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The Relationship Between Government Spending and GDP Growth Rate In The MENA Countries: The Scully Curve Approach

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Abstract

To check the applicability of the Scully curve, a Random Effects Model was applied to MENA countries (1985-2015) using the Hausman test. Five out of the seven studied economic variables had a significant effect on the economic growth rate: Government Spending, its squared value, total domestic investment, the change in imports/ exports; whereas population and inflation rates had an insignificant effect. For Egypt (1985-2015) we relied on time series and a co-integration method was applied using the ARDL model. Results showed a significant inverted U-curve relationship between government spending and GDP. Their inverted U-shaped curve indicated that optimum Government Spending amounted to 25.95% and 36% of GDP for MENA countries and Egypt respectively.

العلاقة بين الإنفاق الحكومي و معدل نمو الناتج المحلي الإجمالي في منطقة الشرق الأوسط و شمال إفريقيا : مدخل منحنى سكالي

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ملخص

لفحص مدى انطباق منحنى سكالي على منطقة الشرق الأوسط و شمال إفريقيا خلال الفترة (1985– 2015) تم تطبيق نموذج التأثيرات العشوائية وذلك إعتماداً على إختبار هوسمان، و أسفرت النتائج عن التأثير المعنوي لخمسة متغيرات من أصل سبعة وهي : الإنفاق الحكومي كنسبة من الناتج المحلي الإجمالي و مربعه و الإستثمار المحلي الإجمالي كنسبة من الناتج المحلي الإجمالي و التغير في الواردات و التغير في الصادرات، في حين كان التأثير غير معنوي لكل من عدد السكان و معدل التضخم على معدل النمو الاقتصادي . أما عن مصر فتم الاعتماد على بيانات سلسلة زمنية ،و تم تطبيق أسلوب التكامل المشترك باستخدام نموذج الانحدار الذاتي لفترات الإبطاء الموزعة ، و أظهرت النتائج أن العلاقة معنوية بين الإنفاق الحكومي و معدل النمو الاقتصادي و تأخذ شكل حرف U مقلوبة ، و أشارت العلاقة إلى أن المستوى الأمثل لإجمالي الإنفاق الحكومي الذي يعظم معدل النمو الاقتصادي قدر بنحو 25.95% ، 36% من الناتج المحلي الإجمالي في كل من منطقة المينا و مصر على التوالي.

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1. Introduction

Public expenditure is defined as an amount of money spent by the government through its various agencies with the objective of realizing a public utility. The crises which happened in capitalist countries led to the fall of the principle of the State neutrality or the Guardian State advocated by Adam Smith. This change in the State role entailed the evolution of the State spending obligations as its role was extended beyond the traditional functions. The evolution of the State role clearly justifies the phenomenon of increasing government spending in all countries, whatever the level of economic development and the economic and political philosophy of each country.

Economists attribute the phenomenon of increasing public expenditures to a number of apparent and real reasons. Apparent factors include inflation and currency devaluation, and the different accounting methods used by the different countries for calculating and recording public expenditures. Real reasons include the expansion of the State administrative entities and ministries to encompass all economic, social, political and cultural domains. In addition, social and political considerations impose on the State the need to spend on such services such as social security, health care, education, and on defense and military affairs. Population growth also inevitably entails increased public expenditure in order to maintain and improve the standard of public services.

Most macroeconomic models indicate the presence of a relationship between government spending and economic growth. This relationship caught the interest of economic researchers and experts throughout the past decades and aroused a strong and vivid debate about the nature of such relationship. The controversy stems from the different views adopted by two major economic schools of thought. The first (classical) school is represented by the German economist Wagner (1892) who contended that the causality runs from the gross domestic product (GDP) to government spending given that increasing economic growth rates inevitably lead to the expansion of the State activity and hence, to the increase of government spending at a higher rate than the growth rate of the average per capita share of GDP (R. M. Bird, 1971). The ideas of the second (Keynesian) school were presented by the English economist J.M.Keynes in the aftermath of the Great Depression of 1929-1933. The proponents of this second school call for State intervention through government spending and the supply of financial resources in order to spur the effective demand on goods and services and realize economic growth (Nelson, C. R., and Plosser, C. I., 1982).

World Bank data indicate that government spending in the MENA countries amounted to 532.5 billion US dollars or 18.1% of their GDP in 2015 as compared to US $ 11,791 billion or 17.8% of GDP at the World level. It is noteworthy that the growth rate of the MENA countries was about 3.1% against 2.5% for the World in 2015 (www.worldbank.org).

