

The impact of the budget deficit on economic growth in Egypt through applying the Threshold Regression Model

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Abstract

This study examines the impact of the budget deficit on economic growth in Egypt during the period from 1995/1996 to 2020/2021. We apply the Threshold Regression Model by identifying three threshold levels of budget deficit: 1) base threshold level -9.5 , 2) decreased threshold from -9.5 to less than 1% , and 3) positive surplus of 1% . Our results indicate that the relationship between budget deficit and the growth in GDP is not consistently a linear one depending on the deficit level. In threshold one where the deficit level is -9.5 , the impact on the growth in GDP is a decrease of 0.265 for each one percent increase in the deficit. In setting two where the threshold level is less than -9.5% to zero deficits, the decline in GDP increased to 0.650 . In the last setting where there is a surplus in the budget, the relationship between GDP and the budget turned positive to 2.14 percent for each one percent of budget surplus. The findings of this study have crucial implications for the government of Egypt in managing the budget and public debt. If the country plans for achieving economic growth, it is necessary to keep budget surplus at one percent or higher.

Keywords:

Budget deficit, economic growth, Threshold Regression Model, the first threshold and the second threshold.

I. Introduction:

One of the most prominent problems faced by the fiscal policy makers, within the whole economic policy, is the deficit in the budget of the state. The deficit in the budget deficit does not only indicate a shortage in the amount of public revenues compared to public expenditures, but it also signals the inability of the state to allocate resources for economic development in a particular year. Consequently, we believe that the public budget deficit and the resulting accumulation of the amount of public debt are the most important aspects of the fiscal policy of the state. The public budget deficit has its compounded impact on the economic activity since servicing the debt increases the amount of national expenditure. The budget deficit dilemma is one of the most important economic problems because it directly affects the performance of economic activity, and the deficit in the general budget threatens the monetary and financial stability of various countries, which led to the deterioration of the purchasing power of the national currency of the majority of countries and the decrease in living standards, and the increase in internal and external debts.

The deficit of the weight in Egypt in recent years exceeded the 7.3% barrier, in 2021 and the economic growth rate is 3.3% especially with the increase in the size of public debt and the increase in debt expenses in a large and large way, and from here comes the importance of the lesson because it deals with the impact of the budget deficit on economic growth in the Egyptian economy, as the increase in the deficit and its continuation has become a worrying phenomenon in the years. The latter while economic growth aims to be a fundamental goal of governments and also a goal for many economic policies and changes.

Based on the above arguments, we believe that reducing the public budget deficit in Egypt is a major goal for the fiscal policy makers. In fact, reducing the deficit was the main motive of the Egyptian economic policy makers to initiate and implement the economic reform program in the period 1990 to 2000.

Research problem and methodology:

The literature on the relationship between budget deficit and economic growth is inconsistent and empirical studies do not show a clear and direct association. For instance, Huymh (2007) in reviewing some studies that dealt with the issue of the budget deficit and economic growth, found that some studies report a negative relationship between budget deficit and economic growth. On the other hand, Pekarski (2011) reports a positive relationship between budget deficit and a country's economic growth. This study extends our understanding of the relationship between the budget deficit and economic growth with application on the Egyptian budget deficit/surplus. In particular, we answer the following question:

Is there a relationship between budget deficit and the economic growth in Egypt?

In examining this relationship, we utilize the standard statistical procedures that have been used in prior research known as the Threshold Regression Model (TR). This procedure enables the research to identify the nature of the relationship whether it is a positive or negative one, and whether it is a linear or non-linear one. to measure the impact of the public budget deficit on economic growth in Egypt. Thus, the GDP growth rate was used as a dependent variable to measure the economic growth, and the public budget deficit was used as a percentage of gross domestic product (Deficit) as an independent variable in the model. We examine this relationship using the deficit as a percentage of GDP .The data of the variables of interest are obtained from the Central Bank of Egypt and National Bank of Egypt for the period of 1995/1996 to 2020/2021.

