Private investment and economic growth in Algeria: The ARDL bounds testing approach (1970-2017)

الاستثمار الخاص والنمو الإقتصادي في الجزائر: دراسة قياسية باستخدام نموذج الانحدار الذاتي للفجوات الزمنية الموزعة المتباطئة (ARDL) خلال الفترة 1970–2017

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Abstract:

This paper presents a study on the impact of public and private investment on economic growth in Algeria in light of reforms and economic trends towards a market economy. Using annual data from 1970 to 2017, the study applies the recently developed Autoregressive Distributed Lag (ARDL)- bounds testing approach .

The study concluded that we have important results so that private investment has a positive impact on economic growth in the short and long terms in line with efforts made to develop the private sector, while public sector investment has a insignificant impact on economic growth, the results also showed that the employment component Export and import also have a positive effect in the long and short run.

Keywords: private investment, economic growth, ARDL test, co-integration, Algeria.

JELClassificationCodes: E13,H54,O41.

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ملخص:

تقدم هذه الورقة دراسة عن تأثير الاستثمار العام والخاص على النمو الاقتصادي في الجزائر في ظل الاصلاحات و التوجهات الاقتصادية نحو اقتصاد السوق. باستخدام البيانات السنوية من عام 1970 إلى عام 2017 ، وباستخدام نموذج الانحدار الذاتي للفجوات الزمنية المتباطئة (ARDL) .

خلصت الدراسة إلى نتائج مهمة بحيث أن الاستثمار الخاص له تأثير إيجابي على النمو الاقتصادي على المدى الطويل والقصير ما يتطابق مع الجهود المبذولة لتنمية القطاع الخاص ، في حين أن تأثير استثمار القطاع العام على النمو الاقتصادي غير معنوي ، النتائج أيضا أظهرت أن عنصر العمالة،التصدير،الاسترداد أيضا لها تأثير ايجابي على المدى الطويل و القصير.

كلمات مفتاحية: الاستثمار الخاص، النمو الإقتصادي، نموذج الانحدار الذاتي للفجوات الزمنية المتباطئة (ARDL) التكامل المشترك،الجزائر.

تصنيفات JEL: E13، H54، O41.

1. INTRODUCTION

Understanding economic growth trends is important for all economies to identify short and long-term strategies according to the characteristics of each country. Since the late 1960's economic growth has been economically explained by several models, starting with the exogenous growth model developed by (Solow, 1956)and the endogenous growth model, pioneered by (Romer, 1986) (Lucas Jr, 1988), (Barro, 1990)and (Rebelo, 1991).

While economists and policymakers generally agree that investment is important for economic growth, identifying the type of domestic investment (public investment or private investment) is the most important element in strategy development, especially long-term.

On the theoretical level, many theories have shown the preference of the private sector investment for its public sector in terms of property rights, transaction costs, efficiency, agency and other theories (Yaya & Sanni, 2005, pp. 3-12). In addition Economic policies are the focus of decision-makers due to their impact on economic growth, Also With back to public investment, increases in the budget deficit have a negative impact on

economic growth, in addition to the negative impact of the expansion of the budget deficit on the volume of private investment.

On the other hand, several studies have proved that public investment stimulates total factor productivity like (Le & Suruga, 2005, p. 48) , (Kumo, 2012, p. 23), (Hatano, 2010, p. 118) and (Haque, 2013, p. 122).

So, The dynamic relationship between public and private investment and their relatives Contribution to economic growth has been given great importance in many studies, both in developed and developing countries, to show the effective weight of each investment and determine the general policies of economic growth.

This study Examine the differential impacts of public private investment on economic growth, Focusing on the ideological shift towards the private sector in Algeria. using time series data from 1970 to 2017, using The ARDL bounds testing approach to captures the long-run as well as the important short-run dynamics private investment and economic growth .

The rest of the paper was organized in three sections:

Section 2 discusses the dynamics of public and private investment in Algeria from 1970 to 2017

Section 3 reviews the theoretical and empirical literature on public and private investment and economic growth.