This study is devoted to investigating the extent of the Scully curve(1) applicability to the MENA countries and determining the optimum level of public expenditure which maximizes the economic growth rate. The second part of this paper reviews previous related studies; while the third part includes the model data and description. The fourth part describes the methodology used by the study and its estimated results. The fifth part presents the conclusion.

Published studies which examine the applicability of the Scully curve (the relationship between economic growth and government spending) can be divided into three groups; The first group argues that this relationship takes the form of an inverted-U shaped curve. The second group confirms the applicability of the Scully curve to certain countries while for the rest of the countries the relationship was estimated to be U-shaped. The third group demonstrates the inapplicability of the Scully curve.

Examples of the first group studies are the following: Chao, Johnny C.P. (1997) estimates the optimum rate of spending to be 34 percent of national income; Chobanov, D. and Mladenova, A. (2009) indicates that the optimal size of government, i.e. the ratio of overall government spending to GDP that would maximize economic growth, is no greater than 25% of GDP (at a 95% confidence level) based on the data of the OECD countries; Scully, G.W. (1994), finds that in order to maximize economic growth, the average rate of federal, state and local taxes combined should range between 21.5 percent and 22.9 percent of gross national product (GNP); Pevcin,P.(2004) suggests that the optimal size of government in the study sample including twelve European countries ranges between 36 and 42 percent of GDP; Asimakopoulos, S. and Karavias,Y.(2015) reveals that the optimal size of government that maximizes economic growth is 18.04% for the whole study sample (129 countries); 19.12% for the developing countries and 17.96% for the developed countries; Ul Husnain, M. I. (2011), finds that the government size is optimized when public expenditures stand at 21.48% of GDP; and CHAO, J.C.P. and Grubel, H. (2016), indicates that for Canada the optimal rate of spending and taxation is approximately 34 percent of national income

The second group counts fewer studies such as:

OBBEN,J.(2013), confirms the Scully curve applicability to 13 out of the 24 countries, whereas the estimated optimal government size ranges from 11.04% (for Turkey) to 23.10% (for Denmark). Eleven of these countries are the following: Austria, Canada, Denmark, Finland, France, Israel, Italy, Luxembourg, New Zealand, Sweden and Great Britain.

Examples of the third group of studies which advocates the non-applicability of the Scully curve are the following: Amhir Khalkhali, and Dar, A. A. (2002) and Guseh, J. (2007), find that government spending and growth are negatively related; whereas other studies reveal a positive relationship between these two variables (e.g. Bose, N. et al. (2007) and Romero-Ávila, D. and Strauch (2008).

2. Model and data description

The present study focused on two cases: First, the case of the MENA Region, and second, the case of Egypt.

2.1. The case of the MENA Region (Panel data)

The applied study used an Unbalanced Panel Data(2) Model for the MENA countries(3) during the period 1985-2015.

For the MENA Region, the model was formulated as follows:

$$Y_{it} \beta_0\ \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \beta_6 X_{6it} + \beta_7 X_{7it} + \mu_{it}$$

Where Y is the dependent variable which is GDP growth rate, β_0 is the equation constant, while $\beta_{1,}\ \beta_{2,}\ \beta_{3,}\ \beta_4, \beta_{5,}\ \beta_{6,}\ \beta_7$ represent the coefficients of the independent variables under study, t stands for the time period 1985-2015, i represents the panel number and the independent variables are: $X_{1,}\ X_{2,}\ X_{3,}\ X_{4,}\ X_{5,}\ X_{6,}\ X_{7..}$ X_1=government spending as a ratio of GDP, X_2=the squared value of that variable, X_3=total investment as a ratio of GDP, X_4=the inflation rate, X_5=the number of population, X_6, X_7=imports' change rate and exports' change rate respectively; and μ_{it} represents the random error term of the equation.

The data were sourced from the international financial statistics of the International Monetary Fund (IMF) data base regarding all the indexes of all the MENA countries, including Egypt. Table (1) shows the descriptive statistics of the variables.

