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IMPACT OF POLITICAL INSTABILITY ON ECONOMIC GROWTH IN THE MENA COUNTRIES: AN APPLICATION OF THE ARDL BOUND TESTING APPROACH

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Abstract:
This study investigates and analyses the profound impact of political stability on Gross Domestic Product (GDP), measured in 2010 constant US dollars, across selected Middle East and North Africa (MENA) countries, specifically Egypt, Libya, Tunisia, and Algeria. The analysis covers an extensive historical period from 1980 to 2018, providing a comprehensive view of the long-term trends. This study employs the Auto-Regressive Distributed Lags (ARDL) econometric approach, originally proposed by Pesaran et al. (2001), which is particularly suitable for examining cointegration and dynamic relationships in time-series data. Rigorous empirical testing demonstrates and confirms the existence of a significant long-term relationship between political instability and economic growth, highlighting how fluctuations in stability can influence the overall economic performance of nations.
Keywords: Political Instability, Economic Growth, Autoregressive Distributed Lag (ARDL), Arab Countries.

1. INTRODUCTION

Political stability plays an important role in the economic development of a country. Political instability is defined as the propensity to execute change by "constitutional" or "unconstitutional» means. In addition, there are a variety of sources of political instability, which are rooted in terrorism and social and ethnic conflict.

Terrorism is defined as political violence against civilian populations, whose objective is to maximise the external and internal disruption of countries. Bounan[1] (2003) defines terrorism as "the set of criminal operations, of a variable nature and importance, intended to intimidate a population to obtain special privileged persons." It is possible to distinguish between two forms of terrorism: state terrorism, which manifests when the state seeks to control the resistance of what it considers a rival for the control of power. Thus, that is individual terrorism, used by social groups to achieve a political goal that actually affects some person.

[1]Bounan M., (2003) : « Logique de Terrorisme » Edition Allia, Paris.

In addition, 'international terrorism' refers to dangerous or violent phenomena affecting the internal stability of people, such as the violation of state criminal law. These phenomena destabilise civil life and government policies. In recent years, the world has experienced international terrorism, which is evidence of the development of collaboration between terrorist movements or ethnic and religious claims. The use of terrorism is linked to both social and economic imbalances, and its political consequences can lead to dangerous assessments that globalise risk.

Ethnic and social conflict: Conflicts are manifested by social conflicts and civil wars that affect a country and cause deterioration of human development and economic growth. Social conflict arises from social organisation itself, which is based on the differentiation of economic, social, and political disparities. Conflicts are manifested by social conflicts and civil wars that affect a country and cause deterioration of human development and economic growth. Social conflict arises from social organisation itself, which is based on the differentiation of economic, social, and political disparities. Lipset (1960) described the concept of political instability. He said, "A country is considered stable if it is a democracy or a liberal dictatorship and consistent for 25 years," but the recent school of political and economic thought has changed the tradition of political instability and defined the approach to political instability. The main concept is that the effectiveness of the government system depends primarily on the coherence of a strong political government. A government is considered inefficient if its policy goals vary over a short period. An unstable political system hinders economic growth. The relationship between economic progress and political volatility can be examined in two ways. First, a politically unstable environment creates uncertainty and volatility, which reduces private investment and slow growth. Second, political uncertainty changes the nature of investments and the pattern of spending, which has a direct effect on economic growth rather than on investment (Asteriou and Price, 2001). The possibility of a change in government threatens future policies and encourages investment elsewhere in a safe place rather than in a risky environment (Gupta,1990; Barro, 1991; Alesina et al., 1996; Perotti,1996; Ades and Chua, 1997). Since 2011, in almost all Arab countries, mass protests ending the widespread idea of Arab exceptionalism[1] have, to everyone's surprise, resulted in the fall of four dictators (Tunisia, Egypt, Libya, and Yemen) and the precipitous political reforms in many countries in the region. The remainder of this paper is organised as follows: Section 2 presents the literature review; Section 3 describes the data and variables and explains the econometric methods; and Section 4 concludes the paper.

2. LITERATURE REVIEW

The fall of the political system has aroused researchers' interest and prompted a closer examination of the effect of political uncertainty on economic progress and GDP growth rate. Over the last few decades, the question of whether political instability influences the rate of economic growth has become an important query for economists and policymakers. Such interest stems primarily from the important policy implications related to the desired actions that can accelerate economic growth and prosperity. Empirical studies on this issue have provided conflicting results, which have been reported in the literature. There is no consensus among economists and policymakers on the nature of the relationship between these variables and economic growth in Nigeria. Various econometric techniques have been used to examine this topic. In the following sub-sections, we provide a brief review of studies that have addressed the nexus between political instability and economic growth.

Various studies have examined the existence of an inverse relationship between political volatility and economic performance. Alesina and Perotti (1996) indicated that, with respect to private investment, political instability leads to low growth, creating risk and uncertainty in the country and resulting in a reduction in the volume of investments. The size of the investment decreases, and the level of output also decreases, reducing the size of employment, low incomes, and high prices and stimulating inflation in capital markets and goods. Due to this reduction in national productivity, pressure is shifting more towards imports, which could reduce the size of the currencies. The empirical literature on the relationship between political instability and economic growth is relatively recent because of missing data. Political turmoil may be responsible for low economic growth rates (Kuznets, 1966), especially during government changes. North (1990) stated that the institutional framework of a society plays an important role in the performance of the economy in the long run. Similar studies provide a theoretical link between political instability and economic growth (Benhabib and Rustichini, 1996; Brock and Blomberg,1996; Svensson,1998; Devereux and Wen, Wen,1998; Darby et al.,2004; Ghate et al., 2003).

Jong-A-Pin (2009) examined the multidimensional nature of political instability (an exploratory factor analysis on a set of 25 indicators of political instability). He finds political instability in four dimensions: politically motivated violence, mass civil protests, instability in the political regime, and instability of the political regime. This determines the causal impact of political instability on economic growth (the use of GMM) and proves that the four dimensions have negative effects on economic growth. Political regime instability has a robust and significant negative effect on economic growth. The empirical results verified that the first two dimensions are challenges to the political regime, while the last two represent real changes in the government and political system (similar to Sanders, 1981). Political regime instability (and not instability within the political regime) refers to the uncertainty that investors face regarding the security of property rights (Svensson, 1998). Darby et al. 's (2004) prediction shows that political instability within governments reduces the likelihood of re-election, which leads to lower public investment and a lower economic growth rate. Paradoxically, according to the model of Besley et al. (2005). Jong-A-Pin (2009) found evidence of inverse causality.

Economic growth stimulates instability in the political system; thus, a lack of growth triggers politically motivated violence. Thus, we can see that democracy (or political competition) triggers economic growth, but it has feedback effects (and vice versa). According to Kuznets (1966, 1973), technological progress is necessary for economic growth, although it must be accompanied by liberal democratic institutions that provide citizens with political freedom and allow them to participate in political processes. In general, the interactions between political instability and economic growth can be classified into four categories. First, the economic literature argues that political instability negatively impacts economic growth, but there is no causality in the opposite direction (Alesina et al., 1996).

