

Total Productivity determinants in Algeria using ARDL model

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Abstract—the aim of this study is to examine and analyze the determinants of total factor productivity in Algeria during the period 1980-2011. Using the standard form of self-regression model with periods of delay spread 'ARDL'. The study concluded, into this results like the importance of the effect of wages, exports and real exchange rate on productivity of the College where the contribution of this moral factors, consistent with economic theory where each wage has a positive impact on overall productivity growth either real exchange rate impact it negatively because of the existence of an inverse relationship with total productivity.

Keywords : productivity , wages , exports , real exchange rate, ARDL model, Algeria.

I. INTRODUCTION

Productivity is an index that illustrates the ability of the various factors of production to achieve a greater proportion of the output of a specific value of the input, which has been invested for the purpose of production, productivity is in this sense is not synonymous with the production, because production refers to the total output produced per unit and one of the inputs, while productivity is a measure output resulting from a given quantity of inputs.

Although there are several indicators to assess the performance of the national economy, but the production is the best indicator to assess this performance, as the analysis of its components growth rates reveal the strengths and weaknesses in economic activity, which is the main source of economic growth and the achievement of economic and social welfare in any country. While characterized by scarcity of factors of production, the potential of increasing productivity is not limited at all, for this racing nation in maintaining the sustainability and continuity of increasing growth rates in productivity, through the introduction of continuous improvements in technological, human, and administrative aspects.

Due to the role of productivity is important in economic and social development and the difficulty of identifying the factors affecting it made many researchers to study and analyze the determinants at the macro and micro level, I tried many of the studies that have focused on productivity to reach a specific framework governed in order to increase and to complete the analytical framework for

productivity concept, it requires analysis factors affecting the productivity and that have direct and indirect effects leave their mark on a number of economic, administrative and social variables in the national economy, They are not only limited to the increase in production and income through the optimal use of economic resources but leave marks indirectly to increased capital accumulation and its impact on costs and prices, wages, profits and there is a clear relationship also in the trade balance by improving productivity and competitiveness of domestic products exported to the world market and its impact also to reduce inflation and increase efficiency and the competitive level at the level of production units and economic institutions.

You can measure and determine the overall productivity contribution of production factors in economic growth through model SOLLOW which is one of the most important contributions in the history of development thinking and knead entered the technology component of the model, but he considered that the technological development external factor cannot be explained, to knead dubbed external model of growth (exogenous growth) and Hedda has led to the emergence of new ideas in the eighties led to the emergence of the modern theory of economic growth in the interpretation and known as external growth model.

The problem of the study:

Due to the above is the problem of the study are as follows:

What are the college determinants of productivity of factors of production in Algeria?

Hypotheses of the study:

Through previous problematic ask the following assumptions:

- The real exchange rate has a negative effect on the moral and the overall productivity of the factors of production.
- The volume of exports have a positive and significant impact on the total factor productivity.
- Wages have a positive and significant impact on the total factor productivity.

The importance of the study:

The importance of the study is as follows:

- Identify and measure the determinants of overall productivity of factors of production and illustrate their importance to decision-makers and economic policy-makers.
- Lack of economic studies such as studies on this topic standard productivity determinant of total factor productivity.

Objectives of the study:

The study aims to determine the effect of the determinants of overall productivity of factors of production through the following:

- Study and analysis of the determinants of overall productivity of factors of production.
- Measure and estimate the overall productivity in the Algerian economy and the analysis of the relationship in the

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short and long term between them and the limitations of using the slow periods distributed self-regression model (ARDL).

II. LITERATURE REVIEW:

1. KHAN study in 2006 entitled: Macro determinants of total factor productivity in Pakistan.

The purpose of this topic the study to determine the overall determinants of productivity in Pakistan, where used this topic study the following variables: inflation, foreign investment, the financial sector, private credit, the budget deficit, population growth, unemployment, government consumption and investment are In general, where he explained that education and trade openness have expenses negative effects on economic growth, while government consumption and foreign investment hath positive effects based on the standard method to estimate the regression relationship between the independent variables and the dependent variable, and concluded that the capital contribution to growth Economic higher than the contribution of labor, as well as there is a direct correlation between productivity growth and overall GDP growth.

