Total Public Expenditure and Long-term Economic Growth in Algeria: Applied Theoretical and Empirical Approaches using ECM

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ABSTRACT
Our research is about use of whole public expenditure of operations and equipment as an instrument of economic growth. Traditional and new theoretical doctrines which are stated in our work indicate that theoretical framework adapted to treatment of this problematic belongs to models of internally formed growth. The aim of our study is to demonstrate importance of total expenditure of state on economic growth in Algeria. To attain this, we have considered carefully a variety of different patterns which have dealt with this main object. Thanks to Econometric modeling, we came to point that expenditures have no effect on economic growth.

KEYWORDS: *budgetary policy, expenditure on operations, equipment expenditure, economic growth, ACP method*

JEL CLASSIFICATION: *E62, O42, P16*

1. INTRODUCTION

Several authors representing new wave, including specially (Abata et al, 2012; Aff & Altermatt, 2014; Baccini, 2010; Santos & Cruz, 2014; Tlili, 2003) and Wajdi (2004), have focused on importance of public spending in process of economic growth.

There has been a number of studies which has highlighted different channels through which public expenditure can affect growth since Barro (1990) founding contribution. Nevertheless, it was difficult to state strong relationships, even if much evidence on effects of public expenditures on growth appears to be conclusive at empirical level.

Works on determinants of economic growth have recently made significant progress. Progress has been made especially in development of statistical databases, in other important advances in development of statistical and econometric software as well. This is what has encouraged economists to undertake countless econometric tests to check validity of economic theories.

The aim of this work is to understand better economic situation in Algeria; to know how public expenditure contributes to economic growth by fixing our attention completely on level and on composition of government‘s expenditure as well and to study utility and efficiency of public expenditure using data from Algerian economy; In other words, to identify promising public expenditure .

We will try to answer central question of our research "How large is impact of public spending on economic growth in Algeria?".

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Answer to our problem can be approached by verifying following hypothesis: fundamental assumption in this research work is to assume that public spending affects positively rate of economic growth.

We will try to answer them with help of several methods: analysis of descriptive statistics, principal component analysis (PCA), and econometric modeling.

2. APPLICATION OF METHOD OF ANALYSIS IN MAIN COMPONENTS ON ALGERIA

This section is devoted to Principal Component Analysis method which uses XLSTAT software. It permits us to obtain more adequate results than descriptive analysis. We will proceed to compare by two approaches obtainable results.

This method is fundamental in multidimensional descriptive statistics because it allows studying simultaneously any given number of all quantitative variables. Each axis is a combination of initial variables, each one more or less well represented by this axis. This representativeness is evaluated by correlation of variable with axis. Variables well represented by a plane are mainly identifiable thanks to circle of correlations: more a variable is closer to circle, better it is represented in this plane.

2.1 Descriptive statistics for total expenditure intervals

According to Table 1, which was based on total government expenditure data relative to GDP using XLSTAT software, we have noticed that interval "94.6, 98.7" corresponding to different rates is interval in which there is highest rate, that is to say: a rate of 6 and in spite of this, it is still not enough compared to rate of economic growth.

Table 1: Evolution and distribution of various intervals of total public expenditure.

lower bound	Upper bound	workforce	frequency	Density
70	74.1	1	0.029	0.007
74.1	78.2	2	0.059	0.014
78.2	82.3	2	0.059	0.014
82.3	86.4	3	0.088	0.022
86.4	90.5	4	0.118	0.029
90.5	94.6	4	0.118	0.029
94.6	98.7	6	0.176	0.043
98.7	102.8	5	0.147	0.036
102.8	106.9	4	0.118	0.029
106.9	111	3	0.088	0.022

Source: authors from ONS data. Ministry of Finance through XLSTAT

Concerning interval "70, 74.1", number of rate occurrences of public expenditure with regard to GDP is only once in 1980.

For a better clarification on importance of different public spending rates over period from 1980 to 2016, we have designed histogram below, which gives clear indication of importance given by government to whole public expenditures allotted to working and equipment.

3. ECONOMETRIC MODELING OF EFFECT OF PUBLIC EXPENDITURE ON ECONOMIC GROWTH IN ALGERIA

In order to identify or break down public expenditures which are conducive to economic growth, we will attempt to transpose and state clearly model of (Bose et al., 2007) for case of Algeria.

These authors have examined effect of fiscal policy on economic growth for developing countries during 1970 and 1980, with particular emphasis on public spending.

