

A Co-integration Analysis of Export Led Growth Hypothesis in Algeria (1970-2016)

تحليل التكامل المشترك لفرضية التصدير يؤدي إلى النمو في الجزائر للفترة (2016-1970)

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الملخص

تهدف هذه الدراسة إلى اختبار فرضية النمو المبني على التصدير في الجزائر، باعتبارها دولة مصدرة للنفط ويعتمد اقتصادها بشكل كبير على تصدير النفط والغاز من أجل تمويل ميزانية الحكومة. أجرت هذه الدراسة تحليل التكامل المشترك باستخدام منهج الانحدار الذاتي للإبطاء الموزع (ARDL) بغرض اختبار فرضية النمو التي تقودها الصادرات في الجزائر وذلك باستخدام بيانات سنوية للفترة الممتدة من 1970 إلى 2016. تدعم النتائج المتوصل إليها صلاحية فرضية النمو المبني على التصدير في الجزائر على المدى الطويل والقصير. توصي هذه الدراسة بالتركيز أكثر على تنويع الاقتصاد ككل من أجل تعزيز النمو الاقتصادي من خلال أساس حقيقي وتنويع الصادرات وبالتالي العائدات.

الكلمات المفتاحية: الصادرات، النمو، الانحدار الذاتي للإبطاء الموزع، التكامل المشترك، الجزائر

Abstract :

This study aims to test the existence of Export Led Growth hypothesis in Algeria, which is an oil exporting country, and its economy relies heavily on exporting hydrocarbons in order to fund the government budget. This study conducted a co-integration analysis using the Autoregressive Distributed Lag (ARDL) approach in order to examine the Export Led Growth hypothesis in Algeria using annual data for the period 1970-2016. The results support the validity of ELG hypothesis in Algeria in long and short runs. This study recommends the government to focus more on the diversification of economy as a whole to enhance the economic growth with real foundation and therefore diversify exports and revenues

Key Words: Export, Growth, ARDL, Co-Integration, Algeria

JEL Classification : C10, F14.

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Introduction:

Foreign trade is considered as an important power that provides the nations with their needs and facilities selling their own products. Among its main objectives is the exchange of goods and services between countries and collecting foreign currencies or gold as the classic theory mentioned. Algeria, like other developing countries seeks to achieve a sustained and growing economic growth. Algeria is connected to the world economy through the exportation channel, which is a very important part in financing the public budget through the oil exporting taxation, in addition to the imports that have a great impact in providing the requirements of local market. However, it pays back the obtained foreign currencies (gold) from exporting oil to buy the needs of the Algerian society. Many developing countries try to adopt Import Substitution Strategy (ISS) to limit the exit of foreign currency and, most importantly promoting the exports. In this regard, this study will focus more on the exports. Accordingly, the following question is posed:

Is the Export Led Growth hypothesis valid in Algeria?

This study followed a quantitative approach to test the existence of export led growth (ELG) theory in Algeria during the period 1970-2016 by using the Autoregressive distributed lag approach for co- integration in order to test the long run relationship between the variables subject of study. This paper will begin with a literature review in the sense of Export led Growth hypothesis, and then it will pass to the imperial study in order to test the impact of the exports and imports as independent variables and the economic growth as a dependent variable. The paper will end by showing the long and short run relationships between exports, imports and economic growth.

1. Literature Review:

Many empirical studies have examined whether or not there exists a mutual relationship between exports and economic growth. Some empirical studies found a direct and positive relationship that comes from exports to stimulate the economic growth of a country. Other studies viewed the relationship between these variables from another aspect; particularly that economic growth induces export growth. However, still other studies found inconclusive results about this relationship. This difference in results is due to different economic conditions of different countries in addition to the studied period and the used variables.

Among the first studies in the relationship between economic growth and exports was a study done by Emery Robert in a statistical manner for 50 countries during the period 1953-1963. This study used a secondary data for the real income per capita as a proxy for economic growth. The study found a positive relationship between the exports growth rate and income per capita growth rate, which expressed a mutual influence between these variables (Emery, 1967). The study also pointed out that exports are a key factor in driving economic growth because of the following benefits.

✓ **Direct advantages**

- Increasing exports raises the country's ability in providing its local market with imports and intermediate goods and helps to focus investments in more efficient sectors. This led to create new competitive advantages.
- Exports help in breadth of markets, specialization as well as benefiting from economies of scale.

