:
- What are the reasons for expanding public spending?
- Can the Economic recovery programs be considered as the right decision made by the Algerian government?

Study Hypotheses:

The main hypothesis of the study is:
A positive relationship is expected between public spending and inflation.

Study Objectives:

The goal of this study is to assess the role that fiscal policy played by knowing the impact of one of its most significant instruments, namely public spending, on price stability in Algeria. The research also aims to check the hypothesis research by constructing an econometric model during the period 2001-2017, when Algeria witnessed unparalleled political and financial stability. The goal of the analysis is therefore to assess the effectiveness of these initiatives, to present some findings and recommendations that could lead to the reduction of negative effects on inflation.

Importance of the Study:

Moreover, the importance of the study lies in the fact that it focuses on a sensitive issue in the Algerian economy, which is price stability, In particular, with rates increasing, the deterioration of the buying power of the citizen and the decreasing value of the national currency. Studying this issue needs to define the nature of the relationship between both public spending and inflation because the country needs to develop policies that ultimately seek to advance the economy, not the other way around. Formulating programs that target large funds will make no sense unless they achieve the desired objectives. Rather, they may create other imbalances, such as an increase in internal demand that causes prices to rise.

Methodology of Analysis and Methods Used:

Based on the topic and goals of the research, we used a descriptive approach to define and examine the different aspects of the subject. For better results, we have also used statistical methods to construct an econometric model, the Vector Error Correction Model (VECM), to verify any long-term relationship between public spending and inflation over the period 2001-2017.

2- Literature Review

2-1- Theoretical Background:

Fiscal policy plays a crucial role in influencing the economy. Taxes and government spending, the two keys instruments, used to affect GDP and aggregate demand. In general, tax cuts and rises in public spending are aimed at rising demand to speed up the economy and overcome the recession, and here, fiscal policy is called expansionary. The increase in taxes and the decrease in government spending aims to so-called contractionary fiscal policy; it aspires to rationalize demand in exchange.

In looking at the causes and consequences of the expansionary fiscal policy, many explanations have emerged for the growth of public spending over time. The Adolf Wagner's law of increasing state activities states that there is a natural increase trend in public spending size and its importance over time. As economic progress and the high level of real income per capita in society increase demand for goods and services in general, and public goods and services mainly education and health services, etc. Wagner derived the theoretical basis of his hypothesis from rapid urbanization and industrialization in the late nineteenth century. During that period, he observed that the economic development of countries in which industrialization was under way was accompanied by increased public activity linked to economic growth (Manyeki & Kotosz, 2017, p. 46).

Bathia (1982) stressed that the expectations of development anticipated in contemporary industrial society increase political pressure, as well as the need to intensify social efforts, which requires an expansion of the public sector and therefore an increase of its expenditures (Ezirim, Muoghalu, & Elike, 2008).

The study of Peacock and Wiseman (1961) on the United Kingdom during the period 1890-1955 made them emphasize the time pattern of public spending trends. They reach the result that the increase in public spending does not usually increase in a smooth and continuous manner. It is rather intermittent and in the form of "jerks" and "step-like fashion" in response to booms and depressions as may be experienced in the economy (Akpan, 2011, p. 63). The most of the absolute or relative increase in government activity has been achieved in periods of revolutions, political and social unrest. After reaching a certain level of spending, it becomes difficult to retreat to lower levels. In return, profusion in public revenues plus people's acceptance of the tax burden encourages governments to increase public spending (Magazzino, Giolli, & Mele, Wagner's law and Peacock and Wiseman's displacement Effect in European Union Countries: A panel data study, 2015, p. 812).

The study by Eltis (1983) of the British economy in the 1970s concluded that there is a double strong relationship between inflation and public spending: the first is that inflation has been seen as the effect of deficit policies, and the second relates to wage increases put forward by workers to protect their purchasing power. (Magazzino, 2011).

In general, the continuous rise in public spending, regardless of its causes, can affect the general level of prices. In this context, Collin Clarck (1943) sees that when the share of public sector activities (represented by expenditures) exceeds 25% of the country's overall economic activity, inflation will automatically occur. The explanation is that when the government's share in economic activity reaches 25%, the income earners will be affected by low incentives, like wages, grants, etc, and that due to higher taxes. No doubt this will affect their productivity, in that they will produce less than they can, which lead to production decline. On the other hand, the government's request for

funding will become stronger even if the budget remains balanced. The lack of adjustment between supply and demand will therefore lead to inflationary spirals. (Ezirim, Muoghalu, & Elike, 2008, p. 28).

It is therefore important to be careful about increasing the volume of public expenditure, although this may sometimes not be an option as much as may be necessary under some economic, social or political conditions, as Wagner, Peacock and Wiseman have indicated.

