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The Causal Relationship between Land Cultivated Cereal and Cereals Yield in Algeria

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Abstract**:** *This paper seeks to investigate the causal relationship between land cultivated cereal and cereals yield in Algeria. The empirical analysis starts by analyzing the time series properties of the data which is followed by examining the nature of causality among the variables. Algeria is from the largest importing countries of cereals. An increase cultivated cereal in Algeria increases cereals yield in Algeria. This study analyzes how change in real crude land cultivated cereal in Algeria affects the real cereals yield of Algeria positively. The empirical analysis involves testing the time series characteristics of the data series (stationary) using ADF test and running the pairwise Granger causality test based on Eviews software.*

Keywords: *Land cultivated cereal, Cereals yield, Cointegration, Granger causality, Algeria.*

1. Introduction

It is no secret that one of the Algerian agriculture and food situation especially know many obstacles and faced significant challenges, some dating back to the volatile climate and geography unique to our country, some linked to the human element, and others are on the whole economic juncture. And Algeria, like many of the developing Arab countries suffer from "many dependencies" any of the is equal relations with cumulative tendency to exacerbations : External financial or dependency accounted for decades consequence to the evolution (before their decline appreciably in recent years).

Imports of Algeria, of independence in regard to food and especially grains of any kind really adds to the treasury of the merits of the state .For this, in collaboration with experts in the field , we are lean to examine and study in a scientific way the causal relationship as existing between Granger land cultivated cereal and cereals yield in Algeria .in order to give a more rigorous study support our specialist colleagues of matter. For this purpose , in this study ,we want to analyses this relationship by introducing a causality of Granger , two times series denoted L and Y and see exactly the strict sense, of this relationship, while, appealing to notions of statistics for this we will give some essential formulas statistics. The remaining part of this paper is organized in the following way, section 2 presents the methodology, section 3 contains empirical results and discussions, and finally conclusions are drawn in section 4.

2. Methodology

2.1.1. Granger Causality Tests

Several studies have been devoted to the study of causality between variables (Granger 1969; Sims 1972). Furthermore, we carried out the Granger causality test where Granger (1969) proposed a time series data-based approach in order to determine causality. For example, if we want to explore the causal relationship between land cultivated cereal $(L_t)$and cereals yield (Y_t)

$$L_t = \sum_i^n \alpha_i Y_{t-i} + \sum_{i=1}^{n} \beta_i L_{t-i} + \epsilon_{1t}$$

$$Y_t = \sum_{i=1}^{n} \lambda_i L_{t-i} + \sum_{i=1}^{n} \delta_i Y_{t-i} + \epsilon_{2t}$$

where n is the number of lags.

If α_i coefficients are jointly significantly different from zero, the Granger test suggests that cereals yield . Y_t causes the land cultivated cereal L_t and if . λ_i is jointly significantly different from zero, the Granger test suggests that the land cultivated cereal . L_t cause the cereals yield Y_t.

If the two causalities are verified, we can conclude the return causality "feedback causality" between the two variables.

2.1.2. Causality Test and Cointegration Variables

All The relationship causality between different time series is based on the following.

2.1.3. Unit Root Tests

A stochastic process is stationary if its first and second moments are constant.

Analytically, Y_t is stationary if

$$E(y_t) = \mu, \forall t$$

$$cov(y_t, y_{t+k}) = \delta(h), \forall t$$

Dickey and Fuller (DF) proposed a basic model of a unit root test

$$\Delta y_t = (\emptyset - 1)y_{t-1} + \varepsilon_t$$

$$\Delta y_t = (\emptyset - 1)y_{t-1} + \beta + \varepsilon_t$$

$$\Delta y_t = (\emptyset - 1)y_{t-1} + \beta + \partial t + \varepsilon_t$$

The hypothesis tests are

$$\begin{cases} H_0: (\emptyset - 1) = 0 \\ H_0: (\emptyset - 1) < 0 \end{cases}$$