Other evidence suggests that economic growth leads to political stability, but not vice versa (Borner and Paldam, 1998). Another trend in the literature is that the causal relationship between political instability and economic growth works both ways (Zablotsky, 1996; Gyimah-Brempong Traynor, 1999). Other studies have verified the absence of a causal relationship between the variables (Campos and Nugent, 2002).

There is extensive literature examining the effects of political instability on economic growth. This reveals several reasons why higher degrees of political instability can cause lower rates of economic growth. Political instability damages key macroeconomic variables such as investment, unemployment, and inflation (Rodrik, 1991). The linkage is straightforward, as political instability implies future risk, which lowers investments and hence impacts the growth of an economy both contemporaneously and over the longer horizon. Furthermore, a politically unstable economy is likely to cause corruption and other distortive activities. Therefore, political instability is likely to negatively impact economic growth.

Utilising panel data from approximately 100 countries, Aisen and Veiga (2008) found that higher inflation volatility is associated with higher degrees of political instability, ideological polarisation, and fragmentation of the political system, and lower economic freedom. They further argue that economic policies in politically unstable countries tend to be discontinued more frequently than in countries that are more politically stable. Such discontinuity in economic policies results in volatile inflation rates. Recognising the high costs of inflation volatility in terms of economic growth and welfare, they urged policymakers in developing countries to improve institutions and create practical mechanisms favourable to long-run price stability. Clearly, such discontinuity in economic policies will also negatively impact investment, which thrives on stability, and therefore will further lower employment and growth. Alesina and Drazen (1991) and Castro and Veiga (2004) showed that delay in the implementation of inflation stabilisation programmes is associated with greater political instability of a country. This result suggests that even higher and more volatile inflation rates are forthcoming in the presence of political instability in the long run.

Many empirical studies have documented that political instability negatively impacts major macroeconomic variables such as GDP, inflation, and private investment. For example, Jong-A-Pin (2009) examined the causal impact of political instability on economic growth using a dynamic panel system generalised method of moments (GMM) model and reports that the instability of the political regime has a significant negative effect on economic growth. Alesina et al. (1996) showed that GDP growth is considerably less in countries and time periods with a high propensity for government collapse using data on 113 countries from the period 1950 to 1982. Mauro (1995), Özler and Rodrik (1992), and Alesina and Perotti (1996), among others, have documented similar results. In a more recent paper, Aisen and Veiga (2013) empirically examined the issue using the system GMM estimator for linear dynamic panel data models covering 169 countries from 1960 to 2004. Their study confirmed earlier findings that political instability unfavorably affects economic growth by lowering physical and human capital accumulation, and it also found that political instability lowers the rates of productivity growth to a larger degree. Therefore, the existing literature seems to agree on the importance of political stability for economic growth. Political stability is seen to result in creating the desired structure, attracting private investors and multilateral businesses that can set the stage for a growth environment, and lead to the implementation of optimal long-term macroeconomic policies. This means that the frequent switch of economic policies, which usually leads to more volatility that negatively affects the macroeconomic performance of a country, will be less frequent.

Over the last several decades, a massive amount of cross-country empirical research has examined the relationship between political institutions and development (Araee, 2016; Heshmati and Kim, 2017; Nawaz, 2015; Pereira and Teles, 2009).

These studies conclude that political institutions positively impact economic growth. Other studies have found a negative relationship between democratic institutions and economic development (Abeyasinghe, 2004; Aisen and Jose, 2013; Iqbal and Daly, 2014; Kurzman et al., 2002; Tavares and Wacziarg, 2001). Additionally, an increasing number of studies have established the weaker and ineffective role of institutions on economic performance in Africa (Asfaw and Mbeche, 2006; Effiong, 2015; Rachdi and Saidi, 2015; Fikadu et al., 2019), particularly in Sub-Saharan Africa (SSA). Regional institutional environments are affected by poor enforcement of the rule of law, corruption, mismanagement, the absence of a strong civil society, and political interference. However, such a cross-sectional study does not tell us the extent to which political institutions influence economic growth over time.

Thus, further research is required to understand how the level of democracy, political violence, and democratic accountability influences economic performance. (Asefa, 2018; Araya, 2019; Bayu, 2019). Most of the above evidence establishes that institutions matter for economic growth and development, although the conclusion made is inconsistent.

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3. METHODS AND RESULTS

3.1. DATA Sources

The data employed for the empirical analysis were extracted from the World Bank database of World Development Indicators (WDI), World Government Indicators (WGI), Database of Political Institutions (DPI2018), and International Monetary Fund (IMF). For the empirical analysis, we examined the period from 1980 to 2018 for four African countries: Tunisia, Algeria, Egypt, and Libya.

In this study, economic growth is seen as dependent on the World Bank's World Development Indicators. In the literature on measuring economic growth, gross domestic product (GDP) has been widely used. Political instability is obtained from the International Country Risk Guide Methodology (ICRG). The GDP variable is expressed in logarithms and in millions of US dollars. Political stability assesses both the government's ability to carry out its declared program(s) and its ability to stay in office.

The risk rating assigned is the sum of three subcomponents, each with a maximum score of four and a minimum score of zero. A score of 4 points equates to Very Low Risk and a score of 0 points to Very High Risk (the subcomponents are: *Government Unity, Legislative Strength and* Popular Support).

The study period was from 1980 to 2018. The descriptive study of all variables is presented in Table 1 below.

3.2. Methods

In this study, we use the Auto-Regressive Distributed Lags (ARDL) cointegration approach to examine the short- and long-term cointegration relationship between economic growth and political stability in each country. The ARDL cointegration procedure was introduced by Pesaran and Shin (1999) and extended by Pesaran et al. (2001). Compared with other cointegration methods (Engle-Granger test, 1987; Johansen test, 1988; Johansen-Juselius test, 1990), the ARDL cointegration approach has advantages. This cointegration technique does not require the assumption that all variables are of the same order of integration. This approach can be applied even if the variables are I (0) or I (1). We chose this technique for two reasons. First, it is effective in executing short- and long-term relationships between different variables that do not have the same order of integration, provided that these variables are stationary integration order level I (0) or I (1) or both. Second, the ARDL approach can eliminate problems associated with omitted and autocorrelated variables. Third, it can be useful for a small application[2]. The equation for the simple model note is as follows:

$$\text{Ln (GDP)}_t=\alpha_0 + \beta_1 PS_t + \varepsilon_t \quad (1)$$

ε (t) is a white noise term; Ln (GDP) is the logarithm of economic growth; and PS is a factor that determines political stability.