At beginning, we are going to analyze whether there is a significant correlation between variables of interest public spending named M with growth after adjustment concerning variables of I. For this we run a series of basic regressions, each of which includes all variables (I) and variable of government expenditure (M):

$$P\,t = \beta 0 + \Sigma\, i = 1n\, \beta i\, It + \Sigma\, j = 1n\, \beta\, j\, M\, t\text{-}1 + Ut \qquad (1)$$

GDP t is rate of economic growth measured by real GDP growth rate.

In equation of our "I" model, we denote a set of variables that condition economic growth as measured by Barro (1990) by log of GDP per head, schooling rate, share of private investment in GDP, log of life expectancy and index of political stability.

Relationship in which:
Gt indicates public expenditure
TSCO: is social indicator of human capital, measured by enrollment rate in primary and secondary education.
TINV: is private investment in relation to GDP.
LESPV is life expectancy in log.
GDP is initial level of development measured by GDP per head in log.

EVALUATION OF EFFECTS OF GLOBAL PUBLIC EXPENDITURE ON ECONOMIC GROWTH IN ALGERIA FROM 1980 TO 2016.

In this stage, we are going to start with effect of overall expenditure (Equipment and functioning) on economic growth in presence of conditional variables to reach maximum rate of economic growth. Hence, we will follow gradual integration method of variables (stepwise progression)

Table 2: Results of evaluation effects global public expenditures on economic growth in Algeria from 1980 to 2016

	C	DIPT	GPC (-1)	TSCO	TINV	LESPV	PIB H	R^2	Prob (F)	DW
M1	4.76 (1.07)	-0.03 (-0.71)	0.38 (2.13)	-	-	-	-	0.20	0.03	2.00
M2	8.67 (0.87)	- 0.02 (-0.42)	0.38 (2.02)	0.00 (0.08)	-	-	-	0.20	0.07	1.99
M3	0.82 (0.07)	-0.03 (-0.55)	0.33 (1.83)	0.01 (0.30)	0.11 (1.48)	-	-	0.26	0.06	1.89
M4	0.01 (2.97)	0.08 (1.18)	0.25 (1.56)	0.47 (2.92)	0.30 (0.39)	- 87.08 (-2.98)	-	0.44	0.00	2.27
M5	-17.14 (-2.53)	-0.01 (-2.74)	-	-0.09 (-8.23)	0.04 (7.92)	6.70 (3.54)	1.00 (83.30)	0.99	0.00	1.19

Source: five models are made by authors using EViews 8 software.

Model 1:

In this model we will study effect of state's overall spending on economic growth without integrating conditional variables. Econometric results obtained by EViews8 software are in Appendix 1. Result of DW is about 1.35. Consequently, there is an autocorrelation problem which does not give us possibility to use pattern; so we have to integrate the GPC (-1) into model in order to reach a figure of DW close to number 2. We have obtained following results from econometric study:

For Student T test prob total expenditure is 0.48 and this value corresponds to more than 10% and therefore, total expenditures do not explain economic growth. Reason is that Algerian government leaves no freedom to private sector and to foreign investment in order to stimulate economic growth. For GPC (-1) prob is 0, 04, coefficient is 0.38. These two values show that GPC (-1) accounts for a proportional effect on GPC. Which means that: economic growth of current year is influenced by rate of economic growth of previous year.

For F file with prob (F stat) = 0.03 less than 5% and therefore model is globally significant and prob value F is: 0.03 which confirms result obtained

For R2 which is approximately of 20%, this value is very far from 100% included in model 1explains 20% of variations of GPC.

For DW which is of order of 2.00 Durbin-Watson, it shows that there is no autocorrelation of errors. All results of these tests do not give us any evidence to accept this model.

Model 2:

In this model, we will integrate first conditional variable: enrollment rate. Econometric results obtained by EViews 8 software are in Appendix 2. Result of DW is of order of 1.34. This, theoretically, does not give us opportunity to use model; so we have to integrate GPC (-1) into model in order to reach a DW number close to number 2.

Value of T indicates that: total expenditure and enrollment rate do not explain GPC, on the other hand, GPC (-1) exerts a positive and significant effect on current economic growth because prob T is about 0.04 and coefficient of 0.38 represents elasticity; that is to say: if GPC (-1) increases by 1% GPC increases by 0.38%.

First, F file is in order of 2510, this value is greater than 2.65, which corresponds to average calculated per file. Hence, global model is significant and prob value F is: 0.07 which confirms result obtained. For R 2 of order of 0.20 this value is very far from 100% so variables are not connected to one another. For DW of order of 1.99, it shows that there is no autocorrelation of errors.

