Exploring Exports and Economic Growth Causality in Algeria

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Abstract: This paper investigates the causality relationship between economic growth, exports and imports in Algeria using Cointegration, Error Correction Model, and VEC Granger causality/Wald Exogeneity tests. The paper finds that economic growth in Algeria is linked to export industries and import is linked to economic growth. In other words, the growth in export sectors Granger causes economic growth which, in turn, promotes the growth of imports in Algeria. The paper suggests policy prescription that the government of Algeria should put emphasis on promoting growth and development of export industries by ensuring increased productivity in such sector.

Keywords: *Exports, growth, Error correction, Granger Causality, Algeria*

1. Introduction

In theoretical growth model, exports are considered as an engine of growth. First, exports being a component of GDP, the increase of exports directly increase GDP. An increase in exports means increase in employment in export sector industries which, in turn, increase income and GDP. Second, reallocating resources from less productive sectors to exports industry and enhancing capacity utilization exports growth promotes GDP growth (Ben-David and Loewy, 1998). Third, exports support foreign exchange earnings which, in turn, assist importing capital goods. The import of capital goods and intermediate goods stimulate domestic growth (Awokuse, 2005; Balassa, 1978a; 1988b; Buffie, 1992). The theoretical exports-led-growth (ELG) model has been hotly debated because empirical evidences of trade theory do not provide conclusive causal relation between exports and economic growth. Cross-country studies, in general, lend supports for ELG i.e. positive association between exports and economic growth (Balassa, 1988 and Moschos, 1989). Islam (1998) causality test found that export expansion led economic growth in two-third of fifteen Asian countries.

Single country study results are conflicting. Studies such as Grabowski et al (1990), Sharma et al (1991) found support in favor of exports led to economic growth (ELG). On the other hand, other studies such as Yamada (1998), Boltho (1996) and Afentis and Serletis (1991) found evidences in support of growth-led exports. Awokuse (2005); Giles and Williams (2000); Hatemi (2002) and Kwan and Cotsomitis (1990) found bi-directional causality between exports and economic growth. Shan and Sun (1998) found evidence of one way causality running from manufacturing to exports growth. Since empirical evidences are mixed and there is no consensus on the causal relation, this paper is motivated to investigate the relation between exports and economic growth in Algeria, one of ten MENA countries. Algeria is a good field of investigation for a number of reasons. First, unlike other MENA countries such as Morocco, Tunisia, Syria and Yemen, Algeria is an oil based country and its oil is an important component of country's exports. Second, Algeria's exports constitute 48% of its GDP in 2006 with imports 24% of GDP. The GDP growth rate of Algeria is 3%. Since the ratios of export to GDP are quite high, the study of interrelationship is of a great interest to many. The objective of this paper is to contribute to this debate by incorporating three distinct variables¹ and exploring their interrelationship through the application of (i) Johansen co-integration VECM, and Granger Causality/ Block Exogeneity Wald test, the recent advances in time series techniques. This paper is structured as: data and methodology is provided in Section II. Section III provides empirical results and conclusions.

¹ Islam (1998) provided detail justification for the uses of these variables in page 416.

2. Data and Methodology

Data for exports, imports and GDP are annual and obtained from the World Bank Indicators, World Bank. Variables are in natural log and in constant dollar (2000). They are:

YN= Real per capita non-export GDP. Non-export GDP is measured as Gross Domestic Product minus exports. Exports are subtracted GDP for avoiding exports biasness and the spurious correlation between exports and growth².

EX= Exports of goods and services. IM= Imports of goods and services. It is incorporated for avoiding a missing variable. It an important channel for affecting the growth of GDP through the imports of capital and intermediate goods. With these variables, the paper estimates the following simple model:

$$YN = f(EX, IM) \quad \text{eq. (1)}$$

This paper uses Vector Error Correction estimates and VEC Granger Causality/ Block Exogeneity Wald Tests for finding causal relation and the direction of causality. As a first step to this object, Augmented Dicky-Fuller (ADF) test, of the following regression, is performed to determine whether three series tend to exhibit deterministic and /or stochastic trend and are, therefore, non-stationary.

$$\Delta X_t = \alpha + (\rho - 1) X_{t-1} + \sum \theta_i \Delta X_{t-1} + \beta T + \mu_t \quad \text{eq. (2)}$$

Where T denotes the time trend and the failure to reject the null hypothesis of unit root ($\rho=1$) signifies the existence of a non-stationary process. The result of the ADF test is provided in Table 1. Second, the cointegration properties of the variables are examined using Johansen (1991 and 1995a) VAR based co-integration test. Results of Co-integration test is provided in Table 2. Third, having established that a co-integrating relationship is present among variables in level form, Vector Error Correction model which combines both short term properties of economic relationship in first difference form as well as the long term relationship in level form is estimated from the following:

$$\Delta YN_t = \sum \alpha_{1i} \Delta YN_{t-i} + \sum \beta_{1i} \Delta EX_{t-i} + \sum \psi_{1i} \Delta IM_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{eq. (3)}$$

$$\Delta EX_t = \sum \beta_{2i} \Delta EX_{t-i} + \sum \alpha_{2i} \Delta YN_{t-i} + \sum \psi_{2i} \Delta IM_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{eq. (4)}$$

$$\Delta IM_t = \sum \psi_{3i} \Delta IM_{t-i} + \sum \beta_{3i} \Delta EX_{t-i} + \sum \alpha_{3i} \Delta YN_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{eq. (5)}$$

Where Y, EX and IM are stationary processes, ECT represents one period lagged error correction term captured from the co-integrated regression from (3, 4, and 5). α , β , ψ , and λ are coefficient, and ε is error term. The null hypothesis that EX does not Granger cause Y is rejected not only if $\sum \beta$ and $\sum \psi$ are jointly significant but also if the coefficient of ECT_{t-1} is significant (Miller and Russek, 2001). But in the Error Correction Model, the causality inference is obtained through the significance of λ . That is, the null hypothesis that EX does not Granger cause Y is rejected if λ is statistically significant even if $\sum \beta_i$ and $\sum \psi_i$ are not jointly significant. The direction of causality is also tested though the VEC Granger Causality/Wald Block Exogeneity tests. The results of error correction estimates and VEC Granger causality test are provided in Table 3.