✓ **Indirect advantages**

- High exports stimulate domestic and foreign investment.
- Exports help in improving the quality of products and reducing its cost.

Michael M.'s study attempted to explore the relationship between the rate of change in the ratio of exports to GDP and changing rate in income per capita for 41 country in the period (1950-1973). This study criticized the variables that Emery Robert used. Where Michael M. sees the exports as a part of GDP, the study results confirmed that economic development is affected by the growth of exports in countries that achieved a minimum level of development. This study supported the existence of a strong correlation between the exports and income per capita in developed countries and there was no correlation found between the study variables in countries with low economic growth (Michael, 1977).

Balassa Bela conducted a research on 11 countries that have a new industrial base during the 1960s and 1970s. In order to test the following hypothesis, the export promotion policy leads to high rates of economic growth through studying the relationship between total and industrial exports on the one hand and GDP and industrial output on the other. The study found a positive relationship between the export growth rate and economic growth rate as a result of the reallocation of the resource in efficient manner (Balassa, 1978).

The study of Jung & Marshall used a sample consisting of 37 countries during the period 1950-1981 through applying Granger Causality test in order to test the causal relationship between the exports growth rate and GDP growth rate. This study criticized the previous studies that ignored the reverse relationship between the exports and economic growth because it can be another possibility where the economic growth led to growth in exports. The founded results support the existence of the reverse relationship between exports and growth in only 04 countries from the study sample (Marshall & Jung, S.W., 1985).

The study of Serletis was restricted on Canada during the period 1977-1985. This study investigated the causal relationship between exports and imports and GDP growth by applying a co-integration analysis and the Granger causality test (Serletis, 1992).

The study of Yih-Chyi, Chuang examined the relationship between exports and economic growth and human capital in Taiwan during the period 1952- 1995 by using the co-integration analysis and Granger Causality test. The results of this study showed that the increase of export growth rate contribute in increasing the economic growth rate in the long run through its impact on the accumulation of human capital (Chuang, 2000).

Hausmann and Klinger utilized yearly records from 1975 to 2005 in order to examine the Export-Led Growth Strategy of the state of Columbia. They used Granger causality test that maintains that the export-led growth strategy is valid in Colombia. They propose that public expenditure on infrastructure and training that has sector specific consequences, should improve foreign direct investments (Hausmann, 2008).

Saima et.al. employed annual statistics from 1971 to 2005 to examine the Export-Led Growth Strategy in Pakistan. The research employed the ARDL co-integration model. The findings pointed out that all of exports, imports and labor influence growth positively, although the trade terms influence it negatively. The research established that the export-led growth in Pakistan is reinforced in both the short and long run terms. However, the labor contribution level only influences the short-run negatively (Saima, Sameena, Sadiya, & Mohammad, 2008).

Nagwa A. Khashaba conducted a study in order to test the validity of ELG hypothesis in Egypt. The study results support the existence of export led growth theory for the country (Nagwa, 2010).

Abbas' research on the relationship between exports and economic growth established a co-integrating relationship in the period 1975-2010. The results proposed that export is caused by production in long run as well as short-run (Abbas, 2012). Mishra's research for India studied the co-integration and causality between exports and growth for the period ranging between 1970 and 2009. The results discovered the existence of a long-run connection between exports and economic growth. The findings also pointed out that the economic growth has caused exports but exports are unable to cause economic growth (Mishra, 2011).

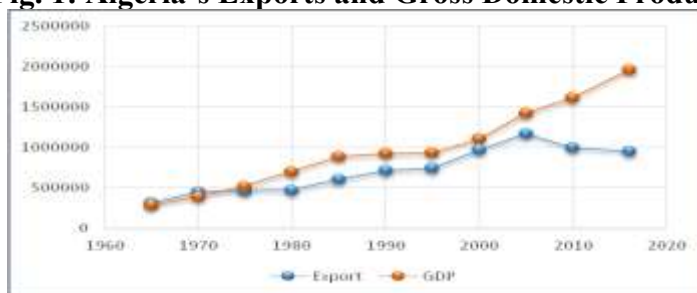
Agrawal examined the export-led growth by investigating the post liberalization period of India and discovered a bi-directional link between export and growth (Agrawal, 2015).

2. Data Description and Model Specification:

2.1. Data Description:

This study analyzes the Export Led Growth Hypothesis in Algeria by using an annual time series data over the period 1970-2016 for the total exports and imports of goods and services and the nominal Gross Domestic Product. The used data were sourced from the World Bank database.