To get a broader view, Dickey and Fuller took an autoregressive process of higher order known as the augmented Dickey-Fuller (ADF) test. This test is represented as follows:

$$\Delta y_t = \emptyset y_{t-1} + \sum_i \theta_i \Delta y_{t-i} + \varepsilon_t$$

$$\Delta y_t = \emptyset y_{t-1} + \sum_i \theta_i \Delta y_{t-i} + \beta + \varepsilon_t$$

$$\Delta y_t = \emptyset y_{t-1} + \sum_i \theta_i \Delta y_{t-i} + \beta + \partial t + \varepsilon_t$$

2.1.4. Cointegration

The main objective of this paper is to assess not only the pairwise nature of causality among the variables but also the short-run and long-run dynamic impacts, which we tested for cointegration using two well-known approaches: the one developed by Engle and Granger (1987) and the other one by Johansen (1988).

2.1.5. Engel-Granger Method

The Engle-Granger test is a procedure that involves an OLS estimation of a prespecified cointegrating regression between the variables. This was followed by a unit root test performed on the regression residuals previously identified. We applied the Engle Granger to find the number of cointegration equations between the two variables.

2.1.6. An Error Correction Model

For interpret the vector euor correction model found in the different regression equations. Indeed an error correction model (ECM) can detect the dynamics of short-term and long-term variable around its stationary equilibrium value. Thus, for an adjustment, error correction requires that the sign of the coefficient of residual is negative and statistically significant.

The model error corrections read

$$\Delta x_1 = \alpha_1 z_{t-1} + lagged(\Delta x_t, \Delta y_t) + \varepsilon_{1t}$$
$$\Delta y_1 = \alpha_2 z_{t-1} + lagged(\Delta x_t, \Delta y_t) + \varepsilon_{2t}$$

With z_{t-1} the error correction term resulting from estimating the cointegration relationship and the error term stationary $|\alpha_1| + |\alpha_2| \neq 0$

2.1.7. Causality Test

The causality test based on the model vector correction has the advantage of providing a causal relationship even if no estimated coefficient of lagged variables used is significant.

Thus, an error correction model after processing can be rewritten as

$$\Delta L_t = \alpha + \sum_{i=1}^{k} \lambda_i \Delta L_{t-i} + \sum_{i=1}^{k} \sigma_i \Delta Y_{t-i} + \theta z_{t-1} + \varepsilon_t$$

$$\Delta Y_t = \beta + \sum_{i=1}^{k} \varphi_i \Delta Y_{t-i} + \sum_{i=1}^{k} \varphi_i \Delta L_{t-i} + \Psi z_{t-1} + \mu_t$$

From both equation L does not cause Y the sense of Granger if $\sigma_i = \theta = 0$.

3. Empirical Results and Interpretation

3.1.1. Statistical Data Properties

The variables that we used in our application are the land cultivated cereal . L_t and the cereal yield. Y_t Figure 1 shows the evolution of real L and Y in Algeria from 1962 to 2012. The real L is characterized by an upward trend while the Y is presented as an additive model.

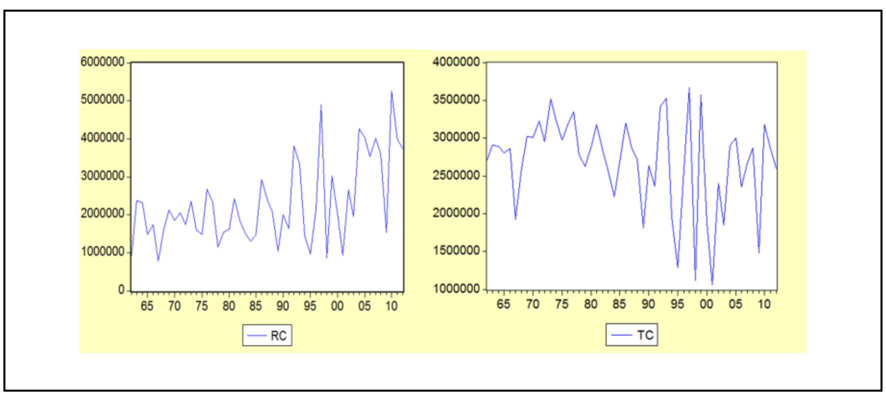

Fig 1: representation of two series L_t and Y_t

TABLE I: Test of stationarity for (Y)

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(Y)

Method: Least Squares

Date: 02/04/15 Time: 22:04

Sample (adjusted): 1962 2012

Included observations: 51 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	-0.675397	0.142507	-4.739402	0.0000
C	1623883.	359946.7	4.511452	0.0000

*MacKinnon (1996) one- sided p-values.

