Causality Testing and Co-integration between Inflation Rates and Economic Growth in Algeria

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***Abstract*— the main purpose of this study is to examine the relationship between inflation rates and economic growth in Algeria during the period 1991-2013, using the methodology of the Co-integration, causality test. The research found that the time series of the inflation rate and the GDP is non-stationary, and to make it stationary the first differences are applied. So the time series is integrated of the first orders and through the use of Johanson test we found that there is relationship co-integration between inflation rates and economic growth in Algeria, and causal relationship in one direction between them.**

***Index Terms*— inflation, economic growth, the Co-integration, Causality Test, Algeria**

I. INTRODUCTION

Inflation is a complex economic phenomenon , is defined as a sustained rise in the general level of prices which leads to a decline in the purchasing power of the consumer .High inflation is affects economic performance, even moderate levels of inflation can distort Investment and consumption decisions.

Like many countries, industrialised and developing One of the most important basic objectives macroeconomic policies is to sustain high economic growth together with low inflation, so the right level of economic growth and mild inflation can be viewed as having favorable impacts on the economy.

in the last few decades. In particular Algeria has huge possibilities to boost its economic growth, including huge foreign-exchange reserves derived from the hydrocarbon sector. The national strategic option is therefore to diversify the economy starting with the non-oil sector, with structural reforms to enhance regulatory efficiency and maintain open markets for the development of a more dynamic private sector have not advanced.

The purpose of this paper is therefore to empirically determine the relationship between inflation and economic growth in Algeria and to examine the causal relationship between these two variables.

II. REVIEW OF RELATED LITERATURE

The existence relationship between inflation and economic growth has extensively been investigated in the economic literature. .This section presents a brief review.

Barrow (1995) investigated an empirical research on the relation between inflation and economic performance from1960 to 1990. The study explains that a country grow faster if its human capital grow more rapidly. The study uses the instrumental variables to measure the causation between inflation and growth. The major finding of the empirical Analysis is that the estimated effect of inflation on growth are significantly negative when some plausible instruments are used in the statistical procedures.

Bruno and Easterly (1995) examined the determinants of economic growth using annual CPI inflation of 26countries which experienced inflation crises during the period between 1961 and 1992. the empirical analysis suggests that there exists a temporal negative relationship between inflation and economic growth beyond this threshold level.

Saaed (2007) explored the relationship between inflation and economic growth in the context of Kuwait, using annual data set on real GDP and CPI for the period of 1985 to 2005. The estimated result of the relationship shows a long-run and strong inverse relationship between CPI and real GDP in Kuwait.

J. Xiao (2009) This study is to research the relationship between inflation and economic growth of China from 1978 to 2007 using co-integration and error correction models accompanying with the Granger Causality Test. The results show that in the long run inflation positively relate to economic growth in bi-direction.

O. P. Chimobi (2010) examine the existence (or not) of a relationship between Inflation and economic growth in Nigeria. The methodology employed in this study is the cointegration and Granger causality test. The results showed that for the periods,1970-2005, there was no co-integrating relationship between Inflation and economic growth for Nigeria data.

J. Behera (2014) This study investigated the impact of inflation on economic growth and established the existence of inflation growth relationship in the context of South Asian countries. In order to examine the impact of inflation on economic growth, for the period 1980-2012. The study found that there is high positive correlation between inflation and economic growth for all the countries. The cointegration result suggest that there is long run relationship exist for Malaysia. However, the rest of the countries have no long run relationship between the two variables.

B. Jayathileke, M. Rathnayake (2014) This paper investigates the short-run and the long-run relationship between the economic growth and the inflation of three Asian courtiers over the period 1980-2010. The methodology used in the study is cointegration and causality test. The results reveal that there is a long run negative and significant relationship between the economic growth and inflation in Sri Lanka. The causality results reveal that there is a unidirectional causality that runs from the economic growth to the inflation in China.

III. METHODOLOGY

1. stationarity:

Manuscript received April 21, 2016

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In econometric analysis, when time series data are used, the preliminary statistical step in to test the relationship the stationarity of each individual series. Unit root tests provide information about stationarity of the data. Non-stationarity data would contain unit roots. Results derived from the regression models would produce 'Spurious' results if we use the data without checking their stationarity properties. [4]
Therefore The unit roots test is initially performed to find the stationary properties of the each time series. Augmented Dickey-Fuller Test (ADF) and Philips and Perron (PP) unit root tests are used for that purpose [1,7].
The stationarity test will utilize the Augmented Dickey-Fuller (ADF) technique (Dickey and Fuller (1981) which is a general auto-regression model formulated in the following regression equation (Dickey and Fuller (1981)

$$\Delta x_t = Px_{t-1} - \sum_{j=2}^{p} \emptyset j \Delta x_{t-j+1} + \varepsilon_t$$

The model hypotheses of interest are: The Series is
H_O: Non-stationary
H_A: Stationary
ADF Statistics is compared to Critical values to draw conclusions about Stationarity (see Dickey and Fuller, 1979 for the critical values) [2].