II. Literature Review

Theories explaining the relationship between the budget deficit and economic growth:-There are many theories that tried to explain the relationship between the budget deficit and economic growth; There are studies that support the existence of a negative relationship between them and another that supports the existence of a positive and another relationship that you see there is no relationship that has to have them and we will review these studies:

1 Support theories of a negative relationship

The neoclassical theory sees that the budget deficit prolonged the economy in a long time, as the deficit leads to a reduction in the tax burden and then consumption increases and interest rates increase due to low savings and because of the budget deficit this deficit is funded by loans, which leads to crowding out public spending for private investment, which leads to influence The negative on the economic growth. (Siddique and Malik, 2001)

2 Support theories of a positive relationship

The relationship between the budget deficit and economic growth from the perspective of the Keynesian theory is different, as Keynes theory differs altogether and in detail from the theory that precedes it in appearing (classic theory), where Keynes rejected the market law for markets and represents one of the classics beliefs, and denied the classic the hidden hand mechanism that they believe in In addition to denying the assumption of the full operation of the classic and Keynes acknowledged the realism of compulsory unemployment; That is why Keynes suggested that the state intervene to achieve full employment, and Keynes dropped the principle of flexibility that the classic assumed (for wages and prices), explaining the growth of trade unions, as Keynes called for the state's intervention to achieve the economic balance, and from achieving this the state has become obliged to interfere in economic affairs. Keynes also called for not to adhere to the principle of the balance of the general budget; Explaining that the budget deficit is desirable in it as long as it leads to the level of operation and output, when a imbalance between the supply and demand occurs, the unemployment occurs, and this unemployment can be eliminated through financing with the deficit by increasing public spending until stability is achieved and on the other side when the economy is exposed to inflation It can be overcome by achieving a surplus of public revenues by increasing taxes and reducing public spending; In summary, Keynes indicated a positive relationship between the budget deficit and economic growth (Anai, 2014).

-3 Support theories of a lack of relationship

Ricardua denied the existence of any effect of the deficit on the changes in the total economy, indicating that the deficit is merely a postponement of taxes and causes a decrease in public savings in exchange for increasing private savings, which Ricardua indicated that the deficit has no significant impact on savings, investment and growth and these assumptions led to me Criticism of the theory for its dependence on a set of strict assumptions and non -applicable (Obaid, Heba, Hashish, 2020).

Fadiala&Rabih (2020) tested the impact of the public budget deficit on economic growth in Algeria in different time span settings: short and long term using the ECM model in the period from 1990-2016. The study concluded that the relationship between the two variables is a direct relationship in the long and short terms. This conclusion is consistent with the Keynesian school, which attributes the budget deficit to an increase in the volume of government expenditure, leading to an increase in the volume of aggregate demand. In addition, Obeid&Hashish (2020) using a two- way causal relationship, examined the relationship between the public budget deficit and economic performance in Egypt in the period from (1990- 2018). The study concluded that there is a direct relationship in the short and long term between the actual total deficit, the gross domestic product and the rate of GDP growth> The study further reports that an inverse relationship in the two terms between the actual total deficit, net exports, foreign direct investment, inflation rate and unemployment rate.

Another study by Al-Banna (2020) investigated the relationship between the budget deficit and GDP growth in Egypt and identifying the main drivers of the changes in GDP. This study concluded that the variables of money supply and exchange rate are positively correlated with changes in GDP, while interest rate and budget deficit have negative relationship with GDP. On the other hand, the study by (Ben El-Bar, 2019), which measured the impact of the public budget deficit on economic growth in Algeria using the (ARDL) model, proved that there is a co-integration between economic growth and the public budget deficit. In addition, there is a direct relationship between the two variables, as a rise in the budget deficit by 1% leads to an increase in the economic growth rate by 825%.