Section 4 presents the methodology and empirical analysis

Section 5 conclusion

2. The dynamics of private investment in Algeria from 1970 to 2017:

2.1 The decoupling of the state from the economic sphere has revealed the importance and urgency of resuming growth through private investment through the embodiment of state structural adjustment programs. The real milestones in the liberalization of investment were manifested in Laws 88-25 of 12 July and 90-10 of 14 April 1990 relating to the direction of national private economic investments, currency and credit (SADOUDI, 2006, pp. 71-73).

- Economic policy through Law 88-25 sought to:

- Cancellation of investment ceiling.
- Cancellation of the investor's prior approval to start the project.
- Encourage investment by allocating a foreign currency financial envelope to cover their import needs.

❖ Law 90-10 aims to reconsider the call for foreign capital to improve the economic policy of the country with the aim of reviving growth and obtaining positive effects through Create jobs and support exclusive technology.

❖ The Investment Law and the Liberalization of Investment Policy of 1993 relating to the establishment, support and follow-up of the Investment Promotion Agency to assist investors in fulfilling the formalities necessary to complete their investments. The Agency has a 60-day deadline to answer whether or not to grant concessions to investors.

❖ Ordinance No. 01-03 on Investment Development for 2001, where the time limit for answering the support decision was reduced to 30 days and other concessions were added.

❖ Law No. 01-18 issued on December 12, 2001 on small and medium enterprises and the establishment of support structures to finance small and medium enterprises are represented in the role of guidance, financing and follow-up. It also provides special facilities and exemptions in our tax aspect ANDI, ANGEM and CNAC, as well as the establishment of two entities responsible for credit guarantee granted to SMGs represented by FGAR and CGCPME.

❖ Order No. 06-08, amending and supplementing the order 01-03 of 2006 on the establishment of a national investment council under the authority of the Prime Minister, in charge of matters relating to investment strategy and investment support policy, and other concessions have been added.

❖ Also, the famous rule 49/51 of 2009, which means that the Algerian partner must own public or private, on 51% of the

investment assets to be established in Algeria by foreigners. The necessity of the commitment of foreign companies that want to invest in Algeria to establish a partnership with local investors give a lot of questions, especially with experts, considering that foreign direct investment is one of the most important determinants of private investment in applied studies.

- In 2016 the authorities issued a new investment law to strengthen the role of the private sector.

2.2 Business climate in Algeria:

Estimating the impact of macroeconomic policies on the success of private investment recovery policies can be seen through the evolution of the business environment in Algeria by measuring the effects of the quality of laws and

Regulations governing the business and institutions responsible for their implementation, as the World Bank strives to provide a business environment index annually examines the precise aspects of the start of economic activity such as the procedures for the establishment of the company, labor legislation, the implementation of contracts, the credit market, bankruptcy procedures, etc.).

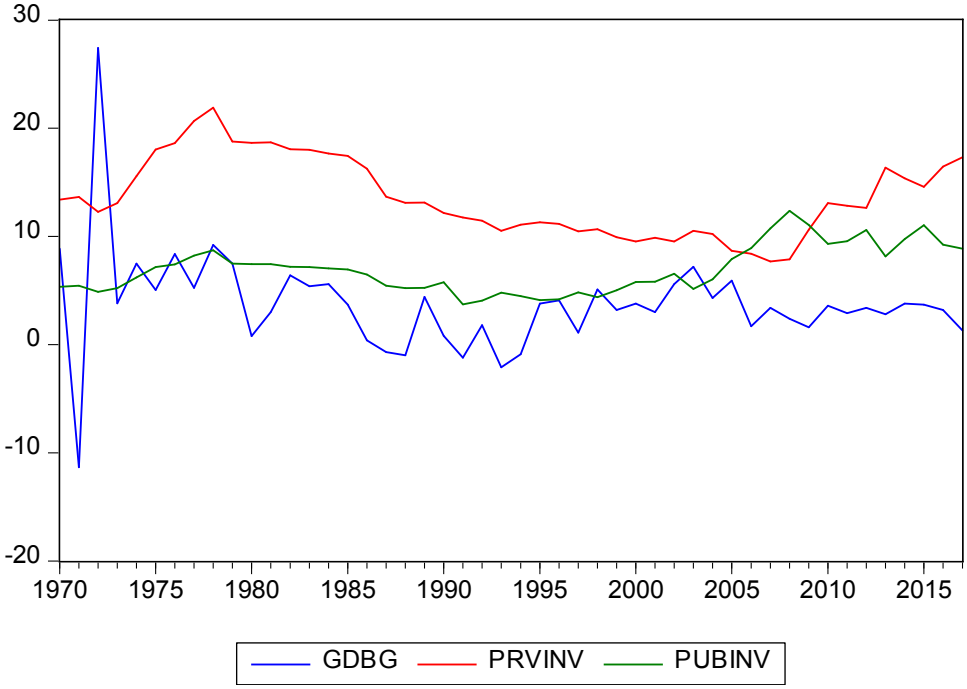
However, it is interesting to note that the business climate in Algeria is not competitive and considering that the private investor is rational in making decisions, the development of private activity becomes inhibited.