The ARDL model used in this study is expressed as follows:

$$\Delta \text{Ln(GDP)}_t = \beta_0 + +\beta_1 \text{LnGDP}_{t-1} + \beta_2 (\text{PS})_{t-1} + \sum_{k=1}^{n} \beta_{1k}\, \Delta \text{Ln(GDP)}_{t-k} + \sum_{k=1}^{n} \beta_{2k}\, \Delta PS_{t-k} + +\varepsilon_t \quad (2)$$

Where Δis the delay operator; is the constant; mean short-term dynamics; while are the long-term coefficients, and Ɛ is the error term of the white noise. The ARDL approach considers $\beta_1 \neq \beta_2$, $(p+1)^k$ number of regressions to obtain the optimal lag length for each variable, where p is the maximum number of lags to use, and k is the number of variables in the equation. The selection of an appropriate offset is based on a criterion; in our study, the appropriate offset was based on the Akaike Information Criteria (AIC). The bounds test is based on the Wald statistic (F-statistic), which tests the null hypothesis of no cointegration. The first step of the ARDL approach consists of estimating Equation (2) using ordinary least squares (OLS).

3.3. Results

3.3.1. Unit Roots Tests

To detect the stationarity and order of integration of the variables, we use the tests of Phillips-Perron (PP, 1988) and Dickey-Fuller GLS (DF-GLS), whose critical threshold is 5%, and with a null hypothesis (H0) of non-stationarity of the variable. The results in Table 2 indicate that all the variables are stationary at the level and different first differences. In this case, we can use the ARDL approach for an empirical estimation. Table 2 presents the results of the ADF and PP unit root tests for the variables. For Algeria, Tunisia, Libya, and Egypt, LnGDP appears to be stationary in the ADF and PP tests at the 5% level. Moreover, the PS is stationary of order 1 (I (1)) for both Tunisia and Libya at the 5% threshold. For Algeria, PS is stationary at the 10% level (I (0) for ADF and I (1) for PP at the 5% level). Concerning Egypt, the ADF test shows that PS is stationary of order 1 (I (1)) at the 5% threshold (I (1) for the PP test). The ADF and PP tests show that the series are stationary, I (0), or non-stationary, I (1). The unit root test confirmed that none of the series were integrated into I(2). Therefore, we apply ARDL bounds testing procedures to establish a long-run relationship between economic growth and political stability. Therefore, we apply ARDL bounds testing procedures to establish a long-run relationship between economic growth and political stability.

3.3.2. ARDL Bound Tests for Co-integration

The ARDL estimate provides the result of the growth rate relationships in terms of their past values and the current and past values of LnGDP and PS. The software "EViews 9" provides the option to realise ARDL modelling automatically. To determine the number of delays, we adopt the Hannan-Quinn (HQ) criterion. The number of retards for Tunisia, Egypt, Algeria and Libya are (1,5), (10, 10), (8, 2) and (2, 12), respectively; these

[2]Pesaran M, Shin Y, Smith R. Bounds testing approaches to the analysis of level relationships. J Appl Econom. 2001;16:289e326.

results are shown in Table 3 below. Figure 1 shows the best 20 models according to the Akaike Information Criterion (AIC), which affirms our results. The results of the autocorrelation of residues test shown in Table 4 indicate that there is no assertion of autocorrelation in the residues of our model, which is essential for the continuation of our estimates. If there is an autocorrelation of the errors, the evaluations of the parameters are not homogeneous. This is due to the shifted values of the variable to be explained, which are manifested as the independent variables in the model. The Wald test was used to identify the existence of a long-term cointegration relationship between the endogenous variable and a set of explanatory variables. In our case, the objective of this test is to verify whether LnGDP per capita has long-term cointegration links with PS in Tunisia, Algeria, Libya, and Egypt. The null hypothesis (H_0) and the alternative hypothesis (H_1) are showing as follows:

$$H_0: \beta_1 = \beta_2$$
$$H_1: \beta_1 \neq \beta_2$$

Table 5 presents the results of the bounds testing approach. We found long-run relationships between variables in the Tunisian and Egyptian cases and the Libyan and Algerian cases. This conclusion is based on the F-value of 61.98163 for Tunisia, 9.752624 for Algeria, 11.17129 for Egypt, and 9.438124 for Libya, exceeding the upper bound values at 1%, 2.5%, 5%, and 10%. In this case, we reject the null hypothesis of no cointegration relationships and accept the alternative hypothesis, which supposes the existence of long-run relationships between the different variables of our econometric model.

The results of the short- and long-run estimations are presented in Tables 6 and 7, respectively. In the long term, a 1% increase in political stability leads to an increase in economic growth of 0.092% (Tunisia), 0.024% (Algeria), 0.009% (Egypt), and 0.102% (Libya). This finding confirms the hypothesis that political stability influences economic growth in the long term. Various studies have shown that the causal relationship between political instability and economic growth works both ways (Zablotsky, 1996; Gyimah-Brempong & Traynor, 1999). Other studies have verified the absence of a causal relationship between these variables (Campos & Nugent, 2000). Other studies have reported the existence of direct and indirect effects of political instability on economic growth (Barro, 1991; Levine and Renelt, 1992; Schneider and Frey, 1985). Thus, the negative impact of political instability has indirect consequences for growth factors such as savings and investment. Other research has emphasised the indirect effect of 'brain drain' (Adebayo, 1985; Kwasi, 1992), which is the process of human capital depletion caused mainly by political unrest. The ECM regressions conditional on the relationship level must be estimated. The results imply that economic growth converges to a long-run equilibrium level with adjustment speeds of 2.24% (Tunisia), 50.13% (Algeria), 72.30% (Libya), and 37.20% (Egypt) through the political stability channel, respectively. To check the robustness of the different modes, we use the Breusch-Godfrey test (Serial Correlation LM), Breusch-Pagan-Godfrey test (heteroskedasticity), and Jarque-Bera test (normality). The results presented in Table 8 prove the success of the normality test of the residuals, the test of absence of serial autocorrelation of order 1 (LM test), and that of homoscedasticity.

3.3.3. Robustness check

In the final step, we used diagnostic tests to assess the robustness of our empirical model. The Cumulative Sum of Recursive Residuals (CUSUMSQ) and Cumulative Sum of Recursive Residuals (CUSUM) were used to analyse the stability of the model over time estimated by the ARDL approach. These two tests were performed in the form of figures. If both the CUSUM and CUSUMSQ curves are within the two critical terminals at the 5% threshold, we accept the null hypothesis, which indicates the stability of the coefficients of the regression; subsequently, the model is stable over time. Figures 3 and 4 indicate that the four Tunisian, Algerian, Egyptian, and Libyan curves of CUSUM and CUSUMSQ are within two bounds of the 5% confidence interval. These results confirm that our econometric model is stable over time for the four countries.

3. CONCLUSION

This study analysed the long-term equilibrium relationship between economic growth and political stability in Tunisia, Libya, Egypt, and Algeria for the period from 1984 to 2018. Our analysis proves that political stability influences economic growth in the four countries, but at different levels. To achieve our objective, we used a model to analyse the relationship between economic growth as a dependent variable and political stability. After checking that the order of integration is strictly less than two. The cointegration test proves the existence of cointegration relationships. This implies that political stability has a positive and significant effect on economic growth for the future of the economies of Tunisia, Egypt, Algeria, and Libya.

