



## **Determinants of the Algerian Economy: Autoregressive Distributed Lag Approach**

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### **ABSTRACT**

The study examines the determinants of the Algerian economy for the period 1970-2016. We employ autoregressive distributed lag cointegration approach proposed by Pesaran et al. (2001). Findings confirm that consumer price index, total imports and broad money are significant in explaining economic growth in Algeria both in short-run and long-run. These findings suggest economic diversification is required to maintain a steady economic growth in the country.

**Keywords:** Autoregressive Distributed Lag, Algerian Economy, Consumer Price Index, Imports

**JEL Classifications:** E31, F14

### **1. INTRODUCTION**

In 1962 Algeria opted for a development strategy based on industrialization of the country. Indeed, industrialization had always been at first concern for Algerian authorities. During the 1960s and 1970s oil revenues began to rise dramatically and thus the government shifted its economic sights to the oil industry. As a result, extensive industrialization took place and the economy flourished.

Until 1967, the structure of the Algerian economy, especially for the banking and monetary system, corresponded to the norms of a market economy. The choice of centrally planned decision economy as a system for organizing the development of the national economy was made in the first 4-year plan, 1970-1973. This Soviet-type planning was formulated in physical terms. This economic organisation led to spur investments that clearly explain the well performance of the Algerian economy after independence. Unluckily, oil prices dropped in the 1980s, negatively impacting on Algeria's economy which had become almost completely dependent on oil.

In the 1990s and the beginning of the 2000s, the political and social context – what Algerians discreetly call the events (“les

événements”) - and the low oil price frustrated the degree of freedom of the governors. Indeed, Algeria suffered from a series of political issues from 1988 to 1998, which was described and called as a civil war. These events followed years of economic deterioration which the country experienced in the 80's after the oil price declined which in turn led to downturn of Algeria's deficits and public debt. The sub- period was characterised by high level of inflation and unemployment rate as well as low level of growth. Inflation was caused, with a lag of up to 12 months, by an increasing budget deficit linked to an excessive increase of the money supply. Algerian political holders were then unable to continue sustaining the manufacturing public sector. As a result and similarly in many other transition economies, by the 1980s, Algerian public enterprises were suffering from big losses that caused a rise in industrial unemployment.

During this period, Algeria suffered from two IMF stabilization programs: A macroeconomic stabilization program from April 1994 to March 1995 and a structural adjustment program from April 1995 to March 1998. These programs were designed for Algerian economy's reform which the country was experiencing a recession with high unemployment rate, a large deficit on the balance of trade and high inflation. Certainly, at the end of

1993, the Algerian economy was experiencing bad situation, i.e. recession, unemployment reached close to 30%, a budget deficit equal to 8.7% of gross domestic product (GDP), a rapid growth of the money supply (+21%), a deficit on the balance of trade exacerbated by a fall in the exchange reserves until they could cover only 6 weeks of imports, and a debt burden of 82% of GDP.

The factors that burden the country were overcome in the 2000s: The “events” came to an end, the dinar became more stable against the dollar, and due to oil price increased so that led to a positive balance of payment and a banking system with excess liquidity. Fortunately, Algeria experienced stable and moderate inflation until the last 2 years. An action took place to reduce the public debt and to protect public expenditures from fluctuations in the budget surplus due to unpredictable variations in the oil price. Thus, a revenue regulation fund (FRR) had been created following to the rise in the oil price.

The Algerian policy makers committed to a new economic strategy whose their main concern was to liberalize the economy. The new reform strategy implemented in 1994 was fitted toward the creation of an open, market-oriented economy, move towards private sector-led economy instead of public sector. At the end of the nineties “90’s,” this new strategy benefited from a favorable context because of two main changes. On the political side, and despite the continuing troubles, Algeria benefited from a more peaceful climate than in the nineties. On the economical side, oil prices played vital role via its continuous rising from US \$13 per barrel in June 1998 until US \$60 in August 2005. The increase of oil prices helped to achieve the objectives of the adjustment program, by strengthening the fiscal and external accounts. These changes that Algeria experienced from 1998 to 2005 gave more flexibility and liberty to the authorities to conduct reforms. Particularly, during this period, Algeria launched an Economic Recovery Program for the period 2001-2004. The main goal of this program was to stimulate aggregate demand and to absorb high unemployment through public investment in infrastructure, support to agricultural production and to small and medium enterprises.