The reality is that the phenomenon of continuous price increase- economically known as inflation is derived from a variety of factors and thus has been interpreted by many thinkers as a monetary phenomenon or could be interpreted by demand, costs, concentrated factories, or structural phenomenon. Starting with the French Jean Bodin (1566), who was the first to deal with the phenomenon of inflation, when interested in investigating the reasons for the high prices that struck France at the time.

In the context of the current study, it is worth focusing a little on inflation resulting from demand and Keynesian analysis in that money is used only to finance transactions, there is a self-demand for money. That is, effective aggregate demand is the primary driver of the level of economic activity. Therefore, any increase in effective demand through increased government spending or private investment spending increases the total effective demand.

Therefore, inflation according to Keynes (1936) is an imbalance between total supply and total demand, or by a decrease in total supply from the level of full employment. Inflation can also be expressed as the gap between total effective demand and the supply of the total volume of goods at the level of full employment. That gap is represented by an increase in the prevailing price levels.

Generally, the means taken by the government in the process of expanding or reducing public spending occur within the policy followed, as these expenditures generally increase in periods of economic stagnation, while decreasing in periods of economic recovery.

2-2- Empirical Evidence

Among the empirical studies that dealt with the topic of inflation, and how it was affected by changes policies in terms of public spending, respectively, the study of Han and Mulligan (2006) where both experimentally tested that growing public spending and expansionary fiscal policies of governments cause high inflation. This is due to the positive relationship between inflation and the size of government during periods of peace and war (Georgantopoulos & Tsamis, 2012, p. 119).

Ezirim et.al (2008) studied the relationship between public spending growth and inflation in the USA using Granger's causal modeling of time series annual data from 1970 to 2002 where a long-term equilibrium relationship was found. Inflation significantly affects public spending decisions in the United States, as public spending growth exacerbates inflationary pressures while lower

public spending tends to reduce inflation in the country (Mehrara, Soufiani, & Rezaei, 2016, p. 155).

Bernstein (1936) highlighted the inflationary effects of increased government spending. In his study of the United Kingdom that spanned over the first three decades of the twentieth century. Much attention has been paid to increasing public spending in order to reduce cyclical fluctuations in employment and production (emphasized by the report "The Royal Commission on Bad Laws"), while other economists - such as Keynes, Martin, Foster, and Pigou - have suggested using public spending as an Economic policy tool, considering depression periods as low cost. Bernstein found out that if these conditions are not favorable, large increases in public spending during periods of economic depression may lead to price and production increases (Magazzino, 2011, p. 3)

As to the crisis of the 1930s, Bullock (1934) assessed the effects of economic policy choices of the Administration status, asserting that insufficient and delayed spending policies enacted in the years 1933-1934, also given the level of prices and the sharp decline in revenue collection, if the conditions of beginning are maintained Monetary stability (Magazzino, 2011, p. 3).

Amer Omran Kadhim (2005) deduced that the strength of the relationship between public spending and inflation in Iraq during the period 1980-1996 where he concluded that the change in public spending by 100% leads to a price change of 183%. He pointed out that the economic blockade that was imposed on the country had a great role in widening and deepening the inflationary gap in the Iraqi economy.

Sometimes the central bank may cause inflation to reduce the real value of public debt (while bearing the harmful consequences of higher prices). Although it will not benefit from the impact of this inflation on debt at the time. A Bruchez's study (2005) has shown that an inflationary shock can yield a gain for the government after a certain period, but in the meantime it will be difficult to meet debt restraint requirements.

Thus, according to what has already been mentioned, public spending is a catalyst for high inflation because it causes an increase in domestic demand for goods and services. Although this effect may be evident if these overheads are not in line with the productive potential of the economy.

3- Empirical Evidence from the Algerian Economy (2001-2017)

3-1- Data & Methodology:

Through this study, we will see the methodology, tools and econometric methods used to know the link between inflation and the evolution of public spending in the Algerian economy between 2001 and 2017. By relying on the EVIEWS 10 program that includes many tests and models that enable to know the impact of the independent variables adopted in the econometric study on the dependent variable.

This study relied on the annual time series data of the Algerian economy available in World Bank database from 2001 to 2017. The number of views during the study period is seventeen (17) views annually.

In order to increase this number to more than thirty (30) views, the annual data was converted to semi-annual, based on the EVIEWS 10 statistical analysis program. Thus, the number of views has become an estimated thirty-six (34) observations.