² See Islam (1998)

3. Empirical Results and conclusion

Table 1: Results ADF Unit Root Tests for Stationarity with Constant

Country: Algeria			
Variables	Level	1 st difference	2 nd difference
YN	-1.11	-5.83*	-6.96*
EX	2.20	-7.98*	-11.84*
IM	-1.20	-5.95*	-8.26*

* Level of significance 1 percent

The ADF unit root test in Table 1 indicates that all three variables, YN, EX, and IM are non-stationary at level. The null hypothesis that they have unit root cannot be rejected. When the ADF test is performed to these variables in first difference, all of the variables become stationary (i.e. the null hypothesis of non-stationary is rejected) at level of significance of 1 percent.

Table 2: Results of Johansen Co-integration Test for Algeria

Included observations: 44 after adjustments

Trend assumption: Linear deterministic trend

Series: YN EX IM

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 *	0.925994	119.4539	29.79707	0.0000
At most 1	0.085302	4.894976	15.49471	0.8199
At most 2	0.021845	0.971854	3.841466	0.3242

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.925994	114.5589	21.13162	0.0001
At most 1	0.085302	3.923122	14.26460	0.8674
At most 2	0.021845	0.971854	3.841466	0.3242

Max-eigenvalue 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

Both trace and Eigenvalue tests, in Table 2, indicate that the null hypothesis that there is no cointegration is rejected at a significant level of 5% for Algeria. The establishment of cointegration suggests that there exists long run equilibrium.

Table 3: Result for Error Correction Models

Country	Dependent variable	t-statistics for ECT_{t-1}	F-statistics for $\sum \Delta YN_{t-i}$	F-statistics for $\sum \Delta EX_{t-i}$	F-statistics for $\sum \Delta IM_{t-i}$
Algeria	YN	-1.72	4.12*	1.61	2.96
	EX	-0.76	4.12*	1.61	2.96
	IM	-1.71	4.12*	1.61	2.96

*significant at a level of 1 percent

The significance of the Error Correction Term and F-statistics, in Table 3, indicates causal and long term relation among the variables in Algeria.

Table 4: VEC Granger Causality/Block Exogeneity Wald Test

Sample: 1960 2005

Included observations: 43

Dependent variable: D(LNIM) (eq. 1)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	8.588601	2	0.0136
D(LNEX)	21.82982	2	0.0000
All	23.33891	4	0.0001

Dependent variable: D(LNGDP) (eq.2)

Excluded	Chi-sq	df	Prob.
D(LNIM)	0.070577	2	0.9653
D(LNEX)	9.160849	2	0.0103
All	11.88615	4	0.0182

Dependent variable: D(LNEX) (eq. 3)

Excluded	Chi-sq	df	Prob.
D(LNIM)	0.670577	2	0.7151
D(LNGDP)	0.063203	2	0.9689
All	0.756012	4	0.9442

VEC Granger Causality/ Block Exogeneity Wald test, in Table 4, shows Granger causality between economic growth, export and imports. Chi-sq value associated with GDP(YN) and Export (LNEX) suggests that both GDP and export Granger causes import growth (eq.1) and exports Granger causes GDP growth (eq. 2) . Thus, the causality runs from exports to economic growth and economic growth to imports (i.e. $EX \Rightarrow YN \Rightarrow IM$). Exports also Granger causes imports ($EX \Rightarrow IM$). Development of Algerian export is a key factor for both the domestic economic growth of Algeria and the growth of imports. Algerian exports and export generating sectors provides vital inputs for the growth of Algeria's GDP and imports. The findings of this paper is consistent and lends supports to previous studies that export led to economic growth found by Balassa (1988), Moschos(1989), Islam (1998) Grabowski et al (1990), Sharma et al (1991) that exports led to economic growth (ELG)

4. Conclusions

This paper examines causal relation between economic growth, exports and imports using advanced econometric tests. The paper tested the series for Stationarity and found all series are non-stationary at level but stationary at first difference. The Johansen cointegration results found cointegrating relation among the series. The significance of ECT and F-statistics indicates causal and long term relation among the variables. The VEC Granger Causality found causality between economic growth, exports and imports. Exports Granger causes economic growth and imports. This paper lends support to previous findings of Balassa (1988),

Moschos (1989), Islam (1998), Grabowski et al (1990), Sharma et al (1991) that exports led to economic growth (ELG).

The paper suggests some policy prescriptions. As economic growth of Algeria is linked to exports, the government of Algeria should lay greater emphasis on export mobilizing industries for its development. (i)The establishment and Improvement of schools, clinics, and facilities for recreations must be provided on site for the children of workers in export industries for addressing their anxiety and stress. (ii)Government must ensure a healthy and safe work environment in the work place for workforce and increased productivity. The limitation of this paper is that it is a study of a single country. So, the findings of this paper cannot be generalized for causality link nexus. Future research should include all MENA countries and more variables than this study to arrive at a generalized conclusion.

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