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The 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 paper aims to analyze the impact of political stability on GDP (2010 constant US $) from some MENA countries (Egypt, Libya, Tunisia and Algeria) during the period 1980-2018. This study is based on the Auto-Regressive Distributive Lags (ARDL) approach that is proposed by Pesaranc et al.(2001). The results prove the existence of a long-term relationship between political instability and economic growth.

Keywords: Political Instability; Economic Growth; Auto-Regressive Distributive Lags (ARDL) ; Arab Countries.

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1. Introduction

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

- **Terrorism:** is defined as political violence against civilian populations whose objective is to maximize the external and internal disruption of countries. Bounan[2] (2003), defines terrorism as "the set of criminal operations, of a nature and importance, variable intended to intimidate a population in order to obtain special privileged persons". It is possible to distinguish between two forms of terrorism: state terrorism, which manifests itself when the state seeks to control the resistance of what it considers to be a rival for the control of power. Thus, that individual terrorism, used by social groups to achieve a political goal that actually affects some person. In addition, international terrorism refers to the dangerous or violent phenomenon affecting the internal stability of peoples, such as the violation of state criminal law. These phenomena destabilize civil life and government policy. In recent years, the world has experienced international terrorism evidence of development of the collaboration of terrorist movements or ethnic and religious claims. The use of terrorism is linked to both social and economic imbalances and their political consequences can lead to dangerous assessments that globalize risk.

- **The ethnic and social conflict**: conflicts are manifested by social conflicts, civil wars that affect a country and cause a deterioration of human development and economic growth. Social conflict arises from the social organization itself, which is based on a differentiation of economic, social and political disparities. Conflicts are manifested by social conflicts, civil wars that affect a country and cause a deterioration of human development and economic growth. Social conflict arises from the social organization itself, which is based on a differentiation of economic, social and political disparities. Lipstel (1960) has described the concept of political instability. He said, "a country is considered as 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 the policy goals vary

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

over a short period. An unstable political system could hinder 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 that reduce private investment and slows growth. Second, political uncertainty changes the nature of investments and changes the pattern of spending that has a direct effect on economic growth rather than the impact on investment(Asteriou and Price, 2001).The possibility of a change of government threatens future policies and encourages investment elsewhere in a safe place than in a risky environment (Gupta ,1990 ; Barro, 1991 ; Alesinaand al., 1996 ;Perotti,1996 ;Ades and Chua,1997).Since 2011, in almost all Arab countries, mass protests ending the widespread idea of Arab exceptionalism1 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 paper proceeds as follows: Section 2 describes the literature review; Section 3 describes data and variables and explains the econometrics methods; and Section 4 concludes the paper.

2. Literature Review

The fall of the political system has aroused the interest of researchers and has prompted a closer examination of the effect of political uncertainty on economic progress and the rate of GDP growth.

Over the last few decades, the question of whether political instability influence the rate of economic growth has formed an important query among economists and policymakers. Such interest stems primarily from the important policy implications in relation 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 about the nature of the relationship of this variable in economic growth. Various econometric techniques have been used to examine the topic. In the following sub-sections, we provide a brief review of studies that have addressed the nexus of political instability with economic growth.

Various studies have examined the existence of an inverse relationship between political volatility and economic performance. Alesinaand Perotti (1996) indicated that, with respect to private investment, political instability leads to low growth; this creates risk and uncertainty in the country, resulting in a reduction in the volume of investments.The size of the investment decreases the level of output also decreases, reducing the size of employment, low incomes, high prices, stimulates inflation of capital markets and goods. Due to this reduction in national productivity, the 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 due to missing data.Political turmoil may be responsible for low economic growth rate (Kuznets, 1966), especially in the times of the change of government. North (1990) said 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(Benhabiband Rustichini,1996 ;Brock Blomberg,1996 ;Svensson ,1998 ; Devereux and Wen,1998 ;Darby and al.,2004 ;Ghateand 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 protest, 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 a negative effect on economic growth. The instability of the political regime has a robust and significant negative effect on economic growth. The empirical results have verified that the first two dimensions are the challenges to the political regime, while the last two represent real changes in the government and the political system (similar to Sanders, 1981).The instability of the political regime (and not instability within the political regime) refer to the uncertainty that investors face regarding the security of property rights (Svensson, 1998).The prediction of Darby et al. (2004), shows that political instability within governments reduces the likelihood of reelection, which leads to lower public investment, hence lower economic growth rate. Paradoxically, according to the model of Besleyand al. (2005). Jong-A-Pin (2009), found evidence of inverse causality.

Economic growth stimulates instability in the political system, so lack of growth triggers politically motivated violence. Thus, we can see that democracy (or political competition) triggers economic growth, but it has feedback effects (vice versa). According to Kuznets (1966, 1973), technological progress is necessary for economic growth, although it must be accompanied by liberal democratic institutions, which provide citizens with political freedom, and which allows them to participate in political processes. In general, the interactions between political instability and economic growth can be classified into four groups: first, the economic literature argues that political instability has a negative impact on 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 and Traynor, 1999). Other studies have verified the absence of the causal relationship between the variables (Campos and Nugent, 2002).