Fig. 1: Algeria's Exports and Gross Domestic Product



Note: The vertical axis values are multiplied by 10000000 Current USD.

Source: Compiled by Authors based on the World Bank data for the period (1965-2016).

The figure above shows the Exports and GDP for Algeria, and as it is clear that the value of exports are declined because of the decline and the fluctuation of oil prices in the recent years.

Table 1: Statistical Proprieties of Data

Variable	Mean	Std. Dev.	Maximum value	Minimum Value
Ln GDP	27.29514	0.324240	27.78743	26.4189
Ln X	25.27963	0.438534	26.00156	24.27080
Ln M	23.38322	0.935755	24.94662	21.06298

Source: Computed by Authors using the Eviews 8 software.

2.2. Model Specification:

Since the main objective of this empirical study is testing the validity of Export Led Growth hypothesis in the case of Algeria, a quite standard model in literature is considered. The model can be written after the transformation to the natural logarithms as follows:

$$LnGDP_t = \alpha_0 + \alpha_1 Ln X + \alpha_2 Ln M + \varepsilon_t \dots\dots\dots(1)$$

Where GDP_t represents the Algerian nominal Gross Domestic Product, X and M indicate the nominal exports and imports respectively, α_i denotes the estimated parameters and ε_t indicates the error term.

3. Methodology:

In order to test the long-term relationship between exports, imports and economic growth, a new methodology was adopted, namely the Auto Regressive Distributed Lag (ARDL) bound test approach developed by Pesaran, MH (Pesaran, 2001). This co-integration Approach is different from other tests of co-integration in that it does not require the used time series subject of the study to be stationary in first difference as Johansen and Julius approach. The only condition for the application of this test is that the time series must not be integrated at second-difference or more $I(2)$. Therefore, the ARDL co-integration approach accepts the series that are stationary at levels $I(0)$ or at first difference or a mixture of the two, in contrast to the Johansen method, which requires that the series must be stationary at the first difference to be valid for co-integration analysis. In this way, the unit root test will be conducted for all the time series subject of study to determine the level of integration and whether the co-integration analysis can be carry out or not.

The ARDL Model takes a sufficient number of time lag to obtain the best set of data for the general model. The ARDL model gives the best results for long-term parameters and the diagnostic tests, which are highly reliable. The ARDL model also helps in separating the long and short-term effects. The SBC criteria is used in choosing the best lag length of the study. The ARDL framework for testing the ELG hypothesis in Algeria is formulated as follows:

$$\begin{aligned} \text{LnGDP}_t = & \delta_0 + \sum_{k=1}^n \delta_{1k} \Delta \text{LnGDP}_{t-k} + \sum_{k=1}^n \delta_{2k} \Delta \text{LnX}_{t-k} + \sum_{k=1}^n \delta_{3k} \Delta \text{LnM}_{t-k} \\ & + \pi_1 \text{LnGDP}_{t-1} + \pi_2 \text{LnX}_{t-1} + \pi_3 \text{LnM}_{t-1} + \varepsilon t \dots (2) \end{aligned}$$

Where δ_0 indicates the drift component and the first difference operator is represented by Δ . Here the π_i indicates the long-run parameters while the terms with summation signs are used to model the short-term dynamic structure. The Suitable lag length is chosen based on the Schwartz-Bayesian criteria (SBC). The co-integration test procedure is based on the F-test.

For this reason, the F statistic will be calculated through the Wald test, where the null hypothesis that says that there is no co-integration between the model variable (the absence of long-term equilibrium relationship) is tested:

$$H_0 : \pi_1 = \pi_2 = \pi_3 = 0 \dots (3)$$

Versus the alternative hypothesis that says that there is a long-run co-integration relationship between the variables subject of the study:

$$H_1 : \pi_1 \neq \pi_2 \neq \pi_3 \neq 0 \dots (4)$$

The computed F-statistic is then compared with two sets of critical values provided by Pesaran, et al. (2001). If the calculated F-statistic is greater than upper critical bound value (UCB), then the null hypothesis of no co-integration will be rejected. If it is less than the lower bound, then the null hypothesis of no co-integration is accepted. In other words, there is no long run relationship among the studied variables. However, if it falls into the bounds, the test is inconclusive.