Table (1): Descriptive statistics of the variables

Variable	Obs.	Mean	Std deviation	Max.	Min.
Y	429	3.89385	7.6309	104.49	-62.076
X_1	429	31.676	7.9451	69.22	14.536
X_2	429	1066.32	558.231	4791.4	211.29
X_3	429	25.7581	9.37632	61.47	5.501
X_4	429	9.9862	20.27	156.79	-9.79
X_5	429	20207894	22224618	91508084	561525
X_6	429	5.556611	14.95	116.5	-54.65
X_7	429	4.73237	17.572	217.4	-69.154

The data in Table (1) indicate that the mean value of the GDP growth rate was about 3.9% with a minimum limit of -62.1% and a maximum limit of 104.5% approximately. Government spending had a mean value of 31.7%, a minimum limit of 14.5% and a maximum limit of 69.22%. The mean value of total investment as a ratio of GDP amounted to 25.8%, with a minimum limit of 5.5% and a maximum limit of 61.5%. The inflation rate recorded a mean value of 9.99%, a minimum limit of -9.79% and a maximum limit of 156.79%. The mean value of the number of inhabitants was 20.2 million, with a minimum of 0.6 million and a maximum of approximately 91.5 million. The change rate of imports had a mean value of about 5.56% with a minimum of -54.65% and a maximum of 116.5% while the change rate of exports recorded a mean value of about 4.73% with a minimum of -69.2% and a maximum of 217.4% approximately.

2.2 The case of Egypt taken separately (Time series)

The model for Egypt was:

$$\text{GDP growth}_{it} = ß_0 + ß_1 \text{Gov. Spending}_{it} + ß_2 \text{Gov. Spending}^2_{it} + \mu_{it}$$

Where GDP growth, i.e. the GDP growth rate, is the dependent variable; Gov. Spending stands for government spending as a ratio of GDP; while $ß_1$ and $ß_2$ represent the coefficients of the independent variables; $ß_0$ is the equation constant, t stands for the study period (1985-2015) and finally μ_{it} represents the random error term of the equation.

In order to obtain data concerning the total government spending index, the study resorted to the final accounts posted on the website of the Egyptian Ministry of Public Finance; and the economic growth rate index was obtained from the World Bank data. It is noteworthy that the study used different data sources for analyzing the time series of Egypt, on one hand, and for analyzing the panel data of the MENA Region including Egypt, on the other hand, in order to secure robust results.

Table (2) presents the descriptive statistics of the variables, as required for the time series analysis.

Table (2): Descriptive statistics of the variables in the case of Egypt

Variable	Obs.	Mean	Std Dev.	Max	Min
GDP growth	31	4.2541	1.6237	7.1521	1.0788
GDP Spending	31	43.155	10.441	73.301	33.306
GDP Spending^2	31	1967.9	1056.5	5372.9	1109.3

Table (2) shows that the mean value of the GDP growth rate was about 4.3% with a minimum of 1.1% and a maximum of 7.2% approximately; while the mean value of the ratio of government spending to GDP was about 43.2% with a minimum of 33.3% and a maximum of 73.3% approximately.

3. Methodology and estimated results

3.1. The case of the MENA Region

The study carried out the following steps for analyzing the panel data and checking the Scully curve applicability to the MENA Region:

The econometric package E-Views 9.0 was used to check the stationarity of the model variables and the integration order of each series in the model, in order to avoid a spurious regression and to determine the adequate econometric method of analysis. Hence, if all the variables are stationary at the level, the Pooled OLS technique, the Fixed effects Model, or the Random effects Model can be used. However, if all the variables are stationary at the first difference, then we can use Johansen's co-integration method. On the other hand, if the variables' results show different degrees of stationarity, such that some variables are stationary at the level and others are stationary at the first difference, then we can apply the co-integration method using the ARDL test.

For the Unit Root Test we used the PP-Fisher Chi-Square procedure.

Table (3) shows the results of this test.

Table (3): Unit Root test (PP-Fisher Chi-square) results

Variables	Level	Level	Result
	Intercept	Intercept and trend	
Y	290.087 (0.000)***		I(0)
X_1	54.2892 (0.042)**		I(0)
X_2	57.8529 (0.021)**		I(0)
X_3	53.221 (0.019)**		I(0)
X_4	102.96 (0.000)***		I(0)
X_5		53.03 (0.05)**	I(0)
X_6	649.145 (0.000)***		I(0)
X_7	585.964 (0.000)***		I(0)

Note: ***,**,* indicate the level of significance at 1%, 5% and 10% respectively.