2. Jajri study, 2007: Entitled: Determines of total factor productivity growth in Malaysia

The purpose of this topic the study to the growth of productivity factors College analysis in Malaysia between 1971 - 2004 as well as to identify the specific factors for the growth of overall productivity factors using standard models where concluded that the Malaysian economy grew by increasing the working and investing heavily, and the opening up to foreign companies and the global economy had a direct impact on the overall productivity growth, in addition to the rapid growth in export.

Malaysia needs time to develop the overall productivity growth and reduce dependence on material inputs, and knead through human resource development, research and technological development.

3. KHATIB study entitled Productivity: College of productivity of factors of production in the Saudi non-oil sector:

The study dealt with this topic estimate the overall productivity of factors of production and their determinants in the Saudi non-oil sector. In order to know the contributions of physical capital, and human capital, and the rest of the other factors in the process of economic growth, according to the expanded growth of the accounting curriculum, and relied on annual data in real terms. The study covered the period 1970-2007 m. To estimate the physical capital, And human capital, and the rest of the other factors in the process of economic growth, according to the expanded growth of the accounting curriculum, and relied on annual data in real terms. The study covered the period 1970- 2007 m. To estimate the physical capital, it used the perpetual inventory method, after the capital stock account in a manner Nehru. Based on internal growth theory, as far as human capital labor force index weighting for skills acquired through education is the number of years of schooling and rewards of investing in education. The study applied the common integration approach for estimating production flexibility for physical capital, and then used the ordinary least squares method to estimate the leftover

solo, and then the overall productivity of the factors of production. It was found that this productivity has grown at an annual rate slightly positive of 0.05%, and the contribution to economic growth up to 1%, and showed the standard study, which applied the approach Johansen co-integration, that the most important overall productivity determinants of the factors of production are oil revenues, economic openness, and the rate of inflation , while other variables did not succeed FDI such as investing, and imports of equipment and machinery, and spending on education, and labor force of the total inflows in the interpretation of the level of productivity of factors of production employment.

1. The formulation of the standard model:

After our study to the theoretical side of productivity and drawing on previous studies, were limited to a number of variables affecting the productivity and are as follows:

$$PROT_t = f(TC_t + slr_t + EXPO_t)$$

PROT_t : Productivity in the industrial sector

EXPO_t : The volume of exports in the year t in million dollars

TC_t :The real exchange rate in the year T

SLR_t : Wages in the industrial sector

2. The stability of time series' study:

	Critical value5 %	PP test		ADF test	
		First differentiation	LEVEL	First differentiation	LEVEL
PRO T	-3.57	-6.77	-2.88	-4.84	-2.88
EXPO	-1.95	-4.88	-2.37	-4.90	-2.94
TC	-1.95	-3.19	-1.46	-2.77	-1.76
SLR	-3.57	-3.28	-1.57	-3.29	-1.85

the time series: (SLR, TC, Expo, Prot) are stable, integrated in first class (1) at the level of moral 5 %, since these variables integrated of the same class, it can be a simultaneous integration test.

The first procedure:

-Choose period of delay optimization model and estimation of model ARDL using eviews 8 program.