In multi-country settings, Karras (2019) utilizing a theory of twin deficits: the budget deficit and the current account deficit from 17 countries during

the period (from 1870 to 2013). The study found out that there is an inverse relationship between the two deficits. Moreover, the results indicated that there is a rate of 1% of GDP causes a gradual decrease or (increase) in the current account balance that reaches its peak after a year of about 0.25% of GDP. Reducing the trade deficit by 1% of GDP requires a reduction in the budget deficit by 4% of GDP and that the fiscal policy should employ multiple mechanisms to develop economic growth.

The study of Arabzodeh(2021) was based on knowing the relationship between wages and the budget deficit using a group of 18 major countries in the Organization for Economic Cooperation and Development in the period (from 1980 to 2014). This study used the ARDL model and found out that there was the centralization of wages that related to the budget deficit and this negative relationship is clear in the Long run not the short run. Moreover, there is a relationship between the centralization of wages and the budget deficit related to wages in various economic sectors.

The study of (Xie& Chan, 2014) aimed at knowing the causal relationship between the government current account deficit and the general budget deficit in 11 countries of Organization for Economic Co-operation and Development through the Granger-Panel causal analysis and to identify the relationship between the two deficits. The results indicated that there is a two-way relationship between the current account deficit and the government budget deficit for the 11 countries, which follows the hypotheses of the twin deficit theory. The study of (Keigo Kameda, 2014) aimed at analyzing the relationship between the budget deficit, public debt and interest rates using data on Japan. The study concluded that the ratio of public debt to GDP does not raise interest rates and that the budget deficit has impacts on public debt, which is consistent with the views of (Feldstein 86) and that long-term interest rates are affected by the expectations of issued bonds, meaning that the expected budget deficit is more important than the current deficit.

The study of (Pekarski, 2011) aimed at knowing the relationship between the state budget deficit and inflation. This study showed that there are many channels in which inflation affects the real budget, and that most of these channels are budget revenues through tax collection, meaning that the issue

of budget deficit can be traced back to a financing problem. Moreover, while there are some economies in which there are high inflation rates and has no financing issues, it shall be necessary to know the main reason for the deficit of the state's general budget. The study of (Glougnaros & Kolluri, 2010) was based on the use of the (OLS) approach on the Fisher model and the IS-LM model. This study used data from several countries (from 1965 to 1985) and the study concluded that there is an indirect relationship between the public budget deficit in those countries and the interest rate, but there is a direct relationship between the budget deficit and other variables, including economic growth. The study of (Oscar et al., 2006) also based on examining the sustainability of the budget deficit in the long term and its impact on fiscal policies in Spain. The study used annual data (from 1964 to 2003) and quarterly data (from 1982 to 2004). The study concluded that there is a non-linear relationship between government expenditures and revenues, and that fiscal policies could not remedy the budget deficit unless long-term fiscal policies were used. The study of (O. Bajor-Rubio, 2006) aimed at examining the long-term sustainability of the public budget when fiscal policy has an effective role in remedying the budget deficit in Spain, a country with fiscal consolidation that has faced the problem of fiscal sustainability in recent years. The results have concluded that fiscal policies will reduce the budget deficit if this deficit is on long-term and if this deficit is 5.30% of the GDP for the general deficit and 7% of the GDP for the central deficit

The research gap is the scarcity of studies that dealt with the non-linear relationship between the budget deficit and economic growth, but rather, there are no studies on Egypt that dealt with the non-linear relationship, as most studies focused on the linear relationship, whether direct or reverse between the budget deficit and economic growth, as well as no study of the same. The modern and new research period in this study, in addition to the precedent, is to determine the amount of the threshold of the coup, then the relationship between the budget deficit and economic growth turns back to expulsion..

III. Research Methodology

The theoretical framework for the Threshold Regression Model

Several studies such as (Bai, Perron, 1998), indicate that the non-linear observations observed in data series need to introduce system switch models, as the increasing shift to nonlinear models drew attention to develop regression models known as threshold models. Among the main applications of Threshold Regression Models (TR), we find: Segmented sampling (SS) models, multiple equilibrium (ME) models, Markof switching (MS) models, the Smooth Transition Auto regressive (STAR) models, the Self-Exciting Threshold Auto regression (SETAR) models, and the Threshold Auto regression (TAR). (Khuwaild et al., 2019).