With the results of this study, we can derive more policy effects. A high propensity for executive change is associated with political uncertainty and, in some cases, threats to property rights, which negatively affect economic growth. In addition, international terrorism designates dangerous or violent phenomena affecting the internal stability of people, such as the violation of the penal rights of the State. These phenomena destabilise civil life and government policies. Conflicts are manifested by social conflicts and civil wars that affect a country and cause deterioration in human development and economic growth. Social conflict stems from social organisation itself, which is based on a differentiation of economic, social, and political disparities.

In the countries of the region, we can conclude that the institutional failures that characterise these countries disrupt long-term economic growth. Simultaneously, the significance of the political stability index could not be confirmed, even though its impact was positive. For future studies, a longer observation period would provide new

insights into this area of research in Africa. The question that then arises is, what are the main channels through which political instability affects economic growth?

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Ethics Approval: This study relies on publicly available secondary data from listed firms and does not involve human participants; thus, ethics approval was not required.
Informed Consent: Not applicable, as no human participants were involved.
Data Availability Statement: Data are available upon reasonable request from the corresponding author.

Figure 1. Conceptual model of factors affecting economic growth

Table1. Descriptive statistics.

Variables	Mean	Min	Max	Obs
Tunisia				
political stability	8.300794	4.166667	11.00000	35
GDP (2010 constant US $)	3.14E+10	1.50E+10	5.09E+10	35
Algeria				
political stability	7.996825	4.250000	10.50000	35
GDP (2010 constant US $)	1.28E+11	8.54E+10	2.03E+11	35
Egypt				
political stability	8.194048	3.916667	11.00000	35
GDP (2010 constant US $)	1.53E+11	2.86E+11	6.50E+10	35
Libya				
political stability	7.790238	4.750000	11.00000	35
GDP (2010 constant US $)	5.35E+10	2.84E+10	7.48E+10	20

Notes: The descriptive study is based on the availability of data from Tunisia, Libya, and Algeria

and Egypt for the period 1984-2018.
Sources: - Political Stability Indicators, ICRG (2018) and Economic Growth, World Bank (2018).

Table 2. Stationarity Test

Pays	Country	ADF		Order of integration	PP		Order of integration
		At the level	In first différence		At the level	Infirst difference	
Tunisia	**LnGDP**	-1.363 (0.588)	-5.992 (0.000*)	I (1)	-1.382 (0.579)	-6.007 (0.000*)	I (1)
	PS	-1.885 (0.335)	-5.441 (0.001*)	I(1)	-1.835 (0.357)	-5.407 (0.001*)	I (1)
Alegria	**LnGDP**	1.103 (0.996)	-3.737 (0.008*)	I(1)	1.180 (0.997)	-3.853 (0.005*)	I (1)
	PS	-2.830 (0.064**)		I(0)	-1.899 (0.328)	-4.221 (0.002*)	I (1)
Libya	**LnGDP**	-3.135 (0.040*)		I(0)	-3.109 (0.042)		I (0)
	PS	-1.770 (0.387)	-6.026 (0.000*)	I(1)	-1.826 (0.362)	-6.026 (0.000*)	I (1)
Egypt	**LnGDP**	-0.456 (0.886)	-3.522 (0.014*)	I(1)	-1.943 (0.309)	-4.806 (0.000*)	I(1)
	PS	-1.943 (0.309)	-4.806 (0.000*)	I(1)	-2.117 (0.239)	-4.747 (0.000*)	I(0)

Source: Author's estimate using Eviews 9.
Note: *and ** denote significance at 5%and 10% level, respectively.

Table 3. ARDL estimation.

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Variables	Tunisia: ARDL(1,5)				Alegria : ARDL (8,2)				Libya :ARDL (2,12)				Egypt: ARDL(10,10)			
	Coef.	Std.error	t-Stat.	Prob	Coef.	Std.error	t-Stat.	Prob	Coef.	Std.error	t-Stat.	Prob	Coef.	Std.error	t-Stat.	Prob
D(LnGPDT(-1))	1.000994	0.000656	1526.143	0.0000*	0.652598	0.208931	3.123504	0.0075*	-0.286057	0.187137	-1.528600	0.1702	0.480657	0.386381	1.244000	0.3018
D(LnGPDT(-2))					0.258952	0.268479	0.964513	0.3512					0.515063	0.565050	0.911535	0.4292
D(LnGPDT(-3))					-0.103606	0.305344	-0.339310	0.7394					-0.950731	0.557028	-1.706791	0.1864
D(LnGPDT(-4))					-0.221371	0.287205	-0.770779	0.4537					0.265498	0.435606	0.609492	0.5853
D(LnGPDT(-5))					-0.116432	0.252665	-0.460815	0.6520					0.036684	0.443339	0.082744	0.9393
D(LnGPDT(-6))					0.135255	0.225119	0.600816	0.5576					0.023132	0.304447	0.075981	0.9442
D(LnGPDT(-7))					0.362207	0.226823	1.596867	0.1326					0.433634	0.344146	1.260029	0.2968
D(LnGPDT(-8))					-0.520735	0.160685	-3.240721	0.0059*					-0.524889	0.352743	-1.488021	0.2335
D(LnGPDT(-9))													-0.026367	0.333209	-0.079130	0.9419
D(PST)	0.003775	0.001339	2.819456	0.0097*	-0.002591	0.001871	-1.385354	0.1876	0.098880	0.014713	6.720796	0.0003*	0.708046	0.312512	2.265663	0.1084

D(PST(-1))	-0.004051	0.001777	-2.280218	0.0322*	0.002147	0.002395	0.896359	0.3852	-0.038554	0.020236	-1.905225	0.0984**	0.001657	0.001438	1.152727	0.3325
D(PST(-2))	0.003644	0.001711	2.130151	0.0441*	-0.002211	0.001702	-1.299024	0.2149	-0.061262	0.017209	-3.559858	0.0092*	-0.001487	0.001392	-1.068081	0.3638
D(PST(-3))	-0.001767	0.001704	-1.036705	0.3107					-0.029463	0.014544	-2.025793	0.0824**	0.001036	0.001311	0.790627	0.4869
D(PST(-4))	0.001237	0.001718	0.720365	0.4786					-0.021569	0.015126	-1.425976	0.1969	0.000668	0.001317	0.507075	0.6470
D(PST(-5))	-0.002235	0.001233	-1.812092	0.0830**					-0.014482	0.014124	-1.025367	0.3393	-0.000998	0.001774	-0.562430	0.6131
D(PST(-6))									-0.036305	0.013945	-2.603440	0.0352*	0.004763	0.001831	2.601410	0.0803
D(PST(-7))									-0.042970	0.014288	-3.007524	0.0197*	-0.001980	0.001839	-1.076502	0.3606
D(PST(-8))									-0.013902	0.025835	-0.538114	0.6072	0.001190	0.002008	0.592492	0.5952
D(PST(-9))									-0.012253	0.024788	-0.494288	0.6362	0.001383	0.001546	0.894926	0.4368
D(PST(-10))									-0.001054	0.023948	-0.043996	0.9661	0.001835	0.000998	1.838632	0.1633
D(PST(-11))									-0.038079	0.021243	-1.792502	0.1162				
D(PST(-12))									0.038079	0.021243	1.792502	0.1162				
C	0.233005	0.112317	2.074542	0.0473*	6.005503	1.393268	4.310371	0.0007*	6.762545	2.810899	2.405830	0.0471*	0.477848	0.185546	2.575369	0.0821**