From the results of Table (3), we find that all the variables used in the model are stationary at the level, meaning that they are integrated of the order I(0) at the level of significance of 1% and 5% respectively. This indicates the need to use the Pooled OLS technique, the Fixed Effects Model, or the Random Effects Model. We used the Random Effects Model while depending on the Hausman Test. We also used the HAC robust standard errors command to overcome the problems of heteroscedasticity and serial correlation between residues.

Table (4) shows the results of this test.

Table (4): Random effects (GLS) Results

Variable	Coefficient	Std error	t-statistic	Prob.
Constant	-8.250121	3.55873	-2.318272	0.0211**
X_1	0.586632	0.194644	3.013874	0.0028***
X_2	-0.00976	0.00274	-3.28053	0.0011***
X_3	0.11253	0.03269	3.44235	0.0005***
X_4	-0.012473	0.019637	-0.63518	0.5258
X_5	8.83E-9	1.91E-8	0.4616	0.6447
X_6	0.12011	0.02250	5.3334	0.0000***
X_7	0.25269	0.0190	13.0339	0.0000***
LSDV R-squared F-statistics	0.65232 62.3689	Within Durbin	R-squared - Watson	0.64121 2.4026
“Between” variance Breusch-Pagan test Hausman test			55.368 0.0723 3.696	0.055* 0.788 0.8147

Note: ***,**,* indicate the level of significance at 1%, 5% and 10% respectively.

The results in Table (4) prove the robustness of the model and its validity according to the statistical, economic and econometric criteria. Hence, P-value (Prob.) is found greater than the significance levels in all the test results, indicating that the estimated econometric model is free from the serial correlation and the heteroscedasticity problems. Moreover, these results indicate that the residues are normally distributed and that the adopted models have been formulated in an adequate functional form.

The value of R^2 is 65.23% and the adjusted R^2 equals 64.12%. Furthermore, the value of the DW-statistic is 2.4, confirming the absence of a serial correlation between residues.

The results of Table (4) also show that the variables were significant at the 1% level except for X_4 and X_5 which represent the inflation rate and the population figure respectively, which had an insignificant effect on GDP growth rate.

The previous results show the applicability of Scully curve to the MENA Region.

Furthermore, the results show that the optimum size (represented by the maximum limit of the curve) of government spending as a ratio of GDP amounts to 25.95%.

3.2. The case of Egypt (Time series)

The study proceeded to analyze time series and to check the Scully curve applicability to Egypt while using the econometric package E-Views 9.0 .

The first step in analyzing time series consisted in checking the stationarity of the variables used in the model and determining the integration order of each series in the model, in order to avoid a spurious regression and determine the adequate econometric technique to be used in the present case.

The analysis depended on the Augmented Dickey Fuller (ADF) test which is the most commonly used test in applied researches for detecting stationarity in time series analyses. Table (5) summarizes the results of the unit root test as follows.

Table (5): ADF- Unit root test results

Variables (Egypt)	/Level Intercept	/Level Intercept trend &	/First difference Intercept	/First difference Intercept & trend	Results
GDP growth	-3.0495 **(0.043)				I(0)
Gov. spending	-1.9797 (0.293)	-2.2864 (0.427)	-6.6229 ***(0.000)		I(1)
Gov. spending^2	-2,5021 (0.127)	-2.4377 (0.354)	-6.8356 ***(0.000)		I(1)
Critical values	Level	Level	First difference	First Difference	
1%	-3.2545	-4.2436	-3.6394	-4.2529	
5%	-2.9810	-3.5443	-2.9511	-3.5485	
10%	-2.6299	-3.2047	-2.6143	-3.2071	

Note: ***,**,* indicate the level of significance at 1%, 5% and 10% respectively.

From Table (5), we note that the time series used in the case of Egypt had different stationarity ranks. We found the GDP growth variable stationary at the level, i.e., integrated of order I(0) at the 5% level of significance; whereas the two other variables, Gov. Spending and Gov. Spending squared, were not stationary at the level, but stationary at the first difference. In other words, they became integrated of order I(1) at the 1% significance level. Therefore, we need to adopt the Bounds Testing approach which is based on the Autoregressive Distributed Lag (ARDL) method for testing co-integration.