To make the period of delay is appropriate for the form as a whole are estimating equation for a slow one followed the other until they get the form that best selection criteria form (AIK. SC. HQ. FP) and depending on the program EVIEWS6 the following results were obtained:

Sample: 1980 2010

Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-321.6385	NA	36.93850	23.47418	23.80723*	23.57600*
1	-283.9130	53.89365	92.65344	24.27950	26.94391	25.09404
2	-209.4228	69.16941*	32.05300*	22.45877*	27.45454	23.98603

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)

From the results above, we note the period of delay is lag = 2

The second procedure:

-Estimate the VECM ARDL-form:
Dependent Variable: D(PROT)
Method: Least Squares
Sample (adjusted): 1983 2010

Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-24.96970	8.410657	-2.968817	0.0096
D(PROT(-1))	-0.473709	0.405544	-1.168082	0.2610
D(LNSLR(-1))	-1.404824	1.894275	-0.741616	0.4698
D(EXPO(-1))	-0.009362	0.029848	-0.313662	0.7581
D(TC(-1))	-0.041256	0.026679	-1.546400	0.1428
D(PROT(-2))	-0.985475	0.385311	-2.557607	0.0219
D(LNSLR(-2))	-5.015156	1.964434	-2.552978	0.0221
D(EXPO(-2))	-0.032838	0.026041	-1.260990	0.2266
D(TC(-2))	0.052402	0.037973	1.379992	0.1878
PROT(-1)	-1.168454	0.400321	-2.918791	0.0106
LNSLR(-1)	2.126295	0.727849	2.921340	0.0105
EXPO(-1)	0.100327	0.034230	2.930951	0.0103
TC(-1)	-0.040600	0.019453	-2.087133	0.0544
R-squared	0.683317	Mean dependent var		0.106999
Adjusted R-squared	0.429970	S.D. dependent var		0.533747
S.E. of regression	0.402981	Akaike info criterion		1.324560
Sum squared resid	2.435900	Schwarz criterion		1.943084
Log likelihood	-5.543846	Hannan-Quinn criter.		1.513649
F-statistic	2.697161	Durbin-Watson stat		2.564772
Prob(F-statistic)	0.036269			

$$D(\text{PROT}) = -24.96 - 0.47 \cdot D(\text{PROT}(-1)) - 1.40 \cdot D(\text{LNSLR}(-1)) - 0.009 \cdot D(\text{EXPO}(-1)) - 0.041 \cdot D(\text{TC}(-1)) - 0.985 \cdot D(\text{PROT}(-2)) - 5.015 \cdot D(\text{LNSLR}(-2)) - 0.03 \cdot D(\text{EXPO}(-2)) + 0.052 \cdot D(\text{TC}(-2)) - 1.168 \cdot \text{PROT}(-1) + 2.12 \cdot \text{LNSLR}(-1) + 0.10 \cdot \text{EXPO}(-1) - 0.04 \cdot \text{TC}(-1)$$

The third procedure:

Be the null hypothesis that there is no relationship of common integration (balancing long-term relationship) between variables as follows:

$$H_0 \quad a_{10} = a_{11} = a_{12} = a_{13} = 0$$

Against the alternative hypothesis:

$$H_1 \quad a_{10} \neq a_{11} \neq a_{12} \neq a_{13} \neq 0$$

Where a_{11} , a_{12} , a_{13} , a_{10} represents the coefficients of the variables in the long period of slow one

The following table describes common integration test results using the Wald test _ counted. F for model ARDL-VECM:

Wald Test

Equation: EQ01

Test Statistic	Value	df	Probability
F-statistic	4.001778	(4, 15)	0.0210
Chi-square	16.00711	4	0.0030

Counted F	p-value	Result
4 .00	0.02	Simultaneous integration in the long term
		The tabular values of F counted. when k = 3
The level of moral	The value of the minimum I(0)	The maximum value I (1)
10%	2 .37	3 .20
5%	2.79	3.67

The calculated table and corresponding value is compared to the value of F counted. by (Pesaran and Al 2001). If there is a fixed limit. And the absence of a general trend, where $K = 3$. The calculated value of F indexed values greater than 4.00 minimum and maximum moral level 5%, 10%, indicating acceptance of the alternative hypothesis of synchronous integration rate long term between variables