2.3 Trends in public and private investment and economic growth in Algeria:

Figure 1 shows that the rate of private investment in the economy (PRIINV) is high compared to public investment (PUBINV) between 1970 and 2017.This is due to the public investment in infrastructure initiated by Algeria, except for the period 2006-2009, which witnessed fluctuating

economic developments in the whole world. Meanwhile, volatile economic growth rates do not exceed 5% on average, according to World Bank data. Thus, we will try to show the effects of public and private investment on economic growth in the short and long term.

Figure .1. Trends in public and private investment and economic growth in Algeria



Source : The International Monetary Fund Data

3 Public and Private Investment and Economic Growth: An Empirical Review:

This section reviews empirical evidence on the impact of public and private investment on economic growth conducted both in developed and developing countries.

The relationship between public and private investment and economic growth at the applied level is very broad. For public investments, the study of (Eberts, 1986), (Aschauer, 1989 a) (Aschauer, 1989b) and (Munnell, 1990)showed that spending on economic infrastructure found

statistically a significant positive correlation between public investment and economic growth.

(Le & Suruga, 2005, pp. 46-48)explore the impact of public investment and FDI on economic growth, using panel data of 105 of developed and developing countries over the period 1970-2009. The study was also expanded to clarify the impact of public investment on foreign direct investment, the results showed the positive impact of both of them on economic growth, in addition to discourage foreign investment IF exceed public investment by 9%.

Unlike the previous study (Devarajan, Swaroop, & Zou, 1996, pp. 334-338)) demonstrated the relationship of public spending and economic growth. Using a sample of 43 developed and formerly developing countries during the period 1970-1990. It has a negative impact on economic growth because it is unproductive if there is an excessive amount of it. This is due to the influence of policymakers in allocating resources.

In additions, There have been a number of studies examining the relationship between the public and private sectors Investment . Studies that have discussed this difference have not yet reached a final conclusion. Some of them on the one hand promote the idea of a complementary effect of public investment for the private.like (Aschauer, 1989b) (Aschauer, 1989 a) , (Blejer & Khan, 1984) , (Dreger & Reimers, 2016).

(Aschauer, 1989b, p. 180)argues that public investment in the United States especially in 'core' infrastructure projects like in transport, communication etc.. has a significant positive impact on private investment . also in the productivity of private sector in the long-run in (Aschauer, 1989 a, pp. 99-100), the result shaw There is a positive statistically significant relationship between public capital and productivity. Evaluation of productivity equations for the movements of public capital within the study period reached a range of 0.38 to 0.56.

While other studies have proven the impact of crowding out of the public private sector as an example we find:

(Mitra P. , 2006, p. 340)estimates a structural VAR model (using data over 1969–2005) argues that public investment "crowds out" private investment

in india .Also (Bahal, Raissi, & Tulin, 2018, p. 12) estimate a range of Structural Vector Error Correction Models (SVECMs) to examine the public and private investment relationship in India over the Period from 1950 to 2012. The results suggest that public investments crowd out private investments in India .