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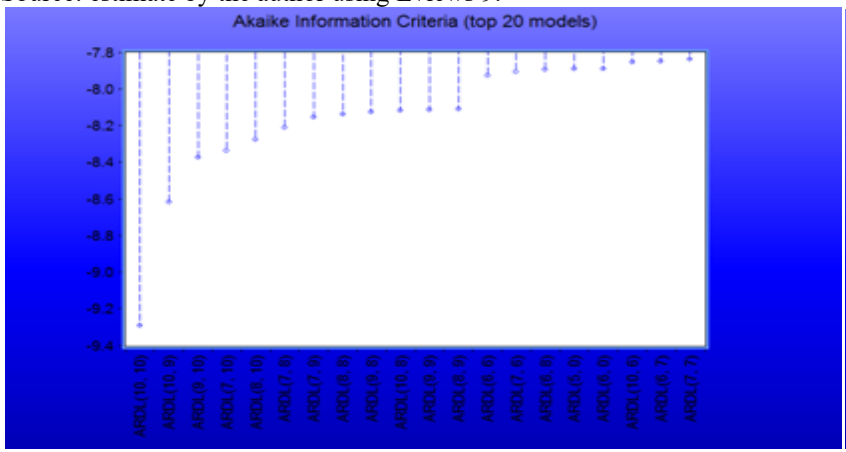
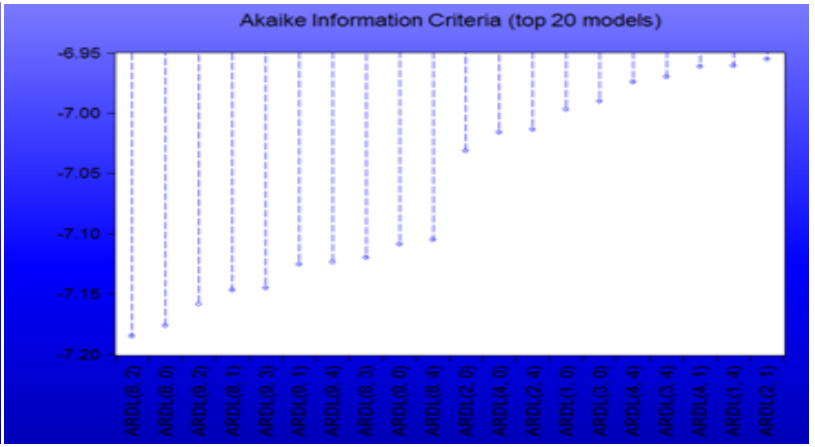
Trend					0.007409	0.001738	4.263558	0.0008*								
Criteria of model:	R-squared .			0.997914	R-squared .			0.998727	R-squared .			0.924207	R-squared .			0.976355
	Adjusted R-squared			0.997370	Adjusted R-squared			0.997636	Adjusted R-squared			0.761792	Adjusted R-squared			0.810840
	F-statistic			2971.144	F-statistic			915.3369	F-statistic			5.690420	F-statistic			2971.144
	Prob(F-statistic)			5441.396	Prob(F-statistic)			0.000000	Prob(F-statistic)			0.013514	Prob(F-statistic)			0.000009

Source: Author's estimate using Eviews 9.
Note: *and ** denote significance at 5%and 10% level, respectively.

Figure2. Akaike Information Criteria (AIC). * The probabilities may be invalid for this equation specification.
Source: estimate by the author using Eviews 9.



Egypt



Algeria

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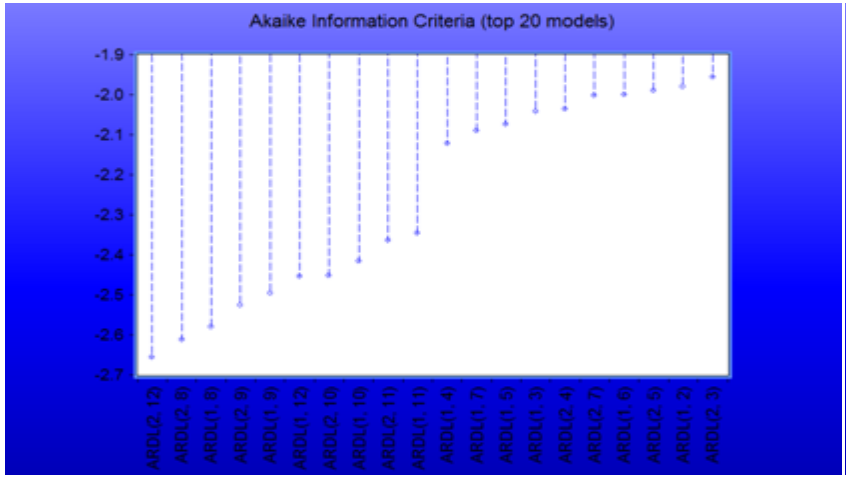
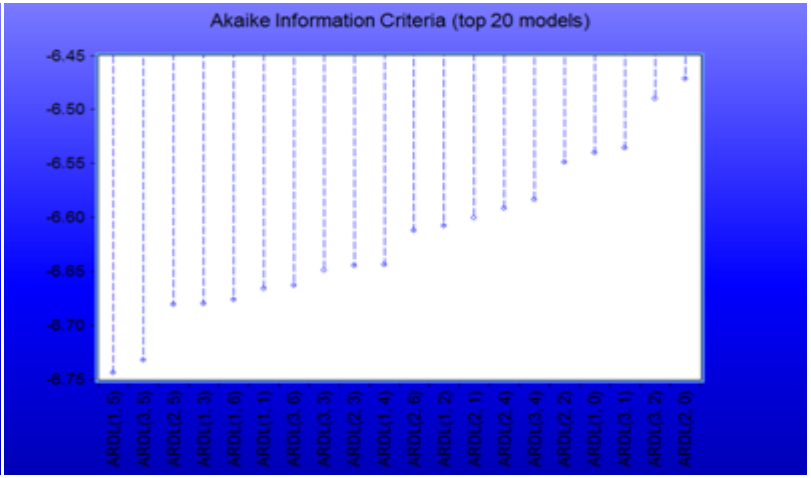


Libya



Tunisia

Table 4. Autocorrelation of residues.