After testing the existence of a co-integration, the second step comprises the estimation of the following ARDL long-run conditional model:

$$\text{LnGDP}_t = \delta_0 + \sum_{k=1}^n \delta_{1k} \text{LnGDP}_{t-k} + \sum_{k=1}^n \delta_{2k} \text{LnX}_{t-k} + \sum_{k=1}^n \delta_{3k} \text{LnM}_{t-k} + \varepsilon t \dots (5)$$

The estimation of the short-run parameters is obtained through estimating the following Error Correction Model (ECM):

$$\text{LnGDP}_t = \delta_0 + \sum_{k=1}^n \delta_{1k} \Delta \text{LnGDP}_{t-k} + \sum_{k=1}^n \delta_{2k} \Delta \text{LnX}_{t-k} + \sum_{k=1}^n \delta_{3k} \Delta \text{LnM}_{t-k} + \theta \text{ECT}_{t-1} + \varepsilon t \dots (6)$$

The ECT_{t-1} indicates the Error Correction Term which must be between 0 and 1, negative and statistically significant showing the speed to move back towards equilibrium.

In order to test the stability of the estimates, the cumulative Sum of Squares of residual (CUSUMSQ) is done. If the plots of CUSUMSQ statistics stay within the critical bounds of 5% significance level, the null hypothesis that states that all the coefficients in the given regression are stable is accepted.

4. The Empirical Results:

4.1. Unit Root Test Results:

In this context, the main objective of this test is confirming that the used time series are not stationary in the second difference I (2) or more.

Table 2: The Stationarity Results of Augmented Dickey Fuller Unit Root Test

Variables	Decin	Level Intercept	Intercept & trend	First Difference Intercept	Intercept & trend
Ln GDP	I(1)	-1.204624	0.5839	-10.23***	-10.89295***
Ln X	I(0)	-3.590***	-4.677082***	-9.390***	-10.26842***
Ln M	I(1)	-2.471943	-3.672678	-4.113***	-4.311736***

Note: (*), (**) and (***) denote 10%, 5% and 1% levels of significance respectively.

Source: Computed by Authors using the Eviews 8 software.

According to the table above, it is clear that 02 series Ln GDP and Ln M are stationary in first difference and Ln X is stationary at level. Therefore, the study variables are stationary in different levels of I (0) and I (1). These results confirm the possibility of applying the ARDL approach for co-integration.

Table 3: The ARDL Co-integration Test Results

Lag length= 1	8.1472***	0.000
Critical values	Lower Critical Bond (LCB)	Upper Critical Bond (UCB)
1% significance level	5.15	6.36
5% significance level	3.79	4.85
10% significae level	3.17	4.14

Note: *** denotes 10%, 5% and 1% levels of significance. The LCB and UCB are sourced from table CI (iii) III: Unrestricted intercept and no trend, M. H. Pesaran, Y. Shin and R. J. Smith, (2001), p. 300.

Source: Calculated by the Authors by using the Microfit 4.1 Software.

The table number 03 shows the result of the co-integration test. The calculated F-statistic is greater than the reference upper critical bonds. The results support the rejection of the null hypothesis at 1% significance level. This confirms the existence of a long run relationship between the exports, imports and GDP.

After getting a co-integration relationship between the variables subject of the study, the next step contains estimation of long and short run parameters. The appropriate lag length was chosen based on Schwarz Bayesian Criterion (SBC).

Table 4: The Long-run Parameters Estimation Results

Variables	Coefficients	T-Ratio	P-Value
C	3.9108**	2.0893	0.043
LnX	0.53857***	6.3982	0.000
LnM	0.28983***	10.3646	0.000
$R^2=0.99729$ F-statistic = 3865*** Durbin's h-statistic= 2.1475(0.032)** Sensitivity analysis: Heteroscedisticity test = 2.8247 (0.100)*** Serial correlation = 3.2342 (0.079)*			

Note: the optimum selected lag length by the ARDL is (1, 1, 0) on the basis of SBC. *, ** and *** which represent 10%, 5% and 1% levels of significance respectively.

Source: Calculated by the Authors using the Microfit 4.1 software, the dependent variable is LnGDP.