Based on the theoretical economic study of the relationship between inflation and public spending, the mathematical form of the regression model expressing the specific economic variables, turned into natural logarithm, of the relationship between inflation and public spending in the Algerian economy for the period (2017 - 2001) is formulated as follows:

$$LINF = f(LPS, LM_2)$$

Whereas:

- **LINF:** It represents the natural logarithm of annual inflation rate in Algeria, as it measures the annual change in the general level of prices calculated by Laspeyres method.
- **LPS:** that is the natural logarithm of the annual development of public spending, represented in total government spending (except for military expenditures).
- **LM2:** is the natural logarithm of the broad money supply. It includes central currency, bank's reserves (deposits) in Central Bank, quasi-money, such as time deposits and savings deposits at short term, and other securities and commercial paper. We include M2 as a second independent variable to get better results.

Before determining the model to use in the analysis, it is worth using the results of the econometric methods that lead to the selection of the appropriate econometric model starting by two main steps: the stability of the time series test, and the co-integration test.

- **Time Series Stability Test:**

The stability of time series is a required condition to obtain rational and reliable results, and to know the possibility of studying the long-term relationship between both public spending and inflation.

In order to know the degree of stability, the Unit Root Test of Augmented Dickey-Fuller (ADF) is used for each series separately. The results showed that each of the two-time series of variables used in the study settles at the first degree as it's shown in the table:

Table 1. Augmented Dickey-Fuller Test

Variables	Augmented Dicky Fuller test statistics			
	Level	P-values	1st Difference	P-values
LINF	-2.786573	0.0711	-5.459867	0.0001
LPS	-0.591273	0.8593	-7.749760	0.0000
LM2	-2.127208	0.2360	-3.802381	0.0074

Source: Prepared by researchers according to Eviews outputs

According to the table 1 above, both inflation rate and public spending are not stabilized at their original state (at level) because the probability p-value for each of them is greater than the level of significance 5%, and thus accept the null hypothesis stating the existence of unit root problem. In turn, the variables settle at the first difference as the P-values become smaller than the level of significance at 5%. This requires rejecting of the null hypothesis and accepting the alternative hypothesis that there is no unit root. Therefore, they are co-integrating in the same degree I ~ (1). This indicates the possibility of doing the co integration test of Johansen.

- **Lag Length :**

This test aims to decide the optimum number of lags to use in the analysis. This refers to the lowest values, mainly, of both the Akaike information criterion (AIC) and the Schwarz information criterion (SC) values:

Table 2. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-52.62271	NA	0.007263	3.588562	3.727335	3.633798
1	19.91222	126.3512*	0.000121*	-0.510466*	0.044626*	-0.329519*
2	27.13309	11.18071	0.000138	-0.395683	0.575727	-0.079028
3	34.93789	10.57425	0.000157	-0.318574	1.069156	0.133792

Source : By researchers from Eviews outputs

According to the results obtained from Eviews shown in the table above. The best number of lags corresponds to one (1) lag.

- **Granger Causality:**

The causality of Granger (1969) helps to answer the question of whether "x" causes "y" and know how much the current "y" can be explained by the previous values of then to see if adding the different x values that can improve the interpretation. It may often be noticed that the causal relationship is two-way, meaning that x Granger causes y and y Granger causes x (Eviews Help, 2019). Table.3 below shows Granger Causality results for both LINF and LPS:

Table 3. Pairwise Granger Causality Tests

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
LM2 does not Granger Cause INF	32	0.91921	0.4110
LINF does not Granger Cause M2		2.49409	0.1014
LPS does not Granger Cause INF	32	3.43668	0.0468
LINF does not Granger Cause PS		0.05051	0.9508
LPS does not Granger Cause M2	32	4.28913	0.0241
LM2 does not Granger Cause PS		1.93130	0.1645

Source: By Researchers from Eviews outputs

Looking at the results in table.3 above, we can reject the hypothesis that Public Spending (PS) does not Granger cause inflation (INF), and accept the alternative hypothesis because the probability value of 0.0468 is less than 0.05. This indicates that public spending causes inflation. We found another granger causality goes from public spending (PS) to broad money (M2) because the

probability value of 0.0241 is less than 0.05. For the rest of the table, we accept null hypothesis because the p-value of each them is greater than 0.05

- **Cointegration Test:**

Since the variables are first-degree integrals, a test of a long-term relationship called cointegration between study variables can be done through Johansen's test of cointegration. The following table gives a summary of the test results:

Table 4. Johansen System Cointegration Test Results

Hypothesized		Trace	0.05	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.475758	34.58492	29.79707	0.0130
At most 1	0.331312	13.91929	15.49471	0.0852
At most 2	0.032016	1.041278	3.841466	0.3075
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: By Researchers from Eviews outputs

The results of the test show that the high critical value of the first line corresponds to a probability of 0.0130 (less than 0.05 percent). So we reject the null hypothesis and accept the alternative hypothesis that there is a single common cointegration relationship between variables, and this is either on Trace Test or on the Maximum Eigenvalues test.