Tunisia

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob...
		1	-0.16...	-0.16...	0.8601	0.354
		2	-0.27...	-0.31...	3.2591	0.196
		3	-0.11...	-0.25...	3.6557	0.301
		4	0.136	-0.05...	4.2862	0.369
		5	0.129	0.054	4.8759	0.431
		6	-0.35...	-0.35...	9.4546	0.150
		7	0.037	-0.08...	9.5092	0.218
		8	0.216	0.046	11.432	0.178
		9	-0.02...	-0.11...	11.461	0.245
		1...	-0.15...	-0.13...	12.515	0.252
		1...	-0.03...	-0.04...	12.571	0.322
		1...	0.312	0.152	17.661	0.126

Egypt

Alegria

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob...
		1	0.066	0.066	0.1457	0.703
		2	-0.12...	-0.13...	0.7167	0.699
		3	-0.11...	-0.09...	1.1939	0.754
		4	-0.28...	-0.29...	4.1712	0.383
		5	-0.14...	-0.16...	4.9969	0.416
		6	0.183	0.106	6.3296	0.387
		7	0.068	-0.04...	6.5201	0.480
		8	0.114	0.052	7.0876	0.527
		9	0.033	-0.02...	7.1379	0.623
		1...	-0.08...	0.000	7.4587	0.682
		1...	-0.12...	-0.06...	8.2574	0.690
		1...	-0.26...	-0.29...	11.925	0.452
		1...	0.005	-0.00...	11.927	0.534
		1...	0.169	0.039	13.637	0.477
		1...	-0.00...	-0.14...	13.639	0.553
		1...	0.263	0.191	18.371	0.303

Libya

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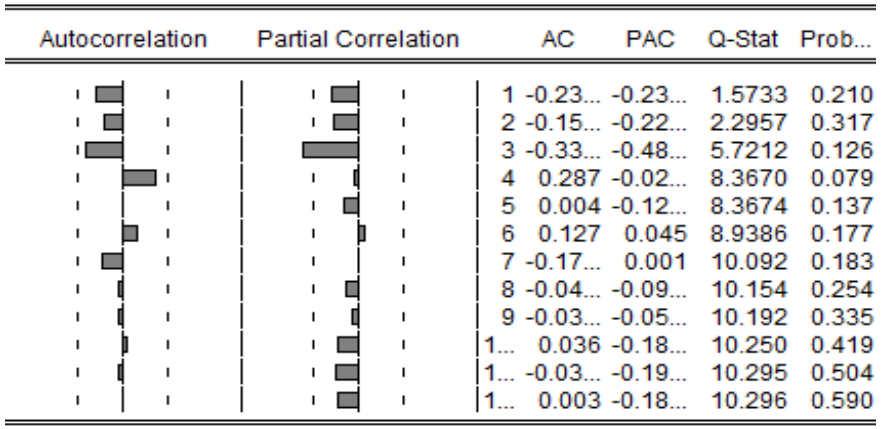
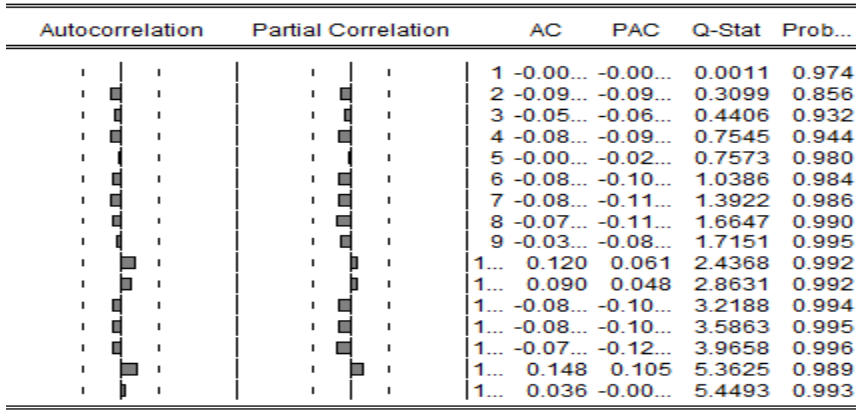


Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob...
		1	-0.23...	-0.23...	1.5733	0.210
		2	-0.15...	-0.22...	2.2957	0.317
		3	-0.33...	-0.48...	5.7212	0.126
		4	0.287	-0.02...	8.3670	0.079
		5	0.004	-0.12...	8.3674	0.137
		6	0.127	0.045	8.9386	0.177
		7	-0.17...	0.001	10.092	0.183
		8	-0.04...	-0.09...	10.154	0.254
		9	-0.03...	-0.05...	10.192	0.335
		1...	0.036	-0.18...	10.250	0.419
		1...	-0.03...	-0.19...	10.295	0.504
		1...	0.003	-0.18...	10.296	0.590



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob...
		1	-0.00...	-0.00...	0.0011	0.974
		2	-0.09...	-0.09...	0.3099	0.856
		3	-0.05...	-0.06...	0.4406	0.932
		4	-0.08...	-0.09...	0.7545	0.944
		5	-0.00...	-0.02...	0.7573	0.980
		6	-0.08...	-0.10...	1.0386	0.984
		7	-0.08...	-0.11...	1.3922	0.986
		8	-0.07...	-0.11...	1.6647	0.990
		9	-0.03...	-0.08...	1.7151	0.995
		1...	0.120	0.061	2.4368	0.992
		1...	0.090	0.048	2.8631	0.992
		1...	-0.08...	-0.10...	3.2188	0.994
		1...	-0.08...	-0.10...	3.5863	0.995
		1...	-0.07...	-0.12...	3.9658	0.996
		1...	0.148	0.105	5.3625	0.989
		1...	0.036	-0.00...	5.4493	0.993

Source: estimate by the author using Eviews 9.

Table 5. ARDL Bounds test. Null hypothesis (H0): No long-run relationships exist.

	Tunisia		**Alegria**		**Egypt**		**Libya**	
Test statistic	**Value K**		**Value**	**K**	**Value**	**K**	**Value**	**K**
F-statistic	61.98163	1	9.752624	1	11.17129	1	9.438124	1
Critical value bounds								
Significance					**I0 Bound**	**I1Bound**		
10%	**I0 Bound**	**I1Bound**	**I0 Bound**	**I1Bound**	4.04	4.78	**I0 Bound**	**I1Bound**
5%	2.44	3.28	5.596.26		4.945.73		4.04	4.78
2.5%	3.15	4.11	6.56	7.3	5.77	6.68	4.94	5.73
1%	3.88	4.92	7.468.27		6.84	7.84	5.77	6.68
	4.81	6.02	8.749.63				6.84	7.84

Source: estimate by the author using Eviews 9.