Description of the used methodology

This study is based on the use of the Threshold Regression Model developed by the study of (Hansen, 2000). As the Threshold Models have a variety of applications in economics, whereas direct applications include models for separation and multiple equilibrium, and other applications including experimental threshold segmentation. The general idea of the threshold models is to find a number of different partial models through the total model, and that each of these partial models operates in a different case space separated from the rest of the other models. Moreover, these spaces are divided according to what is known as the threshold variable. In the case of turbulent time-lapse observations, that is, there is a state of rise and fall in the value of observations, which is the dominant case in practical reality, each observation from the set of consecutive time-lapse observations can belong to a different partial model because the normal threshold models are in fact depending on a horizontal threshold (Mahmoud, 2020).

Model estimation steps using the Threshold Regression Model

First: Unit root test if there is a refraction point

The variable that has a refraction point in the case of belonging to the system before the refraction point takes the value (0) and in the case of belonging to the system after the refraction point takes the value (1).

- **Unit root test results if there is a refraction point using (ADF)**

Table number (1) Unit root test results if there is a refraction point

Variable	Level	1th different		Refraction Point (year)			
	Prob	t-stat	Refraction Type	Prob	t-stat	Refraction Type	
GDP	<0.01	- 5.83	Fixed	0000	0000	0000	2010
DEFICIT	<0.01	- 6.45	Fixed	0000	0000	0000	2009
FINDEFICIT	<0.01	- 4.76	Fixed	0000	0000	0000	2009

Source: Prepared by the researcher using Eviews9 program.

Through the table, it is clear that variables GDP, DEFICIT and FINDEFICIT are stable at level (0) and Statistical significance 1%.

Second: Threshold Regression estimation

Through the result of the unit root test, we noticed the presence of structural refraction points in the time series of the model, and therefore we will use the TR model, which is used to estimate models with structural refractions, which is a non-linear model.

This paper will estimate two models, the first model in which the public budget deficit as a percentage of GDP (DEFICIT) is the threshold variable, while in the second model, the value of the fiscal deficit in billions of dollars (FINDEFICIT) is the threshold variable

1- The first model:

According to this model, goods and services exports will be the threshold variable in the model, and the model will take the following form:

$$\text{GDP}_t = \begin{cases} \alpha_0 + \alpha_{11} \text{DEFICIT}_t + \Sigma_t & \text{If DEFICIT} < C \\ \alpha_0 + \alpha_{12} \text{DEFICIT}_t + \Sigma_t & \text{If DEFICIT} \geq C \end{cases}$$

Whereas, α_{11} is specifically indicated with t in DEFICIT in the first system (before reaching the threshold), while α_{12} is specifically indicated with t in DEFICIT in the second system (after reaching the threshold), while (C) is the threshold value.

Before estimating the model, we will perform the Bai-Perron test to determine the optimal number of systems for the model, and the result is shown in the following table

Table number (2) Bai-Perron test results for the first model

Threshold Specification
Description of the threshold specification used in estimation
Equation: UNTITLED
Date: 02/10/22 Time: 13:11
Summary
Threshold variable: DEFICIT
Estimated number of thresholds: 2
Method: Bai-Perron tests of L+1 vs. L sequentially determined
Thresholds
Maximum number of thresholds: 5
Threshold data values: -9.5, 1
Adjacent data values: -9.8, -1.3
Thresholds values used: -9.5, 1
Current threshold calculations:
Multiple threshold tests
Bai-Perron tests of L+1 vs. L sequentially determined thresholds
Date: 02/10/22 Time: 13:11
Sample: 1 26
Included observations: 26
Threshold variable: DEFICIT
Threshold varying variables: DEFICIT

Threshold test options: Trimming 0.15, Max. thresholds 5, Sig.

level 0.05

2 Sequential F-statistic determined thresholds:			
Critical Value**	Scaled F-statistic	F-statistic	Threshold Test
8.58	15.65599	15.65599	0 vs. 1 *
10.13	13.92899	13.92899	1 vs. 2 *
11.14	10.87656	10.87656	2 vs. 3

* Significant at the 0.05 level.