All results of these tests do not give us proof to accept this results.

Model 3:
In this model we will integrate conditional variables: enrollment rate and investment rate. Econometric results obtained by EViews 8 software are in Appendix 3, result of DW is of order of 1.31. This, theoretically, does not give us possibility to use model. So it urges us to integrate GPC (-1) in model to be able to reach a figure of DW close to number 2.

For student T, total expenditure, enrollment rate and investment rate do not explain an effect on GPC, but GPC (-1) explains an effect on current GPC because prob T is about 0.07 and coefficient of 0.33. This means that there is a proportional relationship between two.
For F file which is of order of 2511, this value is greater than 2.65 which corresponds to average calculated per file. Therefore, global model is significant and value prob F is: 0.06 which confirms obtained result.
For R 2 is about 0.26, this value is very far from 100%, so variables are not connected to one another. For DW is of order of 1.89, which shows that there is no autocorrelation of errors.

All results of these tests do not give us any proof to accept this result.

Change has occurred, but rate of economic growth in current year is still influenced by growth rate of preceding year.

Model 4:
In this model we will integrate conditional variables: enrollment rate, investment rate and life expectancy. Econometric results obtained by EViews 8 software are in Appendix 4, result of DW is of order of 1.41. This theoretically does not give us possibility to use model; So we have to integrate GPC (-1) into model in order to reach a DW number close to number 2.

For student T, total expenditure, investment rate and GPC (-1) do not explain an effect on GPC, and on other hand, rate of economic growth is positively influenced by enrollment rate of so that when enrollment rate changes by one unit, rate of growth increases by 0.00 units; And for life expectancy, when it changes by one unit, rate of economic growth regresses by 0.00. For F file which is of order of 4.35, this value is greater than 2.65 which corresponds to average calculated per file and thus global model is significant and prob value F is: 0.00 which confirms result obtained

For R2 which is of order of 0.44, this value is far from 100%. So variables are not really connected to each or. For DW of order of 2.27, this value shows that there is no autocorrelation of errors.

Based on results of these tests, we can accept this model even if total expenditures do not really have a significant impact on CPG.

Model 5:
In this model we will integrate conditional variables: enrollment rate, investment rate, life expectancy and economic growth per capita. Econometric results obtained by EViews 8 software are given in Appendix 5.

For student results: firstly, we will start with total expenditure, while rate of economic growth has a negative influence of 0.01 units, Economic growth is negatively influenced by enrollment rate so that when there is a change of one unit in enrollment rate there is a regression of 0.00 units in economic growth. When there is a change of one unit in economic growth per inhabitant, there is an increase of 0. 00 units in economic growth; when there is a one-unit change in economic growth, there is an increase of 0.00 unit of rate of investment.

For explanatory statistics of file F which is of order of 1813, this value is greater than 2.65 which correspond to average calculated by file. Thus, global model is significant and prob value F is: 0, 00 which justifies result acquired.

For R 2 which is of order of 0.99, this value is very close to 1 and therefore there is almost complete correlation between variables. For DW which is about 1.19, this shows that there is an autocorrelation of errors.

Following results obtained, we can accept model and it is essential to indicate importance of variable GDP h because it is only after taking account of it that it has improved results of tests. This has appeared in total expenditure that influences economic growth but negatively because Algerian state spends hugely in each annual budget but evolution of rate of economic growth does not correspond to all sums spent. This is a sign that these funds are not spent on interesting projects to promote economic growth. When we always include rate of investment, life expectancy and GDP h, there is a positive impact on rate of real economic growth.

4. CONCLUSIONS

The aim of this study was to understand better how public expenditure contributes to economic growth in Algeria by focusing our research on level and on composition of public expenditure as well.

We came to evidence that impact of public spending on economic growth in Algeria is manageable in short and medium term, except in case of a sharp decline in price of oil for financing of major equipment projects already launched.

In second evaluation, we added another essential method (ACP) of our study. We therefore tested different conditional variables to check if they favor economic growth or if they represent an obstacle to an eventual growth in Algeria. Our results of study of conditional variables of economic growth show clearly existence of a proportional relationship between all conditional variables throughout period examined "1980 - 2016".

In general, estimated econometric modeling of public expenditure in this study explains contribution of determinants of economic growth for Algeria. In this modest investigation, we have identified political conditions under which public spending contributes positively or sometimes negatively to economic growth.