3-2- Results and Discussion :

- The cointegration relationship between inflation and government indicates a causal relationship in at least one direction. The determination of this causal relationship for the long and short terms requires the introduction of granger causality. The most appropriate model in this case therefore is the Vector Error Correction Model (VECM), in order to determine this causality and estimate the speed of reaching the long-term equilibrium of any short-term imbalance between the variables in the model.
- Johansen (1991) developed a method capable of checking the presence of (n-1) cointegrating relationships between n variables (n>2). We will return to the error correction vector model (VECM) which seeks to model a relationship with several explanatory variables, more complex in the future (BSI Economics, 2014). If cointegration has been detected between series we know that there exists a long-term equilibrium relationship between them (Asari, Baharuddin, Jusoh, Mohamad, & Jusoff, 2011). The regression equation form for VECM is as follows (Asari, Baharuddin, Jusoh, Mohamad, & Jusoff, 2011):

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i}$$

$$\Delta X_t = \alpha_2 + p_2 e_{i-1} + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i}$$

The co-integration rank in VECM indicates the number of cointegrating vectors. For example, the rank of two indicates that two linearly independent combinations of non-stationary variables will be stationary. A negative and important ECM coefficient (i.e. et-1 in the above equations) implies that any short-term fluctuations between the independent variables and the dependent variable will give rise to a stable long-term relationship between the variables (Asari, Baharuddin, Jusoh, Mohamad, & Jusoff, 2011).

- **Estimating the Long-term Relationship:**

In terms of framing both inflation and government spending relationship, the long-term equilibrium relationship can be estimated using the Ordinary Least Squares method (OLS) which takes the following form:

$$D(\dot{LINF}) = C(1) * (LINF(-1) + 0.00105305677061 * LM2(-1) - 1.22801943219 * LPS(-1) + 28.1156581639) + C(2) * D(LINF(-1)) + C(3) * D(LINF(-2)) + C(4) * D(LM2(-1)) + C(5) * D(LM2(-2)) + C(6) * D(LPS(-1)) + C(7) * D(LPS(-2)) + C(8)$$

By applying the model to the data related to the study, this relationship is estimated above is extracted below:

$$\boldsymbol{INF = \underset{[-3.08640]}{1.228019PS_{t-1}} - \underset{[+2.87721]}{0.4053M2_{t-1}} - 28.11566}$$

Since the t statistic calculated for all the coefficients is greater than the tabular value of t (2.021) at the significance level of 5% and the degree of freedom (34-2= 32). This indicates that all the coefficients are different from Zero; this means that the long-term equation is therefore significant.

With this significant long-term equation, we conclude that there is a direct relationship between government spending and inflation, oil rents and inflation, and the same is true of money supply and inflation. The results in Appendix (3), show the significant role of government expenditure in affecting the inflation rate in Algeria.

o The speed of adjustment correction term is negative (C (1) = -0.831460) and statistically significant (Prob = 0.0009), which indicates a long-term relationship between all study variables. It explains that independent variables correct themselves every quarter with a rate of 83.14% to reach equilibrium in the long run.

o The coefficient of determination (R-Squared) is estimated at 0.542668, which means that 54.26% of inflation's changes are explained by the independent variables, whereas the remaining percentage (45.74%) is the result of other variables not included in the model (Appendix (3))

o The (Prob (F-statistic)) value is 0.009904, it is less than 0.05. This indicates the significance of the model as a whole (Appendix (3)).

To verify the significance of the independent variables coefficients, and thus the relationship of each independent variable to inflation separately. We use Wald Test-coefficient Restrictions, and thus to verify the relationship of each independent variable to inflation separately. The Wald test (also called the Wald Chi-Squared Test) is, therefore, a way to find out if explanatory variables in a model are significant (Agresti, 2007, p. 11), i.e., if they add something to the model in the relationship between each variable and inflation. Its results shown in Appendix (4) are shown as follows:

- **Non relationship goes from inflation to inflation**: because the probability value is completely below the significance level 0.05, and therefore reject the null hypothesis of the Wald test.
- **Non-relationship goes from money supply (M_2) to inflation**: because the probability value is completely greather than the 0.05 level of significance, and thus we accept the null hypothesis of the Wald test
- **A positive relationship goes from public spending to inflation**: because the probability value is less than the 0.05 level of significance in the sense that the coefficients are not equal to zero and therefore reject the null hypothesis of the Wald test.