** Bai-Perron (Econometric Journal, 2003) critical values.

Threshold values:

Repartition	Sequential	
-9.5	1	1
1	-9.5	2

It is clear from the previous table that at a level of significance of 5%, that the optimal number of systems for the model is 3, which means that there are 2 thresholds.

When estimating this model by using the Eviews9 program, the results were as follows

Table number (3) Threshold Regression results for the first model

Dependent Variable: GDP

Method: Threshold Regression

Date: 02/10/22 Time: 13:07

Sample: 1 26

Included observations: 26

Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined

Thresholds

Threshold variable: DEFICIT

Threshold selection: Trimming 0.15, Max. thresholds 5, Sig. level 0.05

Threshold values used: -9.5, 1

Prob.	t-Statistic	Std. Error	Coefficient	Variable
DEFICIT < -9.5 -- 7 obs				
0.0008	-3.866030	0.068649	-0.265401	DEFICIT
-9.5 <= DEFICIT < 1 -- 16 obs				
0.0000	-8.440649	0.077084	-0.650641	DEFICIT
1 <= DEFICIT -- 3 obs				
0.0004	4.098769	0.523237	2.144628	DEFICIT

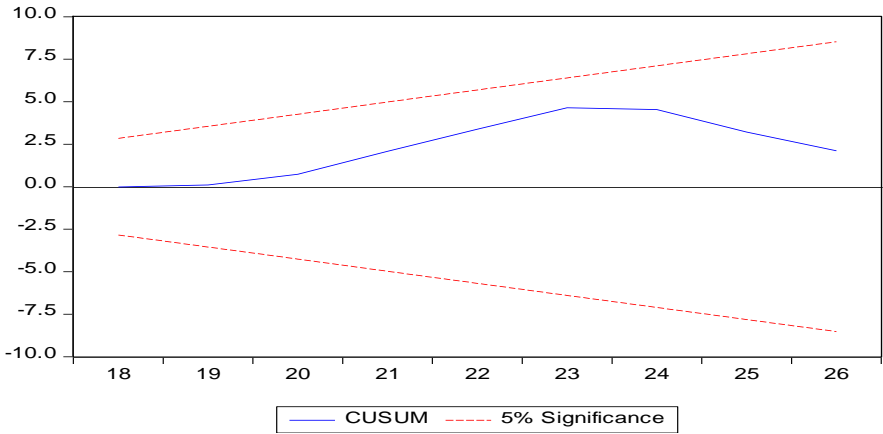
It is clear from the previous table that the threshold value (C) is -9.5% and that the value of α_{11} which is the DEFICIT parameter before reaching the threshold amount is -.265 and that it has a statistically significant and that the value of α_{12} which is the value of the DEFICIT parameter after exceeding the threshold level is -.650 and that it has a statistically

significant but provided that the financial deficit as a percentage of GDP is less than 1%, and if the financial deficit as a percentage of GDP is greater than 1%, meaning there is a surplus, then α_{12} equals 2.14 and that it has a statistically significant. This means that the general budget deficit has a positive impact on GDP growth in Egypt. However, this Impact varies according to the value of the public budget deficit, as before reaching the level of -9.5% of GDP, the impact of the budget deficit is significantly negative, as an increase in the public budget deficit by 1% leads to a decrease in economic growth by 26%. However, after exceeding the level of 9.5% and decreasing the deficit (the first threshold level) and before reaching a surplus of 1% (the second threshold level), the impact of the budget deficit will also be negative, as the increase in the public budget deficit as a percentage of GDP leads to a decrease in growth the economic growth in Egypt by .65 percent, and after exceeding the second threshold, which is to achieve a surplus of 1%, the impact of the public budget deficit is positive on economic growth in Egypt, as an increase in the surplus in the public budget by 1% leads to an increase in economic growth by 2.14%.