Finally Studies that explore the impact of private investment on economic growth:

(Khan & Reinhart, Private investment and economic growth in developing countries. , 1990, p. 25) attempted to separate the effects of the public and private sectors on economic growth, involving 24 developing countries using a simple growth model that explains the degree of effectiveness of both sectors in the Panell study. Results indicated that, first Private and public investment have different effects on long-term economic growth.second, The contribution of total capital to the growth rate ranges from 43% to 54%, while the private sector investment contributes about 43% to the average growth.third The analysis of these results is due to the role of market-based reforms. By providing the necessary infrastructure - roads, electricity, telecommunications, and schools - then public sector investment can have a strong impact on the rate and productivity of private capital formation.

(Rosemary & Dorcas, 2018, pp. 35-40) They try to examines the relationship between the investment climate, private domestic investment and economic growth in 44 sub-Saharan African countries during the period 2004-2015. The data of the study were included in the panel so that the growth equation for Solow (1956) and Swan (1956) was used. The investment climate indicators that were included as representative of transaction costs included: start-up index, access to electricity, access to credit, business registration, building permit, contract execution, tax rate, suspension.

The results of the study showed the following:

• There is a strong relationship between the indicators of the investment climate, private investment and economic growth.

• Unfavorable investment climate will negatively affect private investment and then economic growth. The results indicated positive and significant statistical significance.

• Registration of business and infrastructure referred to by access to electricity and taxes was the main impediment to investment and economic growth, the results indicated its negative and significant through statistical significance, which increased transaction costs.

• The researchers pointed out that activating the role of government in improving the quality of institutions is one of the priorities of economic policies to achieve economic growth.

The stydy of. (Ghura, 1997, pp. 112-124)explains the economic factors determining the economic growth of Cameroon between 1963 and 1996 using an endogene growth model. An addition to the human capital addressed by Lucas (1988).The results of the study proved:

• The existence of increasing yields through the accumulation of physical and human capital, the development of human capital has an important role in expanding the production process in addition to the role played by economic policies, the budget deficit negatively impacted on economic growth.

• With regard to the impact of private investment on economic growth, the results of the study showed an important causal link between private investment and economic growth with high statistical significance. Increasing the percentage of private investment by 1% increases economic growth by 1.4%. This effect is greater than the effect of increasing government investment. Increasing the percentage of government investment by 1% raises growth by 0.8%, which requires the allocation of government investment to capital projects with strict economic standards and adequate rates of return.

• The study also addressed the addition of explanatory variables to show the impact of private investment on economic growth as the real exchange rate as an indicator of external competition, the budget deficit rate, two indicators of fiscal and monetary policy and the share of the oil sector in the GDP. Negative relationship between private investment and

budget deficit. Improvements in external competitiveness positively affect economic growth in terms of fiscal policy.

4 DATA AND METHODOLOGY

4.1 Data – Sources and Description

Our study uses an annual time series data covering the period from 1970 to 2017 where we use the empirical model based on Khan and Reinhart (1990), to explore the relative impact of public and private investment on economic growth in Algeria.

The data were retrieved from the World Bank database World Bank's World Development Indicators and IMF's International Financial Statistics

LNGDB = f(LNPRV, LNPUB, LNLBR ,LNEXP,LNIMPO)

Where:

LNGDB=log of real gross domestic product ..

LNPRV= log of Private investment .

LN*PUB* = log of General government investment .

LNLBR =log of labor

LNEXP = log of exportation

LNIMPO= log of importation.

The study employ a advanced econometric technique of Auto-Regressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran et al (2001).