2. The Cointegration Test:
The second step is the testing of the presence or otherwise of cointegration between the series of the same order of integration through forming a cointegration equation. The basic idea behind cointegration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary. A lack of cointegration suggests that such variables have no long-run relationship: in principal they can wander arbitrarily far away from each other [6]
the variables can be tested by using multivariate cointegration technique. This paper employs Johansen's cointegration test.[8]

3. Causality Test:
In order to test the causality between the series, it is necessary to verify that the two series are stationary and co-integrated. [5]The Causality Test can be adopted to further detect the nature of relationships between inflation and economic growth. Causality Test provide important information of the causal direction between the variables. The knowledge of knowing the causal direction can make the economic variables more effectively controlled to maximize the profits of the public. [3]

IV. Results and Discussion

In this section we shall discuss the results of the Unit root test, Cointegration test, and Causality test.
The original time series data were checked for stationarity. Fig.1 reveals non stationarity as shown below:

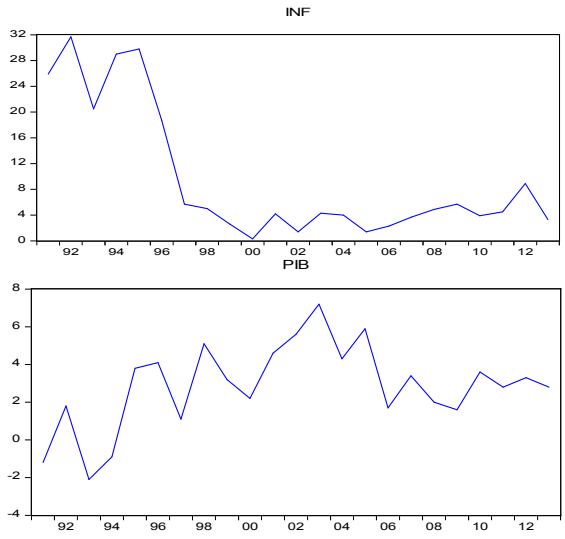

Figure 1. time plot of growth and inflation

The *ADF* test as shown Tab. 1 and Tab. 2 reveals the fact that the zero hypotheses is accepted, the series has a unit root and it is non stationary at levels. It becomes stationary by first order differences, that is the inflation and economic growth are integrated for the same order, *i.e. I (1)*

Tab.1 : The *ADF* test results of inflation

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.903844	0.0558
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	
Augmented Dickey-Fuller test statistic		-4.891839	0.0000
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	

Tab.2 : The *ADF* test results economic growth

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.767006	0.3718
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	
Augmented Dickey-Fuller test statistic		-7.443915	0.0000
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	

Based on this result we can expect that these series may be Co-integrated as well.
The result in Table-3 shows that the null hypothesis of no co-integration (r=0) on trace test between inflation and economic growth could not be rejected at 5%, However, the null hypothesis of no co-integration (r≤1) could be rejected at 5%meaning that there is only one co-integration. Suggesting that there is relationship between inflation and economic growth in the long run.

Tab.3 : Results of johansen's cointegration test.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.440820	16.10504	15.49471	0.0404
At most 1 *	0.169414	3.898103	3.841466	0.0483

The causality tests for inflation and economic growth is given in Table4. It can be observed that there is a causal relationship between them .However, our results show that a uni-directional causality exists only from economic growth to inflation, since the probability value (0.01) less than (0.05). Thus, economic growth causes inflation in algeria.

Table 4: Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
INF does not Granger Cause PIB	21	0.79915	0.4669
PIB does not Granger Cause INF		5.56521	0.0146

CONCLUSION

This study investigates the short run dynamics of the relationship between economic growth and inflation in Algeria for the period of 1991 - 2013 in the framework of Johansen's cointegration test; causality test. The results show that there is a long run relationship between economic growth and inflation in Algeria. A unidirectional causality running from inflation to economic growth was detected in Algeria. In conclusion, most of the time the countries which are characterized with stable high economic growth and stability macroeconomic condition do not suffer from inflation but The challenge for them is to find a growth rate which is consistent with a stable inflation rate.

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