- **Discussion:**

The findings obtained do not contradict the various economic literature that has been discussed. Following an expansionary fiscal, which is based mainly on the huge investments in infrastructure, led to create new spending and incomes for workers in these projects without this having a tangible productive impact, had a direct impact on increasing inflation rates. From the Keynesian viewpoint, this rise is not regarded as troubling as long as public expenditure stimulates productive abilities to meet the growth of demand. The problem is that the reality in Algeria is slightly different, so increased demand did not improve production capacity but led to increased imports of goods and services and monopolistic policies in many productivity sectors. The resources control fund, on which the Algerian state relies to cover the budget deficit pushes the government to take restrictive measurements in imports that reduce the state's currency reserves. By taking such measurements, the demand for imported goods turns to a demand for locally produced goods that are not sufficient in the Algerian case because of a deficiency in local production system which has not succeeded in raising public spending to revive it.

3-4- VECM Quality Statistical Tests

To verify the quality of the form used, the following statistical tests are used:

- **Residuals Serial Correlation Test:**

The results of the "Breusch Godfrey Serial Correlation LM Test" shown in Table 6 demonstrate that the critical values of the statistic are greater than 5% and thus the null hypothesis that there is no serial correlation. We conclude therefore that the model does not have a serial correlation problem.

Table 9. VEC Residual Serial Correlation LM Tests

Lag	LRE stat	df	Prob.	Rao F-stat	df	Prob.
1	14.53108	9	0.1046	1.749714	(9, 44.0)	0.1062
2	5.291570	9	0.8082	0.576113	(9, 44.0)	0.8092
3	5.354791	9	0.8023	0.583391	(9, 44.0)	0.8034

Source : By Researchers from Eviews outputs

- **The Heteroskedasticity Test:**

To ensure that the model does not have a heteroscedasticity problem, the (Heteroskedasticity test Breusch Pagan Godfrey) and (White Heteroskedasticity) test are used. The results represented in table 7, show that the critical value of the statistic exceeds 5%, and hence the null hypothesis that there is no such problem.

Table 10. Heteroskedasticity Test: Breusch-Pagan-Godfrey

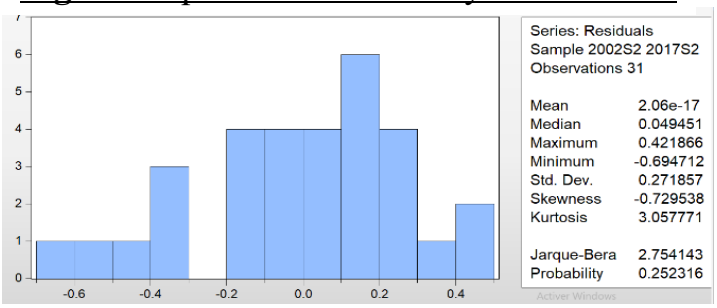
F-statistic	1.309716	Prob. F(9,21)	0.2897
Obs*R-squared	11.14484	Prob. Chi-Square(9)	0.2659
Scaled explained SS	6.312088	Prob. Chi-Square(9)	0.7083

Source: By Researchers from Eviews outputs

- **Testing the Normality of Residuals:**

The results of the Jarque Berra normal distribution test shown in (Fig.1) show that the residuals obey the normal distribution (the probability 0.295456>0.05), which is the main condition for the consistency of the model as a whole.

Fig. 1. Jarque-Berra Normality Test Results

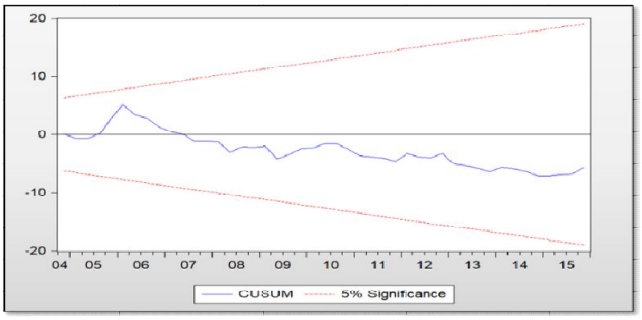


Source: Eviews outputs

- **Stability Test and Cusum Curve:**

Since the CUSUM curve (Fig.2) remains within the 5% level of significance throughout the study period, indicating the stability of the model as a whole.

Fig. 2. Cusum Test Results



Source : Eviews outputs

3-5- Analyzing Shocks and Impulse Response Functions

The results of VECM show that the mechanism and the path of Granger causality are homogenous or heterogeneous during sample time. It cannot however, gives us the dynamic characteristics of the system. The study of dynamic interactions between variables in the post-sample period is performed via the Impulse Response and Variance Decomposition functions.

The impulse response functions measure the degree of impulse response of a transitory or permanent shock to each of the endogenous variables (Rezitisa & Ahammad, 2015). Thus, The Impulse Response functions show future dynamic responses (in the long term) of model's variables, as a relationship in the time, through their response to one or more future positive shocks from the independent variables.