We use the following model in this paper:

$$\Delta LNGDB_t = \alpha 0 + \sum_{i=1}^{n} \alpha 1 \Delta LNGDB_{t-1} - 1 + \sum_{i=1}^{n} \alpha 2 \Delta LNPRV_{t-1} + \sum_{i=1}^{n} \alpha 3 \Delta LNPUB_{t-1} + \sum_{i=1}^{n} \alpha 4 \Delta LNLBR_{t-1} + \sum_{i=1}^{n} \alpha 5 \Delta LNEXP_{t-1} + \sum_{i=1}^{n} \alpha 6 \Delta LNIMPO_{t-1} + \beta 1 \text{ LNGDB} + \beta 2 \text{ LNPRV} + \beta 3 \text{ LNPUB} + \beta 4 \text{ LNLBR} + \beta 5 \text{ LNEXP} + \beta 6 \text{ LNIMPO} + \varepsilon$$

Where:Δ: Denotes the first difference operator. **α**: is the drift component; **εi**: is the white noise residuals.

Table n°1:descriptive statistics of variables

	LNGDB	LNPRV	LNPUB	LNLBR	LNEXP	LNIMPO
Mean	25.29514	24.33694	23.65555	15.46501	24.52326	24.02336
Median	25.24812	24.28755	23.49215	15.47059	24.53616	24.01011
Maximum	26.01362	25.33542	24.83809	16.22725	25.01204	24.97135
Minimum	24.27110	23.39013	22.46980	14.55361	23.76508	23.03049
Std. Dev.	0.446520	0.429226	0.652710	0.522203	0.322745	0.487392
Skewness	-0.299669	0.270523	0.338830	-0.220568	-0.274672	0.222773
Kurtosis	2.451744	3.540069	2.185418	1.939822	1.963117	2.466981
Jarque-Bera	1.319581	1.168811	2.245534	2.637154	2.753809	0.965242
Probability	0.516960	0.557437	0.325378	0.267516	0.252359	0.617164
Sum	1214.167	1168.173	1135.466	742.3207	1177.117	1153.121
Sum Sq. Dev.	9.370870	8.659063	20.02344	12.81673	4.895722	11.16488
Observations	48	48	48	48	48	48

Source: Computed by Authors using Eviews10

4.2Empirical Results and Discussions :

4.2.1 unit root tests: The table below reports Augmented Dickey –Fuller unit root tests for stationarity.

Table 2. ADF unit root tests

		LNGDB	LNPRV	LNPUB	LNLBR	LNEXP	LNIMPO
with constant	t-statistic	-3.71	-0.44	-0.92	-1.40	-1.33	-1.80
	prob	0.007 ***	0.89 no	0.77no	0.57 no	0.60 no	0.37no
With constant and trend	t-statistic	-4.73	-0.95	-1.56	-1.75	-1.64	-1.26
	prob	0.002 ***	0.94no	0.97no	0.70no	0.75 no	0.88no
Without constant and trend	t-statistic	6.04	2.55	2.07	5.44	1.17	2.09
	prob	1.00 no	0.99no	0.99 no	1.00 no	0.93 no	0.99no
		d(LNGDB)	d(LNPRV)	D(LNPUB)	d(LNLBR)	d(LNEXP)	d(LNIMPO)
with constant	t-statistic	-9.44	-4.82	-6.43	-8.19	-10.38	-4.74
	prob	0.00***	0.0003***	0.00***	0.00***	0.00***	0.0003***
With constant and trend	t-statistic	-10.4	-4.76	-6.37	-8.33	-11.17	-4.54
	prob	0.00***	0.0019***	0.00***	0.00***	0.00***	0.0037***
Without constant and trend	t-statistic	-5.30	-4.33	-5.91	-0.92	-9.54	-4.44
	prob	0.00***	0.0001***	0.00***	0.31 no	0.00***	0.00***
Order of integration		I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Source: Computed by Authors using Eviews10

Note: The null hypothesis is that the series is non-stationary, or contains a unit root. *, **, * denotes the rejection of null hypothesis of unit root at the 1%, 5% and 10% significance levels respectively.**

The lag length in the ADF test is based on the Akaike Information Criterion (AIC).

- All variables are integrated in the same order we can run an ARDL model.