This paper attempts to explore determinants of the Algerian economy. In order to do so, an empirical estimation is made using newly developed approach known as autoregressive distributed lag (ARDL) provided by Pesaran et al. (2001). The Algerian economy heavily depends on the oil and gas sector for her revenue. However, the financial sector has been bedeviled by incessant instability. Financial instability characterizes the economy since the 1980’s due to, perhaps, the various financial policies applied. The domestic financial institutions in the country usually receive subsidies from the government to achieve higher competitiveness against foreign institutions. More so, from 1980 to 1988, broad money decreased dramatically until the year 1996. Broad money recovered its steady growth from 1996 to the year 2010. Exports of oil and gas – which comprise between 94% and 98% of total exports in Algeria, have increased dramatically, except the period of 1985 to 1994. This is because these products are surely needed in developed countries, and also, being exported in raw form (World Development Indicators, 2010). On the other hand, imports continue to rise except the period 1990-1997 and this might be due to the fragility features

of industrial organizations to achieve self-sufficiency because of poor technology and unskilled manpower. Again, as a result of big portion of hydrocarbons sector in GDP, exports maintained greater than imports. Hence, balance of payments of goods and services sustained positive regardless volume of goods and services being imported (World Development Indicators, 2010).

The paper is structured as follows. Section 2 outlines the literature review. Section 3 describes the used data and methodology, and section 4 reports empirical results. Finally, section 5 summarizes and concludes the paper.

## 2. LITERATURE REVIEW

From an empirical front, a rising number of literatures outline the way financial intermediates may enhance economic growth. Financial institutions play an important role in funds mobilizations, resources allocations, risks diversifications, and, thus, donate to economic growth (Greenwood & Jovanovic, 1990; Jbili, Enders, & Treichel, 1997, Calderon & Liu, 2003). Modern economic growth theory states that financial markets and intermediates seem endogenously in response to market imperfection and, thus, donate to durable economic growth. Furthermore, financial intermediates play a crucial role in transaction cost reduction, investing decisions through assessing potential business and invest in most promising one.

The relationship between trade openness and economic growth is a greatly discussed issue in economic development and growth studies. Nevertheless, this topic is far from being determined. Utmost of growth literatures admit obscure causality between openness and economic growth. Adequate studies have implemented to stress the effect of openness on economic growth, in which openness may cause increase or decrease in world growth (Romer, 1990; Grossman and Helpman, 1990; Rivera-Batiz and Romer, 1991a; b; Matsuyama, 1992, Wacziarg & Welch, 2003). Whereas, (Harrison, 1996) confirms that openness may be equal to neutrality concepts, which denotes the provocation to save foreign currency through substitution and benefit an extra unit through exports.

Abdus (2011) examined the exports and economic growth causality in Algeria and Benamraoui, A. (2003) explores the effects of globalization of financial services on banking industry and stock market in Algeria. Some other studies emphasized the relationship between financial development and economic growth in Middle East and North Africa (MENA) countries (Kar et al., 2011). Also, Selçuk and Erdal (2005) examined the causal relationship between openness and economic growth in MENA countries.