The estimated long-run coefficients for exports and imports were statistically significant at 1% significance level. The estimated coefficient of LnX denotes that the increase in exports by 1 unit will raise the LnGDP with 53.85 unit. The estimated parameter of LnM indicates that the increase in imports by 1 unit will raise the Ln GDP with 28.98 units. According to the long-run estimated model, it is clear that the contribution of exports in raising the economic growth is high in comparison with the imports. However, the imports as well have a positive impact on the economic growth through providing the Algerian local market with its needs (intermediate goods, capital, food...etc.) which effect the economic growth in Algeria in an indirect manner.

Diagnostic tests reported at the bottom of Table 4 indicate that the model is fairly well specified where the model passed the Heteroscedasticity test and the serial correlation test successfully.

Table 5: The Results of Error Correction Model ECM

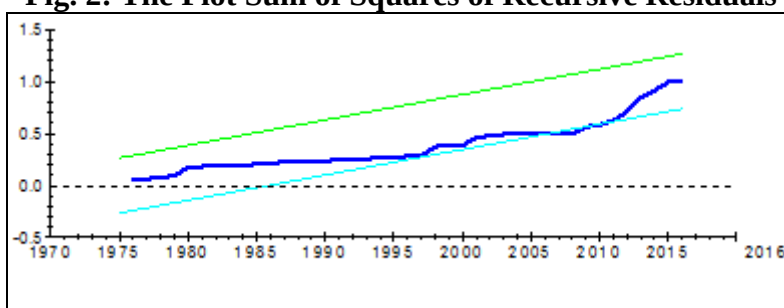
Variables	Coefficients	T-Ratio	P-Value
ΔLnX	0.47728***	10.5586	0.000
ΔLnM	0.60059***	4.2641	0.000
ΔC	0.81943**	2.2340	0.031
ECT_{t-1}	-0.20723***	-4.4213	0.000
$R^2=0.75286$ Adjusted $R^2= 0.72933$ Log-likelihood= 29.4339 $F(3, 43)=42.6486^{***}(0.000)$ $\text{ECT}_{t-1} = \text{LnGDP}_{t-1} - 0.53857* \text{LnX}_t - 0.28983*\text{LnM}_{t-1} - 3.9108*C$			

Note: ARDL (1, 1, 0) selected on the basis of SBC. *, ** and *** which represent 10%, 5% and 1% significance levels, respectively. The dependent variable is LnGDP .

Source: Calculated by the Authors using Microfit 4.1 software.

The short- run estimated coefficients presented in table 5 are statistically significant for export and import parameters at 1% significance level. The error correction term (ECT) is correctly signed and statistically significant at 1% significance level, which confirms the existence of the error correction mechanism. This result confirms the evidence of co-integration among variables in the model, precisely, the estimated value of ECT_{t-1} is -0.20723. The absolute value of the coefficient of ECT_{t-1} is small, which indicates a low speed of adjustment to equilibrium; only about 20.72% of the disequilibrium, caused by previous period shocks, returns back to the long-term equilibrium.

In order to test the stability of the estimated model, the CUSUMSQ is carried out in this study.

Fig. 2: The Plot Sum of Squares of Recursive Residuals

Note: The straight lines represent critical bounds at 5% significance level.

Source: Compiled by the Authors using Microfit 4.1 software.

Conclusion:

This study tested the validity of Exports Led Growth theory in Algeria by using time series data that covered the period 1970-2016. This study employed a recently developed approach of co-integration that called the Autoregressive distributed Lag (ARDL) bonds testing approach.

The study results indicated a strong co-integrated long run relationship among the variable subject of the research: GDP as a dependent variable, exports and imports as explanatory variables in this study. This supports the existence of a long run relationship among the variables subject of analysis. The long run estimated parameters for exports showed a positive impact on the changes that occur for the GDP in the long run, where the changes in the exports by one unit cause the raise of GDP with 53.85 units. These findings support the validity of ELG hypothesis for Algeria in the studied period. These results are more confirmed by looking to the exports structure in Algeria and the extent to which the public budget relies on the oil revenues.

These results must be read in a way where it is necessary for Algeria to diversify its exports in order to avoid oil price fluctuation impact on the economic growth. As for the imports, they also have a positive impact on the economic growth. That is because of the extensive dependence on the imported goods in providing the needs of the Algerian local market. Even though the imports can provide the local market with its needs, it affects the country's reserve of foreign currency in the consumption products.

In this context, this study advise the government to follow a strong Substitution Strategy of Imports (SSI) for different products in order to ameliorate the local production quality that can be exported later on in order to win gold instead of losing it.

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