4.2.2 bounds test for co integration analysis:

Results of the bounds test procedure for co-integration analysis between real private investment and its determinants are presented in the table below.

Table 3. bounds test co integration

Test statistic	Value	signif	I(0)	I(1)
F statistic	8.479435	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Source: Computed by Authors using Eviews10

The result show a long-run co integration relationships among the variables in Algeria's private sector investment at all level 10% 5% 2.5% 1% , It can be seen that the computed F-statistic is above the less bound value.

4.2.3 Results of the Long Run ARDL Model of Private Investment in Algeria:

The long-run ARDL model was estimated based on the Akaike Information Criterion (AIC) .

The optimal lag length based on Akaike Criterion is ARDL(4, 3, 4, 4, 1, 4)

Table .4. The long-run ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPRV	0.220113	0.016618	13.24550	0.0000
LNPUB	0.007326	0.017030	0.430204	0.6722
LNLBR	0.365628	0.019992	18.28887	0.0000
LNEXP	0.408096	0.021682	18.82223	0.0000
LNIMPO	0.118703	0.021714	5.466702	0.0000
C	1.304647	0.507091	2.572807	0.0192

Source: Computed by Authors using Eviews10

EC = LNGDB - (0.2201*LNPRV + 0.0073*LNPUB + 0.3656*LNLBR + 0.4080 *LNEXP + 0.1187*LNIMPO + 1.3046)

Results show the following:

the coefficient of private investment (LNPRV) is positive, and statistically significant at 1%. This indicates that private investment had a positive impact on economic growth in Algeria where the coefficient of public investment (LNPUB) is POSITIVE BUT statistically insignificant .so in the long terme the private investment is more effective then public investment . Through the results we can point out that increase in private investment by 1 % stimule economic growth by 22.01% in long terme .

The other variables show that labour (LNLBR) positively affects economic growth,so increase in LABOR by 1 % stimule economic growth by 36.56% , while Foreign trade operations have A POSITIVE effect on economic progress in the long run in Algeria.so:

- increase in exportation by 1 % stimule economic growth by 40.80%.
- increase in importation by 1 % stimule economic growth by 11.87% This is due to the import of some raw materials and industrial machinery, although Algeria is known for its heavy import of consumer goods.

4.2.4 Results of the short run dynamic in Algeria:

Table .5. short run dynamic test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDB(-1))	-0.191866	0.052920	-3.625601	0.0019
D(LNGDB(-2))	-0.072633	0.033974	-2.137917	0.0465
D(LNGDB(-3))	-0.058146	0.020946	-2.775938	0.0125
D(LNPRV)	0.071535	0.014057	5.088957	0.0001
D(LNPRV(-1))	-0.149800	0.021442	-6.986325	0.0000
D(LNPRV(-2))	-0.032281	0.021556	-1.497524	0.1516
D(LNPUB)	0.002635	0.008768	0.300510	0.7672
D(LNPUB(-1))	-0.018989	0.008200	-2.315811	0.0326
D(LNPUB(-2))	0.008408	0.009579	0.877700	0.3917
D(LNPUB(-3))	0.033206	0.007083	4.687868	0.0002
D(LNLBR)	0.047261	0.021745	2.173412	0.0433
D(LNLBR(-1))	-0.244194	0.048733	-5.010798	0.0001
D(LNLBR(-2))	-0.159164	0.034154	-4.660236	0.0002
D(LNLBR(-3))	-0.071010	0.023548	-3.015605	0.0074
D(LNEXP)	0.303713	0.016533	18.36995	0.0000
D(LNIMPO)	0.075183	0.012410	6.058369	0.0000
D(LNIMPO(-1))	0.019745	0.014043	1.406063	0.1767
D(LNIMPO(-2))	0.014096	0.014085	1.000833	0.3302
D(LNIMPO(-3))	-0.017087	0.010437	-1.637092	0.1190
CointEq(-1)*	-1.094061	0.122406	-8.937983	0.0000

Source: Computed by Authors using Eviews10

Results show the following:

First ,The ECM_{t-1} is equal to -1.094 and highly significant , that confirms the existence of stable long-run relationship.