We first checked the presence of a long-run balanced relationship between the model variables[4]. This characteristic was confirmed by the results of Table (6), as the value of the F-statistic calculated for the model exceeded the corresponding upper critical bound (UCB) value. Moreover, we checked the quality of the model used in the analysis and its being void of the different estimation problems by using Diagnostic Tests. The results of these tests are displayed in Table (7). We noted that the P-value (Prob.) was greater than the significance levels in all the test results. This indicates that the estimated econometric models are free from serial correlation between residues, and from the problem of heteroscedasticity. Moreover, the analysis shows that residues are normally distributed and that the used model has been formulated in an adequate functional form.

Table (6): Bounds testing results

Regressor: (K = 2)		F-statistic
GDP growth $_t$ = f(Gov. Spending $_t$, Gov. Spending $_t^2$) ARDL (4, 0, 1)		4.76673**
Significant level	Critical values bounds	Critical values bounds
	Lower critical bound (LCB)	Upper Critical bound (UCP)
10%	2.17	3.19
5%	2.72	3.83
2.5%	3.22	4.5
1%	3.88	5.3

Note: ***,** ,* indicate the level of significance at 1%, 5% and 10% respectively.

Given that the F-test does not have a standard distribution, we find two critical values for the statistics of this test: A lower critical bound (LCB) which assumes that variables are integrated of order I(0) and an upper critical bound (UCB) which assumes that variables are integrated of order I(1).

If the calculated value of the F-statistic is greater than the upper critical bound of the data set ($F^T > F^U$) then the null hypothesis will be rejected and the alternative hypothesis will be accepted, i.e., the presence of a co-integration relationship between the variables; and vice-versa. So if the calculated value of the F-statistic is smaller than the lower critical bound, then the null hypothesis will be accepted, thus indicating the absence of a co-integration relationship between the variables. However, if the calculated value of the F-statistic falls between the upper critical bound and the lower critical bound, then it will not be possible to decide whether or not a co-integration relationship exists between the variables.

Table (7): Diagnostic Tests

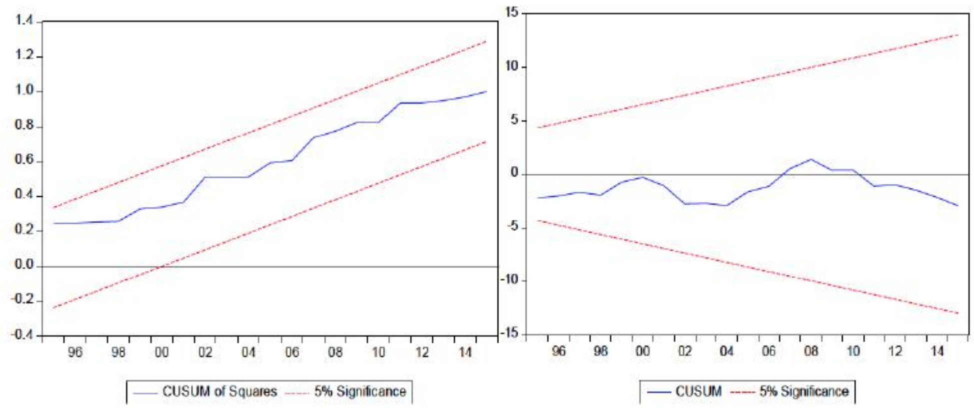
Diagnostic Test	Tests used	F-statistic		F-statistic (Prob)	
Heteroscedasticity	Breusch-Pagan-Godfrey	F(7,19)		1.3249(0.292)	
Serial correlation	Lagrange multiplier stat.	F(2,18)		0.7278(0.497)	
Normality	Jarque-Bera			1.6838(0.431)	
Function form	Ramsey RESET Test	F(1,19)		0.8168(0.424)	
Stability test	CUSUM			Stability	
	CUSUM of Squares			Stability	
R-squared	0.6189	Adjusted R-squared	0.50457	Durbin -Watson stat.	2.2265

Note: ***, ** ,* indicate the level of significance at 1%, 5% and 10%respectively.

In addition, key regression statistics show the high value of the coefficient of R^2 which is equal to 61.89%,while the adjusted R^2= 50.5%. Furthermore, the value of the DW-statistic is close to 2, thus confirming the absence of a serial correlation between residues.

Figure (1) shows the results of the cumulative sum of recurrent residues (CUSUM) test and the cumulative sum of the squares of recurrent residues (CUSUM of Squares) test (for checking the stability of regression models) which confirm the absence of structural changes in the used data; i.e. there were no leaps or sudden changes in the data through time.