## 3. DATA AND METHODOLOGY

The study used annual series from 1970 to 2016. The employed variables are as follows: GDP measured in local currency. BM is broad money outside banks, including demand deposits other than those of the central government. Consumer price index (CPI) represent CPI reflects changes in the cost to the average consumer of acquiring a basket of goods and service. Imports of goods and services represent the value of all goods and other market services

**Table 1: Unit root test -ADF**

	Level		1 <sup>st</sup> difference	
	Constant	Constant and trend	Constant	Constant and trend
LGDPLC	-2.935001 (-1.695264)	-3.523623 (-1.217492)	-2.936942*** (-6.353675)	-3.526609*** (-6.745328)
LBM	-2.375946 (-2.926622)	-0.925799 (-3.510740)	5.255518*** (-2.928142)	-6.025510*** (-3.513075)
LCPI	-1.510773 (-2.928142)	-2.081153 (-3.513075)	-2.169812*** (-2.928142)	-2.375543*** (-3.513075)
LIMPORT	-1.335680*** (-2.926622)	-3.267803* (-3.518090)	-5.230046 (-2.929734)	-5.488872 (-3.515523)

\*\*\*denote significance at 10% and 1% levels respectively. Values in parentheses represent t-value. ADF: Augmented Dickey-Fuller

**Table 2: Long-run relationship**

Model: (LGDPLC, LBM, LCPI, LIMPORTLC)(2,0,0,0)	LBM	LCPI	LIMPORTLC	INTERCEPT
	0.37128	0.56645	0.26861	3.7663
	(0.058278) <sup>a</sup>	(0.044092) <sup>a</sup>	(0.060346) <sup>a</sup>	(0.29325) <sup>a</sup>

Figures in parentheses ( ) indicate the standard errors. While, superscript denotes statistical significance at 1% level

**Table 3: Error correction representation for the selected ARDL model**

Model: DLGDPLC, DLBM, DLCPI, DLIMPORTLC	DLGDPLC	DLBM	DLCPI	DLIMPORTLC	DLGDPLC
	3.4013	+0.27224	dlgdplc <sub>t-1</sub>	+0.33530	dlbm <sub>t-1</sub>
	(0.55767)	(0.12156) <sup>a</sup>	(0.095276) <sup>b</sup>	(0.090849) <sup>b</sup>	(0.054457) <sup>b</sup>
				+0.51156	dlcpi <sub>t-1</sub>
				+0.24259	dlimportlc <sub>t-1</sub>
				-0.90310	ecm <sub>t-1</sub>
				(0.15371) <sup>b</sup>	

Standard errors in parentheses, D means the first difference, and the superscript "a, b" denotes statistical significance at 5% and 1% levels respectively. ARDL: Autoregressive distributed lag

received from the rest of the world. Data were retrieved from World Bank Indicators.

Following previous empirical studies, the model is presented as:

$$Ln(RGDPC) = \beta_0 + \beta_1 Ln(bm) + \beta_2 Ln(cpi) + \beta_3 Ln(importlc) + \varepsilon (1)$$

Where Ln is the natural logarithm form for each variable.

Thus, the above model attempts to determine GDP determinants in Algeria.

#### 4. EMPIRICAL RESULTS

The empirical results commence by testing the order of integration of the variables. The Augmented Dickey Fuller approach was employed.

Table 1 obviously reveals that the variables are a combination of I(0) and I(1) variables. Thus, the ARDL approach popularized by (Pesaran et al., 2001) is most suitable for this study.

The Table 2 displays the results of long run coefficient for the selected model. All variables play an important role in determining economic growth level in Algeria. Broad money, CPI, and total imports determine economic growth level in Algeria. Broad money appears to be significant at 1%; an increase by 1% in broad money which reflects to the sum of currency outside banks including demand deposits, lead to 0.3% increase in economic growth. Also 1% increase in the inflation rate cause 0.5% increase in the economic growth of Algeria, while total import rises GDP by 3.7% as a result of 1% increase in total imports.

We proceed to compute short run model along with error correction Reorientations ECT. Error correction term,  $ecm_{t-1}$  measures the speed of adjustment, when explained variable adjust to change in the independent variables before converging to the equilibrium level. The experimental findings are based on the

re-parameterization of the estimated ARDL (1, 0, 0, 0, 0, 0, 0) model. From the results error-correction model must be significant and attached with a negative sign. The negative  $ecm_{t-1}$  means that the variables have converged in the long run. In this model the probability of  $ecm_{t-1}$  is 0.001 (Table 3).