3. Assessing the relationship in the long term.

Dependent Variable: PROT

Method: Least Squares

Sample: 1980 2010

Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.58099	2.689106	-6.165986	0.0000
EXPO	0.068897	0.010939	6.298235	0.0000
LNSLR	1.355204	0.238193	5.689534	0.0000
TC	-0.020413	0.009132	-2.235337	0.0339
R-squared	0.918604	Mean dependent var		1.483908
Adjusted R-squared	0.909560	S.D. dependent var		1.421777
S.E. of regression	0.427573	Akaike info criterion		1.258532
Sum squared resid	4.936112	Schwarz criterion		1.443563
Log likelihood	-15.50725	Hannan-Quinn criter.		1.318848
F-statistic	101.5711	Durbin-Watson stat		0.863013
Prob(F-statistic)	0.000000			

$$\text{prot} = -16.58 + 0.06\text{EXPO}_t + 1.35\text{SLR}_t - 0.02\text{tc} + e_t$$

We note that the results obtained were completely in agreement with expectations of economic theory, this is evident through the trade-off between the overall productivity and exports 6 and 1% and also overall productivity and wages 1, either the relationship between overall productivity and the real exchange rate s_2 are inverse relationship.

4. Estimate the relationship in the short term:

Dependent Variable: D(PROT)
 Method: Least Squares
 Sample (adjusted): 1981 2010
 Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXPO)	0.059002	0.011107	5.312005	0.0000
D(LNSLR)	1.129918	0.540838	2.089197	0.0466
D(TC)	-0.037511	0.014799	-2.534651	0.0176
E(-1)	-0.522570	0.158023	-3.306922	0.0028
R-squared	0.621978	Mean dependent var	0.100322	
Adjusted R-squared	0.578360	S.D. dependent var	0.515641	
S.E. of regression	0.334825	Akaike info criterion	0.773151	
Sum squared resid	2.914809	Schwarz criterion	0.959977	
Log likelihood	-7.597259	Hannan-Quinn criter.	0.832918	
Durbin-Watson stat	2.179485			

$$D(\text{prot}) = 0.05D(\text{EXPO}_t) + 1.12D(\text{SLR}_t) - 0.02D(\text{tc}) - 0.52e(-1)$$

Notes from the table that the correction factor is negative and moral, therefore, is to verify the authenticity of the corrected the error and this means that the behavior of the variable of productivity take one period up to the balance in the long term, as it appears from the results that 52% of the level of the balance in the long term would be corrected each year.

Through the above study we noted that real exchange rate refers to the existence of an inverse relationship between it and the total productivity. As high real exchange rate to 1% this will decrease the total productivity about 6% and this is consistent with economic theory, where the exchange rate would lead to a drop in exports and rise in imports, which reflected the looting on the trade balance, on the other hand,

As regards to the proportion of exports to GDP. The real moral was the positive impact where the regression rate which increased the ratio of exports to real GDP by 1% will lead to an increase in total factor productivity by about 6% and this consistent with economic theory that sees the existence of a direct correlation between total exports and the total productivity Where the increase and expansion of exports would increase specialization in goods production, research and development and access to appropriate technology, This can improve productivity and raise competitiveness of local exports to foreign imports, this all positively affect economic growth.

As for the wages they were moral and positive influence so that wage increases by 1% leads to increased total productivity by 6% and this in the long run any correlation between them and this consistent with economic theory that sees the existence of a direct correlation between wages and productivity College so that higher wages increase productivity College but by the largest proportion of wages.

Results:

The regression coefficient for the variable exchange rate real 0.037 – in the short term and 0.02 – in the longterm and the value came compatible with economic theory.

The regression coefficient for the variable ratio of exports to gross domestic product results in the short term, 0.059 and 0.071 in long term implying a direct correlation between the ratio of exports to GDP and total value came in compatible with economic theory.

The regression coefficient of the variable remuneration 1.129 in the short term and 1.356 in the long term which means there is a direct correlation between wages and total value of consent came with economic theory.

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