Table 6. Short-run estimation

Variables	Tunisia: ARDL (1,5)				Alegria : ARDL (8,2)				Libya: ARDL (2,12)				Egypt: ARDL(10,10)			
	Coef.	Std.error	t-Stat.	Prob	Coef.	Std.error	t-Stat.	Prob	Coef.	Std.error	t-Stat.	Prob	Coef.	Std.error	t-Stat.	Prob

D(LnGPDT(-1))					0.192408	0.164226	1.171607	0.2585	0.229323	0.302909	0.757070	0.5040	-0.480070	0.374261	-1.282716	0.2897
D(LnGPDT(-2))					0.360193	0.187241	1.923688	0.0724**					0.034993	0.367530	0.095211	0.9302
D(LnGPDT(-3))					0.363452	0.158936	2.286783	0.0362*					-0.915738	0.345946	-2.647055	0.0772**
D(LnGPDT(-4))					-0.026247	0.152239	-0.172407	0.8653					-0.650239	0.332159	-1.957618	0.1452
D(LnGPDT(-5))					0.014126	0.147321	0.095886	0.9248					-0.613556	0.204925	-2.994053	0.0579**
D(LnGPDT(-6))					0.161293	0.145735	1.106757	0.2848					-0.590424	0.233360	-2.530097	0.0854**
D(LnGPDT(-7))					0.441455	0.148641	2.969942	0.0090*					-0.156790	0.229094	-0.684392	0.5429
D(LnGPDT(-8))													-0.681679	0.319620	-2.132782	0.1227
D(LnGPDT(-9))													-0.708046	0.312512	-2.265663	0.1084
D(PST)	0.003775	0.001339	2.819456	0.0097**	-0.001254	0.001020	-1.230091	0.2364	0.120494	0.012882	9.353650	0.0026*	0.000443	0.001048	0.423054	0.7008
D(PST(-1))	-0.003644	0.001711	-2.130151	0.0441*					-0.086567	0.049164	-1.760787	0.1765	0.001487	0.001392	1.068081	0.3638
D(PST(-2))	0.001767	0.001704	1.036705	0.3107					-0.003027	0.021537	-0.140541	0.8971	-0.001036	0.001311	-0.790627	0.4869

D(PST(-3))	-0.001237	0.001718	-0.720365	0.4786					0.002231	0.013211	0.168882	0.8766	-0.000668	0.001317	-0.507075	0.6470
D(PST(-4))	0.002235	0.001233	1.812092	0.0830**					-0.004990	0.012954	-0.385197	0.7258	0.000998	0.001774	0.562430	0.6131
D(PST(-5))									0.044161	0.013053	3.383299	0.0430*	-0.004763	0.001831	-2.601410	0.0803
D(PST(-6))									-0.028985	0.018208	-1.591862	0.2097	0.001980	0.001839	1.076502	0.3606
D(PST(-7))									-0.013365	0.029160	-0.458320	0.6779	-0.001190	0.002008	-0.592492	0.5952
D(PST(-8))									0.038842	0.031389	1.237417	0.3040	-0.001383	0.001546	-0.894926	0.4368
D(PST(-9))									-0.033402	0.028933	-1.154447	0.3319	-0.001835	0.000998	-1.838632	0.1633
D(PST(-10))									0.055058	0.026905	2.046348	0.1332	-0.039273	0.017008	-2.309025	0.1041
D(PST(-11))									-0.064853	0.020683	-3.135615	0.0518**				
D(PST(-12))																
Trend					0.006817	0.001673	4.074457	0.0009*								
CointEq (-1)	-0.022481	0.010948	-2.053442	0.0495*	-0.501345	0.121825	-4.115278	0.0008*	-0.723003	0.382590	-4.503617	0.0108*	-0.372098	0.102993	-3.612853	0.0013*

Table 6. Short-run estimation

Source: Author's estimate using Eviews 9.

Note: *and ** denote significance at 5%and 10% level, respectively.

Table7. Long term estimate

Variables	**Tunisia**	**Alegria**	**Egypt**	**Libya**
	Coefficient	Coefficient	Coefficient	Coefficient
PS	0.092 (0.05**)	0.024 (0.063**)	0.009 (0.013*)	0.102 (0.016*)
Constant	10.364 (0.000*)	10.686 (0.000*)	10.743 (0.000*)	9.812 (0.000*)
Trend	-	0.014 (0.000*)		

Source: Author's estimate using Eviews 9.
Note: *and ** denote significance at 5%and 10% level, respectively.

Table 8. Robustness test

	Tunisia	**Alegria**	**Egypt**	**Libya**
Breusch-Godfrey Serial Correlation LM Test				
	0.281 **(0.757)**	**2.217** **(0.145)**	**1.051** **(0.567)**	**0.294** **(0.747)**
Heteroskedasticity Test: Breusch-Pagan-Godfrey				
	0.401 **(0.919)**	**1.106** **(0.413)**	**2.722** **(0.222)**	**0.343** **(0.924)**
Jarque-Bera (test de normalité)				
	1.728 **(0.094)**	**1.811** **(0.404)**	**0.437** **(0.803)**	**0.114** **(0.944)**

Fig. 3. CUSUM test.

Algeria **Libya**

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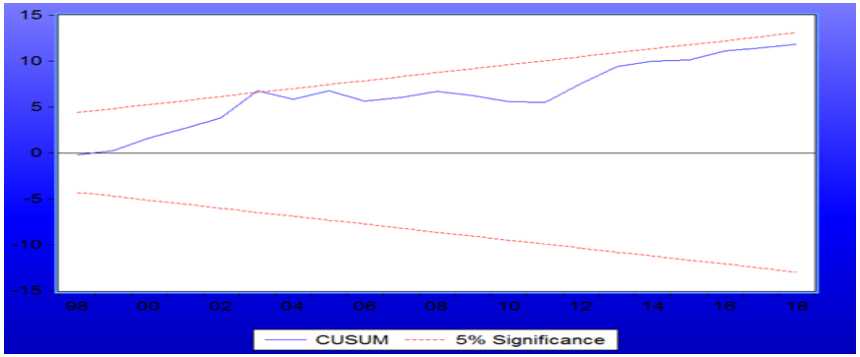
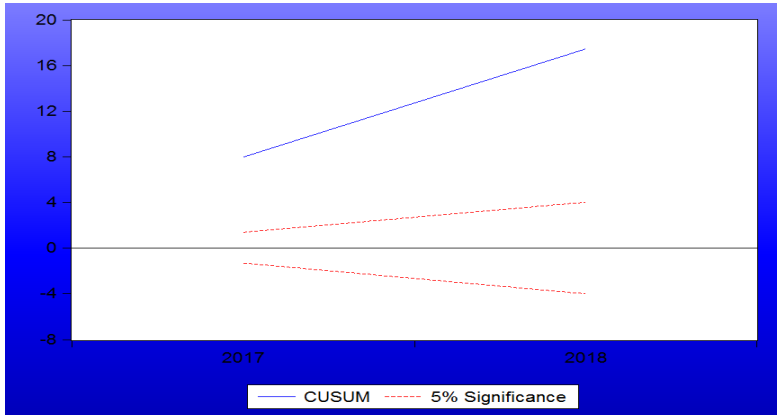
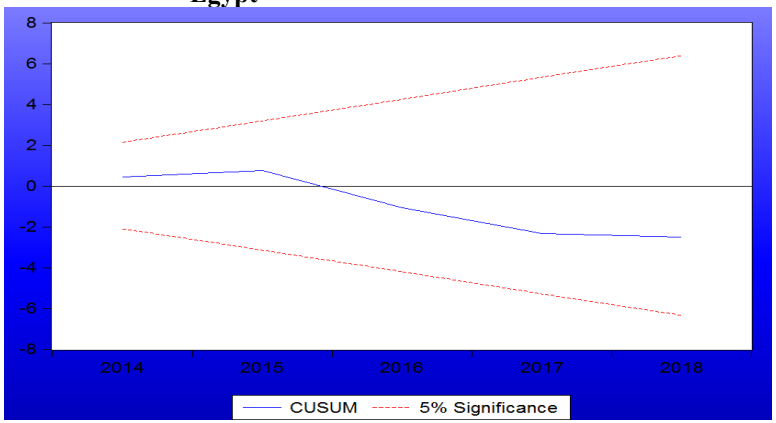
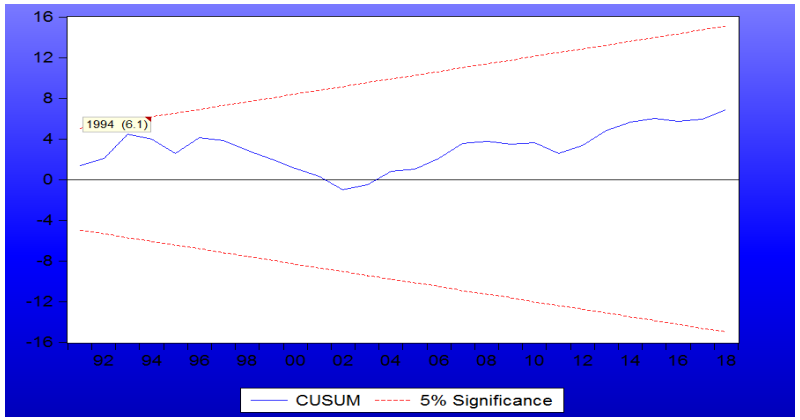