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APPENDICES:

(A1)

Dependent Variable: GPC
Method: Least Squares
Date: 06/12/14 Time: 08:59
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIPT	-0.031442	0.044179	-0.711702	0.4821
GPC(-1)	0.380088	0.178116	2.133938	0.0411
C	4.769744	4.418814	1.079417	0.2890

R-squared	0.205984	Mean dependent var	2.860986
Adjusted R-squared	0.153050	S.D. dependent var	2.374622
S.E. of regression	2.185362	Akaike info criterion	4.487948
Sum squared resid	143.2742	Schwarz criterion	4.623994
Log likelihood	-71.05115	Hannan-Quinn criter.	4.533724
F-statistic	3.891308	Durbin-Watson stat	2.001038
Prob(F-statistic)	0.031437		

(A 2)

Dependent Variable: GPC
Method: Least Squares
Date: 06/12/14 Time: 09:05
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIPT	-0.027368	0.064597	-0.423677	0.6749
TSCO	0.005302	0.060401	0.087774	0.9307
GPC(-1)	0.382643	0.183461	2.085686	0.0459
C	3.903883	10.84000	0.360137	0.7214

R-squared	0.206195	Mean dependent var	2.860986
Adjusted R-squared	0.124077	S.D. dependent var	2.374622
S.E. of regression	2.222426	Akaike info criterion	4.548289
Sum squared resid	143.2362	Schwarz criterion	4.729684
Log likelihood	-71.04676	Hannan-Quinn criter.	4.609323
F-statistic	2.510966	Durbin-Watson stat	1.995667
Prob(F-statistic)	0.078269		

(A3)

Dependent Variable: GPC
Method: Least Squares
Date: 06/12/14 Time: 09:37
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIPT	-0.035190	0.063519	-0.554007	0.5840
TSCO	0.018153	0.059818	0.303474	0.7638
TINV	0.118695	0.080000	1.483680	0.1491
C	0.822205	10.82339	0.075966	0.9400
GPC(-1)	0.335040	0.182616	1.834665	0.0772

R-squared	0.264054	Mean dependent var	2.860986
Adjusted R-squared	0.158918	S.D. dependent var	2.374622
S.E. of regression	2.177778	Akaike info criterion	4.533214
Sum squared resid	132.7960	Schwarz criterion	4.759958
Log likelihood	-69.79803	Hannan-Quinn criter.	4.609506
F-statistic	2.511563	Durbin-Watson stat	1.898634
Prob(F-statistic)	0.064216		

(A 4)

Dependent Variable: GPC
Method: Least Squares
Date: 06/12/14 Time: 09:41
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIPT	0.081177	0.068350	1.187665	0.2453
TSCO	0.471298	0.160931	2.928571	0.0068
TINV	0.030256	0.076640	0.394778	0.6961
LESPV	-85.08483	28.54214	-2.981025	0.0060
C	310.0174	104.1608	2.976335	0.0061
GPC(-1)	0.256565	0.163441	1.569771	0.1281

R-squared	0.446295	Mean dependent var	2.860986
Adjusted R-squared	0.343757	S.D. dependent var	2.374622
S.E. of regression	1.923654	Akaike info criterion	4.309296
Sum squared resid	99.91200	Schwarz criterion	4.581388
Log likelihood	-65.10338	Hannan-Quinn criter.	4.400846
F-statistic	4.352479	Durbin-Watson stat	2.276960
Prob(F-statistic)	0.004925		

(A 5)

Dependent Variable: GPC
Method: Least Squares
Date: 06/12/14 Time: 09:32
Sample: 1980 2013
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIPT	-0.013358	0.004863	-2.746676	0.0104
TSCO	-0.098012	0.011900	-8.236405	0.0000
PIBH	1.008451	0.012105	83.30994	0.0000
TINV	0.044735	0.005642	7.928687	0.0000
LESPV	6.706374	1.893369	3.542033	0.0014
C	-17.14517	6.756979	-2.537402	0.0170

R-squared	0.996922	Mean dependent var	2.800092
Adjusted R-squared	0.996373	S.D. dependent var	2.365170
S.E. of regression	0.142449	Akaike info criterion	-0.900887
Sum squared resid	0.568164	Schwarz criterion	-0.631529
Log likelihood	21.31508	Hannan-Quinn criter.	-0.809028
F-statistic	1813.902	Durbin-Watson stat	1.190027
Prob(F-statistic)	0.000000		