- **Model stability test:**

The (Cwsum) test is carried out for the cumulative sum of the residuals, and the stability of the estimated parameters is achieved if the graph of the (Cwsum) test falls within the critical limits at the level of significance of 5%

Shape number (1) Cwsum result test for the first model



The second Model:

In this model, the financial deficit in billion dollars will be entered as a threshold variable, and the form of the model shall be as follows:

$$\text{GDP}_t = \begin{cases} \alpha_0 + \alpha_{11} \text{FINDEFICIT}_t + \Sigma_t & \text{If } \text{FINDEFICIT} < C \\ \alpha_0 + \alpha_{12} \text{FINDEFICIT}_t + \Sigma_t & \text{If } \text{FINDEFICIT} \geq C \end{cases}$$

Whereas, α_{11} is specifically indicated with t in FINDEFICIT when FINDEFICIT is less than the threshold level, while α_{12} is specifically indicated with t in FINDEFICIT when FINDEFICIT is greater than the threshold, while (C) is the threshold value and it is the value at which the model system changes. Accordingly, the results were as follows:

Table number (4) Bai-Perron test results for the second model

Threshold Specification

Description of the threshold specification used in estimation

Equation: UNTITLED

Date: 02/10/22 Time: 13:23

Summary

Threshold variable: FINDEFICIT

Estimated number of thresholds: 2

Method: Bai-Perron tests of L+1 vs. L sequentially determined

Thresholds

Maximum number of thresholds: 5

Threshold data values: -13.22, 0.83

Adjacent data values: -17.69, -0.62

Thresholds values used: -13.220001, 0.82999999

Current threshold calculations:

Multiple threshold tests

Bai-Perron tests of L+1 vs. L sequentially determined thresholds

Date: 02/10/22 Time: 13:23

Sample: 1 24

Included observations: 24

Threshold variable: FINDEFICIT

Threshold varying variables: FINDEFICIT

Threshold test options: Trimming 0.15, Max. thresholds 5, Sig.

level 0.05

2 Sequential F-statistic determined thresholds:			
Critical Value**	Scaled F-statistic	F-statistic	Threshold Test
8.58	10.41995	10.419950	vs. 1 *
10.13	19.69399	19.693991	vs. 2 *
11.14	6.572293	6.5722932	vs. 3

* Significant at the 0.05 level.

** Bai-Perron (Econometric Journal, 2003) critical values.

Threshold values:		
Repartition	Sequential	
-13.220001	-13.220001	1
0.82999999	0.82999999	2

It is clear from the previous table that at a level of significance of 5%, that the optimal number of systems for the model is 3, which means that there are 2 thresholds.