There is a full literature that examines the effects of political instability on economic growth. It reveals several reasons why higher degrees of political instability can cause lower rates of economic growth. Political instability has a damaging impact on key macroeconomic variables, such as investment, unemployment and inflation (Rodrik, 1991). The linkage is straightforward as political instability would imply 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 distorting activities. Therefore, political instability is likely to have a negative impact on economic growth.

Utilising a panel data of around 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 argued that economic policies in politically unstable countries tend to be discontinued more frequently compared to countries that are more politically stable. Such discontinuity of economic policies will then result in more volatile inflation rates. Recognising the high costs in terms of economic growth and welfare caused by inflation volatility, they urged policymakers in developing countries to improve institutions and create practical mechanisms favourable to long-run price stability. Clearly, such discontinuity of 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 would be forthcoming in the presence of political instability.

Many empirical studies have documented that political instability has a negative impact on 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 generalized 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 of government collapse using data on 113 countries from the period 1950 to 1982. Mauro (1995), Özler and Rodrik (1992), 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 the earlier findings that political instability unfavorably affects economic growth by lowering the 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 to 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 growth environment and will also 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 macroeconomic performance of a country, will be less observed.

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 oncluded that political institution has a positive impact on economic growth. The other studies 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 established the weaker and ineffective role of the institution on economic performance in Africa (Asfaw and Mbeche, 2006; Effiong, 2015; Rachdi and Saidi, 2015; Fikadu et al., 2019), particularly SubSaharan African (SSA). Region institutional environments are affected by poor enforcement of the rule of law, corruption, mismanagement, absence of strong civil society and political interference. However, such a cross-sectional study did not tell us to what extent political institutions influence economic growth over time.

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

3. METHODS AND RESULTS

3.1.DATA Sources

Data employed for the empirical analysis are extracted from the World Bank database of World Development Indicators (WDI) and World Government Indicators (WGI), Database of Political Institution (DPI2018) and International Monetary Fund (IMF). For empirical analysis, we examined the period from 1980 to 2018 for 4 African countries: Tunisia; Algeria; Egypt; Libya.

In this study, the economic growth is seen as dependent on the World Bank's World Development Indicators. In the literature for measuring economic growth, gross domestic product (GDP) has been widely used. Political instability comes from the International Country Risk Guide Methodology (ICRG). The GDP variable is expressed in logarithms and millions of US dollars. Political stability is an assessment both of 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 points and a minimum score of 0 points. 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* Popular Support).

The study period is from 1980 to 2018.The descriptive study of all our variables is summarized in Table 1.

3.2.Methods

In this study, we use the ARDL cointegration approach (Auto- Regressive Distributed Lags) to examine the short- and long-term cointegration relationship between economic growth and political stability for each country. The ARDL cointegration procedure was introduced by Pesaran and Shin (1999) and extended by Pesaranet al.(2001). Compared with other cointegration methods (Engle Granger test, 1987; Johansen test, 1988; Johansen and Juseluis test, 1990) the ARDL cointegration approach has advantages. This cointegration technique does not require the assumption that all variables come from the same order of integration. This approach can be applied even if the variables are I (0) or I (1). We choose this technique for two main 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 are I (0) or I (1). Second, the ARDL approach can remove

problems associated with omitted and auto correlated variables. Third, it can be useful for a small application[3]. The simple model note equation is as follows:

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

$\varepsilon\ (t)$ is white noise term, Ln (GDP) is the logarithm of economic growth, and PS is the factor that determines political stability.

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

$$\Delta \mathbf{Ln(GDP)_t} = \boldsymbol{\beta_0} + + \boldsymbol{\beta_1 LnGDP_{t-1}} + \boldsymbol{\beta_2 (PS)_{t-1}} + \sum_{\mathbf{k=1}}^{\mathbf{n}} \boldsymbol{\beta_{1k}} \Delta \mathbf{Ln(GDP)_{t-k}} + \sum_{\mathbf{k=1}}^{\mathbf{n}} \boldsymbol{\beta_{2k}} \Delta \mathbf{PS_{t-k}} + + \boldsymbol{\varepsilon_t} \qquad (2)$$

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 equality. The selection of appropriate offset is based on a criterion, in our study the appropriate offset is based on Akaike Information Criteria (AIC). The bounds test is based on the Wald statistic (F-Statistic) that tested the null hypothesis of no cointegration. The first step of the ARDL approach consists in estimating equation (2) by the ordinary least square (OLS).

3.3.Results

3.3.1. Unit Roots Tests

In order 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. In this case, we can use the ARDL approach for our empirical estimation. Table 2 gives the results of the ADF and PP unit root tests for the study variables. For Algeria, Tunisia, Libya and Egypt, LnGDP seems to be stationary in ADF and PP test at level of 5%. Moreover, PS is stationary of order 1 (I (1)) for Tunisia and Libya at the 5% threshold. For Algeria, PS is stationary at levels I (0) for ADF at the 10% level (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 threshold of 5% (I(1) for the PP test). The two tests ADF and PP show that the series are stationary I (0) or I (1). Unit root test confirms that none of the series

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

is integrated of I (2). Therefore, we may apply ARDL bounds testing procedures for establishing the long-run relationship between growth economic and political stability. Therefore, we may apply ARDL bounds testing procedures for establishing the long-run relationship between growth economic and political stability.