TABLE II : Test of stationarity for (L)

Null Hypothesis: L has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.866650	0.0000
Test critical values:	1% level	-3.565430	
	5% level	-2.919952	
	10% level	-2.597905	

*MacKinnon (1996) one-sided p-values.

3.1.2. Test of Stationnarity of Y and L

prob 0:0000 less than 0.05, then we can conclude that Y was stationnary..

prob 0:0000 less than 0.05, then we can conclude that L were stationnary.

Tables 1 and 2 present the test results for stationnarity of L and Y. The results showed that the two variables were stationnary.

3.1.3. Cointegration Tests

Table 3 presents the test results for the number of cointegrating vectors. The results showed that the trace statistic 25,80463 greater than 15,49471 suggests the presence of one cointegrations among the two variables.

TABLE III: Test of cointegration

Date: 02/04/15 Time: 22:06

Sample (adjusted): 1963 2012

Included observations: 50 after adjustments

Trend assumption: Linear deterministic trend

Series: L Y

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 *	0.397734	25.80463	15.49471	0.0010
At most 1	0.008995	0.451799	3.841466	0.5015

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

3.1.4. An Error Correction Model Estimate

TABLE IV: VECM

Vector Autoregression Estimates
Date: 06/23/15 Time: 23:51
Sample (adjusted): 1964 2012
Included observations: 49 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	Y	L
Y(-1)	0.258448	-0.202202
	(0.24755)	(0.16806)
	[1.04404]	[-1.20315]
Y(-2)	0.339163	0.003642
	(0.24636)	(0.16725)
	[1.37670]	[0.02177]
L(-1)	-0.521545	0.215963
	(0.38121)	(0.25881)
	[-1.36812]	[0.83446]
L(-2)	-0.778233	-0.116087
	(0.38993)	(0.26472)
	[-1.99585]	[-0.43853]
C	4451526.	2861067.
	(823556.)	(559115.)
	[5.40525]	[5.11714]
R-squared	0.348299	0.074298
Adj. R-squared	0.289053	-0.009857
Sum sq. resids	3.77E+13	1.74E+13
S.E. equation	925584.2	628382.5
F-statistic	5.878895	0.882876
Log likelihood	-740.0619	-721.0853
Akaike AIC	30.41069	29.63614
Schwarz SC	30.60373	29.82918
Mean dependent	2308071.	2676372.
S.D. dependent	1097735.	625308.4

3.1.5. Causality Tests

Table 5 shows that the Prob statistic of the first test D 0,2706 and Prob statistic of the second testD 0:0007 less than 0:05 suggest the presence of one senses of causality among the two variables.

TABLE V: Test of causality

Pairwise Granger Causality Tests

Date: 02/04/15 Time: 22:16

Sample: 1961 2012

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
Y does not Granger Cause L	50	1.34594	0.2706
L does not Granger Cause Y		8.65358	0.0007

4. Conclusion

This paper employs an empirical analysis to examine the impacts of fluctuations on the level of real agriculture activity in Algeria. The first step in the empirical analysis involves testing the time series characteristics of the data series using ADF test and running the pairwise Granger causality test. This was followed by applying the Johansen cointegration test and the estimation of the long- run cointegrating vectors and the number of cointegration equations equals one.The analysis was capped with the estimation of short-run error correction model (ECM).

Granger pairwise causality test showed that the null hypothesis that L do not Granger cause Y could be safely rejected at the 1 percent level. In other words, null hypothesis that Y does not Granger cause L could be safely rejected at the 1 percent level and finally we find that the one variable was causes or there.

In the outlook ,our collaborative research laboratory with our fellow economsts at the university of Bechar in Algeria leads a comprehensive study on the nature of time series considered in all economic fields especially regarding linearity and non linearity of the processes macroeconomic of then assuming this last are linear which is not always the case.

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