We notice from the above table that the results are similar to the short term, as:

- The private investment has a positive and significant impact on economic growth at 1 percent level,while increasing in private investment by 1 % stimule economic growth by 7.15 % in short terme.
- The coefficient of public investment (LNPUB) is positive but statistically insignificant.

- The coefficient of labor (LNLBR) is positive and statistically significant at 5%.
- Same for export variable and import variable have positive coefficients and are statistically significant at 1 % level, so increasing in exportation and importation by 1% stimulate growth by 30.37% and 7.51% respectively.

4.3 Diagnostic test:

Table.6. Diagnostic test

	Test statistic	P.value
Heteroscedasiticity	0.66	0.83
Normality (Jarque-Bera)	0.71	0.69
Serial correlation	0.21	0.80

Source: Computed by Authors using Eviews10

Various diagnostic tests on serial correlation and heteroscedassiticity, and normally were conducted to confirm the efficiency of the model .Table (6) reveals that the estimates are free from serial correlation, heteroscedassiticity, and normally distributed).

4.4 CUSUM and CUSUMQ stability tests:

Finally, to demonstrate the structural stability of long-term and short-term relationships we rely on the test proposed by Pro through the the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ), the principle of tests is that If the plot of the CUSUM and CUSUMSQ stays within the 5 percent critical bound the null hypothesis that all coefficients are stable cannot be rejected. This is shown in Figs. 2 and 3. However, the parameters of the model do not suffer from any structural instability.

Figure.2. CUSUM test

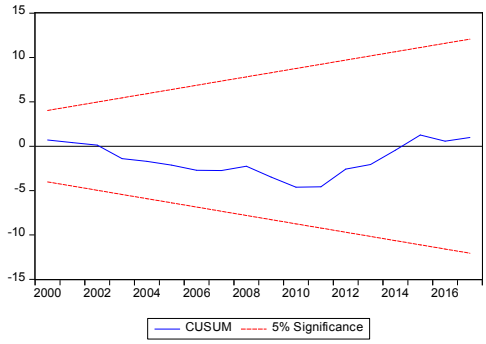
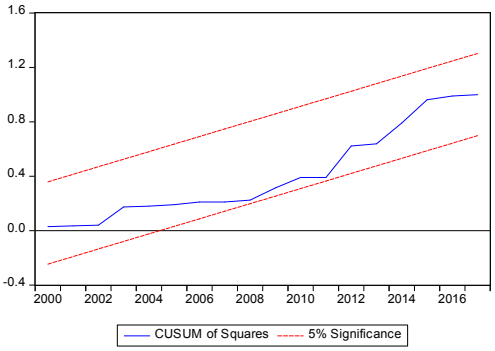


Figure n.3.CUSUM of Squares test



Source: Authors , using Eviews10

IV-Conclusion:

Given the relative importance of the roles played by the components of investment in the growth process, we tried through this study, which contributes to the analysis of the impact of private investment and some variables based on economic models and empirical studies in economic growth.

The paper has investigated the impact of private investment on economic growth in Algeria over the period of 1970-2017 The period was determined by the situation of the Algerian economy, In particular, it undertook major structural economic reforms during the 1990s, which necessitated the formulation of new policies and the promotion of private initiative.

The study employ a advanced econometric technique of Auto-Regressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran et al (2001). The empirical findings obtained in the four decades showed that private investment is the key long run determinants on economic process in Algeria

So first, the study concluded that there is a short-term and long-term relationship between private investment and economic growth in Algeria. This means that private sector positively affects economic growth in the short- and long-term process, reversing public investment that has been shown to have a insignificant impact on long-term economic growth.

Second, the study proved that labor and foreign trade operations support economic growth. The import process may seem somewhat controversial but may be due to the import of industrial machinery and raw materials.

Finally, regarding the term error correction (ECM) is negative and significant (-0.86), indicating that 86% of the imbalance will be adjusted annually.

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