According to Eviews outputs, for 10 periods, we obtain the following results (see Appendix :

- **Response of inflation rate to one or more positive shocks in the money supply**: From the results shown in Appendix (3) we see that a positive shock in money supply (LM2) will have a significant positive impact on inflation rates (LINF), this is clearly evident from the fourth period (from the second year). Repeated shocks in money supply will further increase the inflation rates, which indicates that money in Algeria is exogenous.
- **Response of inflation rate to one or more positive shocks in public spending:** As indicated in Appendix (3), a positive shock in public spending will be positive, mostly from the first until the eighth period. After a slight dip, it goes back up from the fifteen period. An occurrence of repeated shocks leads to a continuous rise in inflation. This indicates public spending affects strongly inflation trends.

3-6- Variance Decomposition Analysis

Decomposition of variance plays a vital role in statistics as it helps to deal with certain a priori questions of a somewhat different type. Among the methods of determining the consistency of an evaluation or measurement instrument, the principle of generalizability is specifically based on a breakdown of this type. This is why two large components of the observed variance are calculated and distinguished: one called variance of differentiation (or "real" variance) and one

of instrumentation (or "error") (irdp, 2020).The Variance Decomposition results for 15 periods yield the following results (Appendix 6 and Appendix 7 respectively):

- **Variance Decomposition of LINF:**

In the short term, variance decomposition results show that the largest percentage, which is 100% of inflation rate changes, is explained by shocks in the same variable (inflatin) during the first four periods (two years), after which this percentage gradually decreases. As for the independent variables, the public spending is the most important that explains inflation changes with an estimated rate of 29.57%, followed by money supply with only 1.05%. In the medium term (from the fourth period to the tenth period, we see that public spending (PS) stay the main interpreter in error variance during this period with 34.50%. The money supply is also rising, but at very low rates, to just be at 1.49%. In the long run (ten to fifteen period) , public spending (PS) is still considered as the most important interpreter with a rate of 37.41% followed by money supply at the level of 1.56%.

We conclude therefore that public spending is the main interpreter high inflation rates in the short, medium and long term for the post-sample period (the future period), while money supply is the second interpreter.

- **Variance Decomposition for LPS:**

In terms of public spending, we see that they explain most of the changes (percentages greater than 90%) whether in the short and medium term with a rate of 90.08% (the peak for this variable), after which this percentage gradually decreases. With regard to inflation, it is the second explicator, and this since the first period, although at slightly higher rates (less than 8%), while the money supply remains the last explicator at rates not exceeding not 2.60%.

We conclude therefore that public spending is the main interpreter high inflation rates in the short, medium and long term for the post-sample period (the future period), while money supply is the second interpreter.

4- Conclusion

From this study, it is clear that the relationship between public spending and inflation needs a deep analysis, and that causal relationship makes the volume of public spending affect the evolution of inflation rates. That may be related to many factors, such as the nature of the spending and its productivity, as well as the prevailing circumstances that cause raise in public spending to levels that are difficult to return back to it. Domestic demand, here, exceeds supply if it is sufficiently elastic, causing inflation to rise. This is what happened in the Algerian economy. Despite the state's efforts to improve the economic as well as the social conditions, and that thanks to the financial prosperity that occurred as a result of high oil prices, the results in the long run are disappointing because eighteen years of plans and projects were not enough to establish a strong and productive economy. And despite the huge sums that were used to achieve this. This is due to deficiencies in terms of productive capacities,

and the conduct of these plans has allocated huge sums to unproductive infrastructure. Even more, these experimental study results shown a positive relationship in the long run transmitted from public spending to inflation.

Accordingly, the main hypothesis of the study is accepted as the expansionary spending policy pursued by the country which is mainly based on massive investments in infrastructure, leads to the creation of new spending and incomes for workers, without an effective productive impact. This makes it an unwise decision by the Algerian government.

The expansionary fiscal policy that Algeria has pursued since 2001, based on plans and programs, to support economic recovery has in fact been unable to revive the economy and build a productive economy during eighteen years of consecutive plans. This displays that there is no clear and effective import substitution policy that would reduce the increased import bill. So the Algerian economy got improved at the time, thanks to improvement in oil revenues.

From this point, investment should be directed to the productive and important sectors in response to the needs of the Algerian economy, in order to reduce inflation rates in the long term, with a focus on the agricultural sector, as being the main contributor to the replacement of many necessary imported goods.