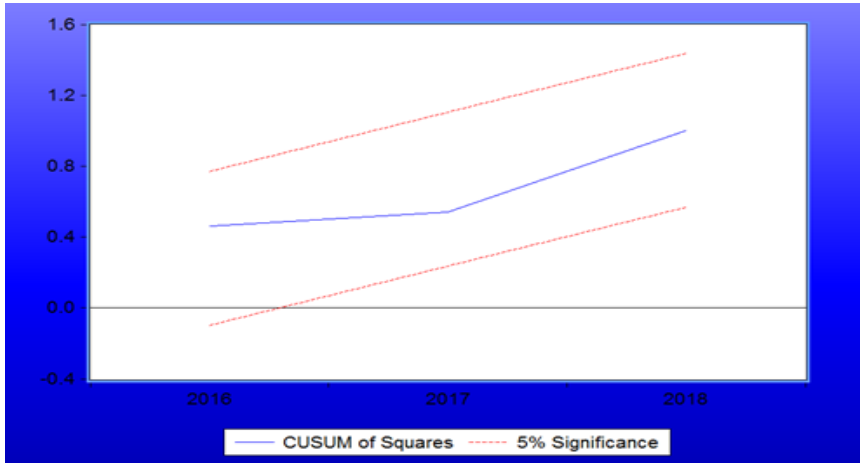
Egypt **Tunisia**



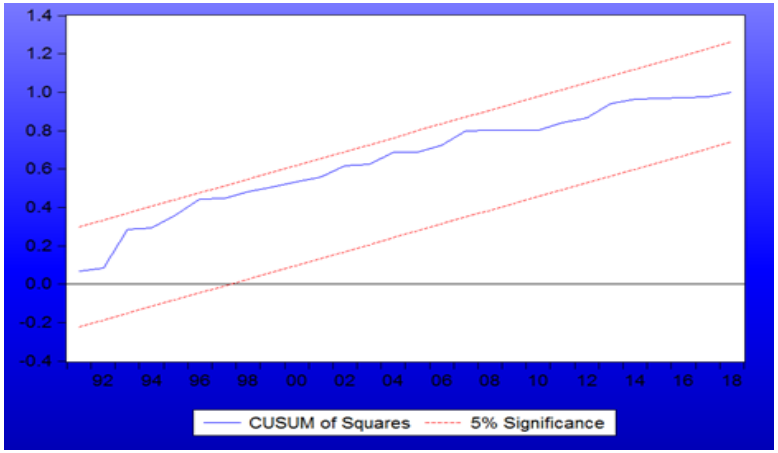


Source: estimate by the author using Eviews 9.

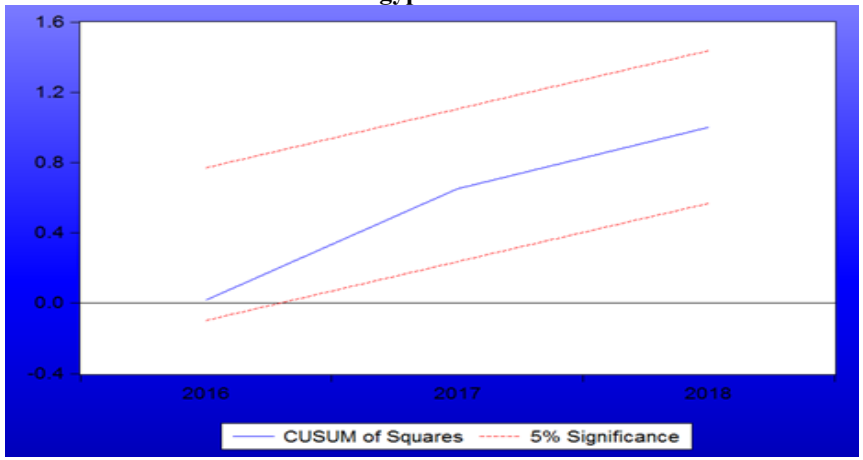
Figure 4. CUSUMSQ test.



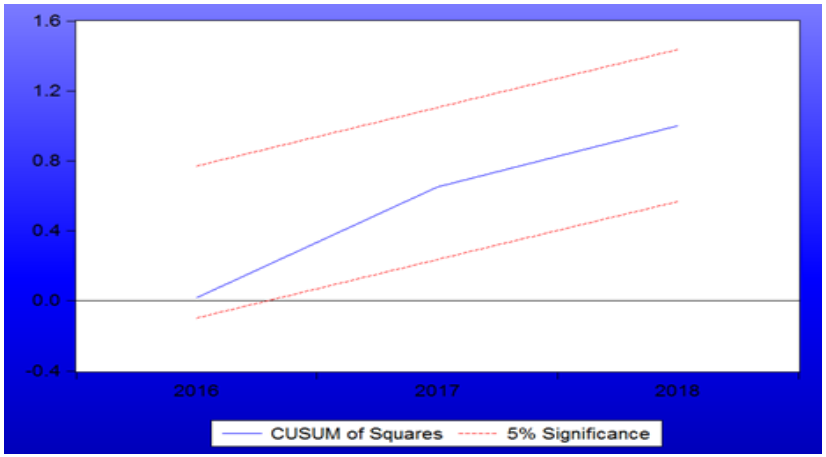
Egypt.



Tunisia



Libya



Algeria

Source: estimate by the author using Eviews