Table number (5) Threshold Regression results for the second model

Dependent Variable: GDP

Method: Threshold Regression

Date: 02/10/22 Time: 13:22

Sample (adjusted): 1 24

Included observations: 24 after adjustments

Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined

Thresholds

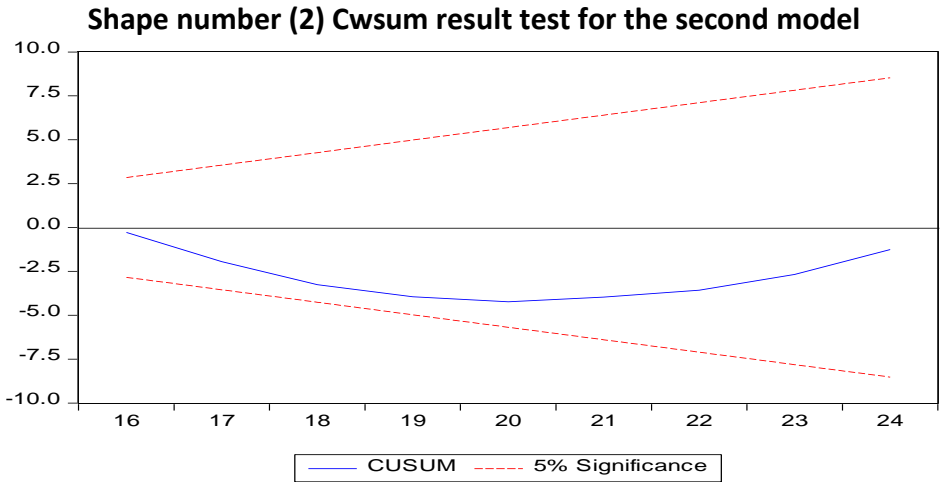
Threshold variable: FINDEFICIT

Threshold selection: Trimming 0.15, Max. thresholds 5, Sig. level 0.05

Threshold values used: -13.220001, 0.82999999

Prob.	t-Statistic	Std. Error	Coefficient	Variable
FINDEFICIT < -13.220001 -- 10 obs				
0.0002	-4.526752	0.023475	-0.106265	FINDEFICIT
-13.220001 <= FINDEFICIT < 0.82999999 -- 11 obs				
0.0000	-6.247818	0.097143	-0.606930	FINDEFICIT
0.82999999 <= FINDEFICIT -- 3 obs				
0.0021	3.510258	0.618045	2.169496	FINDEFICIT

It is clear from the previous table that the threshold value (C) is -13.2% and that the value of α_{11} which is the FINDEFICIT parameter before reaching the threshold amount is -.106 and that it has a statistically significant and that the value of α_{12} which is the value of the FINDEFICIT parameter after exceeding the threshold level is -.606 and that it has a statistically significant but provided that the financial deficit is less than 0.82 billion dollars, and if the financial deficit in billion dollars is greater than 0.82 billion dollars, meaning there is a surplus, then α_{12} equals 2.16 and that it has a statistically significant. This means that the general budget deficit has a positive impact on GDP growth in Egypt. However, this Impact varies according to the value of the public budget deficit, as before reaching the level of -13.2 billion dollars, the impact of the budget deficit is significantly negative, as an increase in the public budget deficit by 1% leads to a decrease in economic growth by .106%. However, after exceeding the level of 13.2 billion dollars and decreasing the deficit (the first threshold level) and before reaching a surplus of 0.82 billion dollars (the second threshold level), the impact of the budget deficit will also be negative, as the increase in the public budget deficit leads to a decrease in growth the economic growth in Egypt by .60%, and after exceeding the second threshold, which is to achieve a surplus of 0.82 billion dollars, the impact of the public budget deficit is positive on economic growth in Egypt, as an increase in the surplus in the public budget by 1% leads to an increase in economic growth by 2.16%.



IV. Results

After conducting the standard study, the study reached the following results:

If the fiscal deficit as a percentage of GDP decreased and turned into surplus that is $> 1\%$, this means that the budget deficit has a positive impact on the growth of GDP in Egypt.

1. The impact of the fiscal deficit varies according to the value of the budget deficit before reaching the level of -9.5% of the GDP, the impact of the budget deficit is negative, but with increasing the budget deficit by 1% leads to a decline in economic growth by 0.26% . Moreover, after the level of -9.5% and before reaching a surplus of 1% , the impact of the budget deficit is greatly negative. With increasing the budget deficit that will lead to a decrease in economic growth by 0.65% , but after achieving a surplus of 1% , an increase in the budget deficit by 1% leads to an increase in economic growth by 2.14% .

V. Conclusions and recommendations

In general, there is a non-linear relationship between the public budget deficit and economic growth in Egypt, and the cut-off point is the decrease in the deficit and its transformation into a surplus greater than or equal to 1% of GDP, then the relationship turns from an inverse to a direct relationship between the budget deficit and economic growth in Egypt.

The Egyptian government needs to find ways to increase the volume of sovereign revenues to achieve a surplus, such as increasing the volume of tax revenues, by expanding the tax base and fighting tax evasion .

Determining the optimal size of government expenditure, whereby the budget deficit can be reduced by reducing the volume of unproductive expenditure and rationalizing the size of government expenditure.

The need to search for new means of financing for the budget (developing investment projects capable of achieving a return commensurate with their cost).

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