5- Appendices

Appendix 1. Study variables

	INF (% annual)	**PS ($ US constant 2010)**	**M2 (% annual)**
2001	4.225988349	17831833353.10237	54.05140869190737
2002	1.418301923	19561521189.11688	18.0521153645852
2003	4.268953958	20226612908.4842	16.30615568032159
2004	3.961800303	20368199199.17129	10.45122349834177
2005	1.382446567	19981203415.00745	11.69360353531348
2006	2.314524087	21220038026.89699	19.64477662934539
2007	3.673827269	21580778672.93745	23.090739222132
2008	4.862990528	24192052892.1847	16.03708228987221
2009	5.734333414	26248377387.6227	4.840835097040692
2010	3.913043478	27770783276.42298	13.54843173012714
2011	4.521764663	30492320035.59711	19.9070032552161
2012	8.894585294	31346104998.83368	10.93691708590835
2013	3.253684177	31596873839.3334	8.409999836997169
2014	2.916406413	31944439451.64879	14.42367387030432
2015	4.784976963	32934717072.8523	0.297131027590294
2016	6.397714109	33362868396.50153	0.8157745024443126
2017	5.591	33796585683.30167	8.380854997496672

Source : The World Bank

Appendix 3. **VECM Results**

Dependent Variable: D(LINF)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 10/20/20 Time: 01:03
Sample (adjusted): 2002S2 2017S2
Included observations: 31 after adjustments
D(LINF) = C(1)*(LINF(-1) - 1.22801943219*LPS(-1) + 0.00105305677061 *LM2(-1) + 28.1156581639) + C(2)*D(LINF(-1)) + C(3)*D(LINF(-2)) + C(4)*D(LPS(-1)) + C(5)*D(LPS(-2)) + C(6)*D(LM2(-1)) + C(7)*D(LM2(-2)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.831460	0.218799	-3.800101	0.0009
C(2)	0.389101	0.163985	2.372782	0.0264
C(3)	0.048881	0.164128	0.297823	0.7685
C(4)	1.477318	1.845350	0.800563	0.4316
C(5)	5.234730	1.826825	2.865480	0.0087
C(6)	0.017573	0.061586	0.285339	0.7779
C(7)	0.029067	0.069604	0.417596	0.6801
C(8)	-0.091185	0.083263	-1.095151	0.2848

R-squared	0.542668	Mean dependent var	0.044248
Adjusted R-squared	0.403480	S.D. dependent var	0.401998
S.E. of regression	0.310482	Akaike info criterion	0.716255
Sum squared resid	2.217181	Schwarz criterion	1.086317
Log likelihood	-3.101958	Hannan-Quinn criter.	0.836886
F-statistic	3.898815	Durbin-Watson stat	2.524880
Prob(F-statistic)	0.006099		

Appendix 4. Wald Test Results

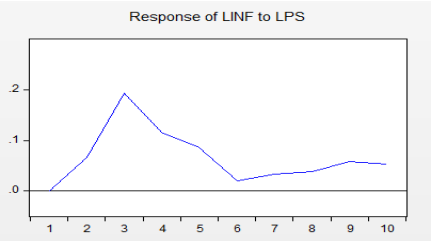
Wald Test:
Equation: Untitled

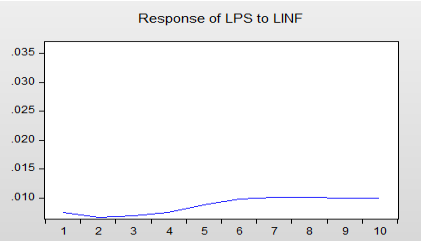
Test Statistic	Value	df	Probability
F-statistic	3.068580	(2, 23)	0.0659
Chi-square	6.137160	2	0.0564

Test Statistic	Value	df	Probability
F-statistic	4.141910	(2, 23)	0.0291
Chi-square	8.283820	2	0.0159

Null Hypothesis: C(6)=C(7)=0

Appendix 5. Impulse Response Functions Results





Appendix 6. Variance Decomposition of LINF

Variance Decomposition of LINF:

Period	S.E.	LINF	LPS	LM2
1	0.310482	100.0000	0.000000	0.000000
2	0.370751	96.29247	3.511202	0.196332
3	0.424758	74.37998	24.76916	0.850860
4	0.443813	69.37839	29.57076	1.050853
5	0.455018	66.71771	31.83802	1.444273
6	0.455742	66.62642	31.89717	1.476403
7	0.459501	66.51551	32.00600	1.478482
8	0.463545	66.22295	32.31778	1.459273
9	0.468562	65.00971	33.51490	1.475395
10	0.472338	63.99413	34.50681	1.499058
11	0.475442	63.17228	35.29825	1.529468
12	0.477715	62.63899	35.81704	1.543970
13	0.480157	62.14128	36.30612	1.552603
14	0.482773	61.61847	36.82371	1.557820
15	0.485568	61.01791	37.41611	1.565980

Appendix 7. Variance Decomposition of LPS

Variance Decomposition of LPS:

Period	S.E.	LINF	LPS	LM2
1	0.028867	6.446502	93.55350	0.000000
2	0.037469	6.749497	93.23792	0.012578
3	0.053205	4.767672	93.86650	1.365827
4	0.062345	5.008819	93.42677	1.564407
5	0.073121	5.123900	92.98181	1.894286
6	0.081694	5.915510	92.10358	1.980910
7	0.090811	6.380878	91.48383	2.135294
8	0.098969	6.759871	91.02021	2.219921
9	0.106964	6.901138	90.78127	2.317590
10	0.114271	7.034492	90.57755	2.387956
11	0.121257	7.144016	90.40330	2.452681
12	0.127830	7.271451	90.22829	2.500260
13	0.134157	7.378627	90.08026	2.541115
14	0.140209	7.468348	89.95706	2.574588
15	0.146038	7.535474	89.85992	2.604610

6- References

Agresti, A. (2007). *An Introduction to Categorical Data Analysis.* (J. W. Sons, Ed.) Hoboken, New Jersey, United-States: Wiley-Interscience.

Akpan, U. F. (2011). Cointegration,Causality and Wagner's Hypothesis:Time Series Evidence for Nigeria, 1970-2008. *Journal of Economic Research*(16), pp. 59-84.

Asari, F. F., Baharuddin, N. S., Jusoh, N., Mohamad, Z., & Jusoff, N. S. (2011). A Vector Error Correction Model (VECM)Approach in Explaining the Relationship Between Interest Rate and Inflation Towards Exchange Rate Volatility in Malaysia. *World Applied Sciences Journal, 12*(Special Issue on Bolstering Economic Sustainability), 49-56.

Binh, P. T. (2013). *Unit Root Test, Cointegration, ECM, VECM and Causality Models.* Retrieved 7 17, 2020, from http://charitythinking.weebly.com/uploads/4/5/5/4/45542031/topics_in_time_series_econometrics.pdf

Bruchez, P.-A., & Schlaffer, B. (2012). Endettement public excessif : mieux vaut prévenir que guérir. *Working Paper de l'AFF*(18).

BSI Economics. (2014). Qu'est ce qu'un modèle à correction d'erreur? *Bis Economics*. Retrieved 9 30, 2020, from http://www.bsi-economics.org/280-qu'est-ce-qu'un-modele-a-correction-d'erreur

Eviews Help. (2019). *Granger Causality*. Retrieved 7 15, 2020, from Eviews: http://www.eviews.com/help/helpintro.html#page/content/groups-Granger_Causality.html

Ezirim, C. B., Muoghalu, M. I., & Elike, U. (2008). Inflation versus public expenditure growth in the US: An empirical investigation. *North American Journal of Finance and Banking Research, 2*(2), pp. 26-40.

Georgantopoulos, A., & Tsamis, A. (2012). The Interrelationship between Money Supply, Prices and Government Expenditures and Economic Growth: A Causality Analysis for the Case of Cyprus. *International Journal of Economic Sciences and Applied Research, 5*(3), pp. 115-128.

irdp. (2020). *Décomposition (de la variance, de la variabilité d'un phénomène)*. Retrieved from Institut de la recherche et de documentation pédagogique: https://www.irdp.ch/institut/decomposition-variance-variabilite-phenomene-2070.html

Magazzino, C. (2011). The nexus between public expenditure and inflation in the Mediterranean countries. *Munich Personal RePEc Archive*(28493), p. 4. Retrieved from https://mpra.ub.uni-muenchen.de/28493/1/MAGAZZINO-The_nexus_between_public_expenditure_and_inflation_in_the_Mediterranean_Countries.pdf

Magazzino, C., Giolli, L., & Mele, M. (2015). Wagner's law and Peacock and Wiseman's displacement Effect in European Union Countries: A panel data study. *International Journal of Economics and Financial Issues, 5*(3), pp. 812-819.

Manyeki, J. K., & Kotosz, B. (2017). Empirical Analysis of the Wagner Hypothesis of Government Expenditure Growth in Kenya: ARDL Modelling Approach. *Club of Economics in Miskolc, 13*(2), pp. 45-57.

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Mehrara, M., Soufiani, M. B., & Rezaei, S. (2016). The Impact of Government Spending on Inflation through the Inflationary Environment, STR approach. *World Scientific News*(37), pp. 153-167.

Rezitisa, A. N., & Ahammad, S. M. (2015). Investigating Agricultural Production Relations across Bangladesh, India and Pakistan Using Vector Error Correction and Markov-Switching Models. *Agricultural Economics Research Review, 28*(1), pp. 57-72.

The World Bank. (2020). *Algeria.* Retrieved 1 2, 2020, from The World Bank IBRD-IDA: https://data.worldbank.org/country/DZ