Figure (1): CUSUM and CUSUM of Squares test:



Based on the above-mentioned results, the used model was deemed valid for estimating the long and the short-run relationship. Table (8) presents the estimation results.

Table (8): ARDL Regression estimation: (AIC) (4,0,1)

Variable	Coefficient	Std. error	t-statistic	Prob.
Long-run coefficients				
Gov. Spending	0.24181	0.0380	6.3627	0.000***
Gov. Spending^2	-0.00332	0.0009	-3.7496	0.001***
Error correction coefficient				
$Ø_i$	-0.87581	0.2256	-3.8828	0.001***
Short-run coefficients				
((D(*GDP growth (-1*	0.33421	0.1993	1.6771	0.109
((D(*GDP growth (-2*	0.54245	0.1857	2.9215	0.008***
((D(*GDP growth (-3*	0.28312	0.1574	1.7989	0.087*
(D(*Gov. Spending*	0.21178	0.0615	3.4436	0.003***
(D(*Gov. Spending*^{2}	-0.00423	0.0009	-4.345	0.000***

Note: ⋆⋆⋆, ⋆⋆,⋆ indicate the level of significance at 1%, 5% and 10% respectively.

The results in Table (8) show that variables were significant in the long-run at the 1% level and show the applicability of Scully curve to Egypt. Hence, government spending as a ratio of GDP had a significant and positive effect on GDP growth rate whereas the square value of that variable had a significant negative effect thus denoting that government spending in Egypt takes the shape of an inverted U-curve. Consequently, it was found that the optimum size (represented by the maximum limit of the curve) of government spending as a ratio of GDP amounts to 36%.

We also discovered that the Error Correction Model[5] ECM(-1) was significant and negative, denoting that the error correction mechanism is present in the model and that the relationship is stable in the long-run. This result is consistent with the results of the CUSUM and CUSUM of Squares tests.

4. Conclusion

The main objective of this study was to investigate the extent of the applicability of Scully curve to Egypt in particular and the MENA Region as a whole during the period 1985-2015. The study revealed that in Egypt, the relationship between government spending as a ratio of GDP and the economic growth rate takes the same inverted U-shape as the Scully curve. However, the optimum ratio (which would maximize the economic growth rate) of government spending to GDP was estimated at 36%.

Similarly in the case of the MENA Region, the study revealed that the relationship between government spending as a ratio of GDP and the economic growth rate takes the same inverted U-shape as the Scully curve. The optimum ratio (that would maximize the economic growth rate) of government spending to GDP was estimated at 25.95%.

Footnotes

(1) Scully curve expresses the relationship between government spending (as a ratio of GDP) taken on the horizontal axis, and the economic growth rate on the vertical axis. This curve has an inverted U-shape and shows that the economic growth rate reaches its peak at the turning point of the curve when government spending as a ratio of GDP does not exceed 25% to 26% after which the curve starts declining. See: Scully, G., (1989), The Size of the State, Economic growth and the Efficient Utilization of Natural Resources. Public Choice 63: 14964-.

(2) It is noteworthy that the model has been re-estimated using balanced panel data through deleting the missing data years (i.e., the government spending data); therefore the study period became 1990-2015. The study revealed the same results as those reached in the above-stated estimation (concerning the significance of the relationship and the inverted U-shaped curve); however, the optimum rate (realizing the maximum limit of the curve) of government spending as a ratio of GDP was found to be 38.1% approximately.

(3) The study sample included the following countries: Jordan, the Comoros, Algeria, Bahrain, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Iran, Tunisia, The Arab Emirates, Yemen, Djibouti, Syria, Egypt, Israel, and Mauritania.

(4)It is noteworthy that in the case of Egypt, due to the availability of data starting from Year 1980, the relationship between government spending and economic growth was estimated during the period (1980-2015) in order to check the extent of the Scully curve applicability during that period. The natural logarithm of the dependent variable was used, and the analysis revealed that the relationship takes an inverted U-shape; however, the optimum size (required to maximize economic growth) of government spending as a ratio of GDP was 38.95%.

(5) The Error Correction Model (ECM) has two important functions. Firstly, it estimates short-run variables; and secondly, it expresses the error correction term (ECT) which is represented by % in the previous equation and this term measures the speed of disequilibrium adjustment in the short-run towards equilibrium in the long-run. It has to be significant and negative to evidence the stability of the relationship in the long-run, i.e. to prove that the error correction mechanism is present in the model.

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