Since  $ect_{t-1}$  is negative and statistically significance, we can conclude that the short run cointegration relationship exists for this model. The coefficient is 0.90310 which suggests that convergence to equilibrium level of GDP in 1 year is corrected by about 9.031% in the following year.

A battery of diagnostic tests was also applied to the empirical model to gauge the adequacy of the specification of the model (Table 4). The diagnostic test explores the heteroscedasticity, normality, functional form and serial correlation associated with the model. The diagnostic tests presented in Table 4, confirm that there is no evidence of m problem with the model. Furthermore, DW-statistic is  $>R^2$  we conclude that there is no autocorrelation.

The stability test for the model applies the cumulative sum of the squares of recursive residuals (CUSUM-squared) and the cumulative sum of recursive residuals (CUSUM) proposed by Brown et al. (1975), which are presented in Figures 1 and 2. These results again confirm the robustness of our results achieved in the diagnostic tests. Obviously, the CUSUM and CUSUM-squared statistics stay within the critical bounds indicating significant relationship between agriculture area and the other variables.

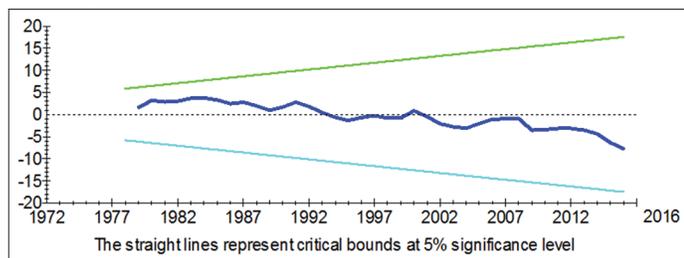
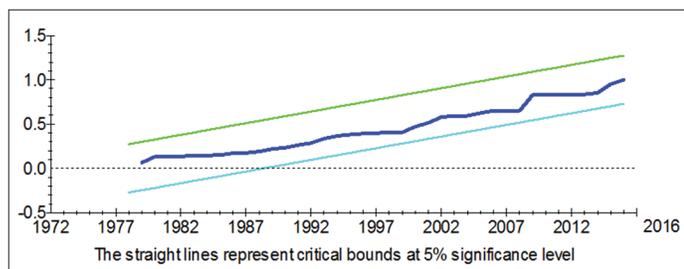
Finally, we found the parameters remained stable over the entire study period using CUSUM and CUSUM square tests, because both of the recursive lines fall within the bound.

#### 5. CONCLUSION

This study investigated the economic development determinants in Algeria. Estimated results, using ARDL model to cointegration

**Table 4: Diagnostic tests**

Test statistics	LM version	P-value	F version	P-value
Serial correlation	0.030804	[0.418]	F (1, 30)=0.51261	[0.480]
Functional form	2.1647	[0.626]	F (1, 30)=0.18421	[0.671]
Normality	0.40690	[0.000]		
Heteroscedasticity	0.29085	[0.240]	F (1, 37)=1.3584	[0.251]
R <sup>2</sup>	0.99890	DW-statistic	1.9855	

**Figure 1:** Plot of cumulative sum of the recursive residuals**Figure 2:** Plot of cumulative sum of squares of recursive residuals-squared

approach, reveal that broad money, CPI, and total imports play an important role in economic growth level. These indicators positively but not equally contribute to economic growth level. Long run results show that change by 1% in broad money increases GDP by 3.71%. While 1% increase in CPI leads to increase in GDP by 5.66%. Furthermore, 1% increase in total imports lead to 2.68% in GDP in Algeria.

Furthermore, by applying a bulky number of diagnostic test and the CUSUM and CUSUMSQ tests to the model, we found the parameters remained stable over the entire study period and the diagnostic tests confirm that there is no evidence of diagnostic problem with the model. Moreover, R square level of 99.89% endorse the fit of our model.

From the policy perspective, there is a dire need to diversify the economy in order to attain higher GDP level. Financial sector policies should be further strengthened to address growing financial stability risks. Monetary policy must adjust to a changing

liquidity environment while guarding against potential inflationary pressures.

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