3.3.2. ARDL Bounds Tests for cointegration

The ARDL estimate gives the result of the growth rate relationships in terms of their past values as well as current and past values of LnGDP and PS. The software "Eviews 9" gives the option to realize ARDL modeling automatically. For the determination of the number of delays, we adopt the criterion of Hannan-Quinn Criterion (HQ) The number of retards for Tunisia, Egypt, Algeria and Libya are (1,5), (10, 10), (8, 2) and (2, 12) respectively; these results are shown in Table 3 below. Fig. 1 shows the best 20 models according to the Akaike Information Criteria (AIC) who 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 will not be homogeneous. This is due to the shifted values of the variable to be explained which are manifested as independent variables in the model. The Wald test was using to identify the existence of a long-term cointegration relationship between the endogenous variable and the 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 for the country Tunisia, Algeria, Libya and Egypt. The null hypothesis (H_0) and the alternative hypothesis (H_1) are showing as follows:

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

The Table 5 shows the results of Bounds testing approach. We found the existence of long run relationships between variables in Tunisian and Egypt, Libya and Algeria case. This conclusion has based on F-value at 61.98163 for Tunisia, F-value at 9.752624 for Algeria, F-value at 11.17129 for Egypt and at 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 we accept the alternative hypothesis, which suppose the existence of long run relationships between the different variables of our econometric model.

The results of short and long run estimations are presented in Table 6 and 7. 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 long-term economic growth. Various studies have shown that the causal relationship between political instability and economic growth works both ways (Zablotsky, 1996; Gyimah-Brempong and Traynor, 1999). Other studies have verified the absence of a causal relationship between the variables (Campos and 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 emphasized 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 an adjustment speed of 2.24% (for Tunisia), 50.13% (for Algeria), 72.30% (for Libya) and 37.20% (for Egypt) through the political stability channel. To check the robustness of the different modes, we use the Breusch-Godfrey tests (Serial Correlation LM), Breusch-Pagan-Godfrey test (Heteroskedasticity) and the Jarque-Bera test (normality). In fact, the results presented in Table 8 prove the success of the test of normality of the residues, the test of absence of serial autocorrelation of order 1 (LM-test) and that of homoscedasticity.

3.3.3. Robustness check

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

3. Conclusion

this study analyzed 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 with different levels. To achieve our objective, we use a model to analyze the relationship between economic growth as a dependent variable explained by political stability. After checking that the order of integration is strictly less than two. the use of the cointegration test proves the existence of cointegration relations. which implies that political stability has a positive and significant effect on economic growth for the future of the Tunisian economy, Egypt, Algeria and Libya.

With the results of this study, we can derive more policy effect. A high propensity for executive change is associated with political uncertainty and in some cases threats to property rights, which negatively affects economic growth. . In addition, international terrorism designates the dangerous or violent phenomenon affecting the internal stability of peoples such as the violation of the penal rights of the State. These phenomena destabilize civil life and government policy. Conflicts are manifested by social conflicts, civil wars that affect a country and cause a deterioration in its human development and economic growth. Social conflict stems from the social organization 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 characterize these countries end up disrupting long-term economic growth. Simultaneously, the significance of the political stability index could not be confirmed, even though its impact was found to be positive. For future studies, a longer period of observations would bring new insights into this area of research for the africa region. The question that then arises: What are the main channels of transmission of political instability on economic growth?

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Fig. 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	Infirst difference		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.

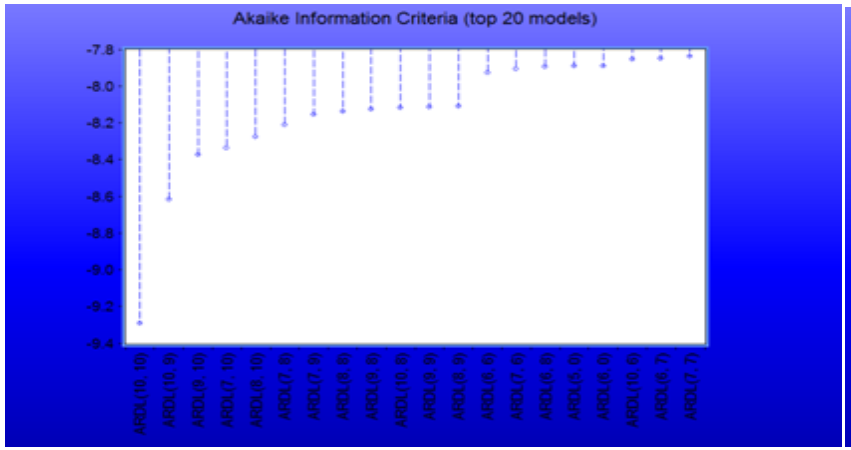
Table 3. ARDL estimation.

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

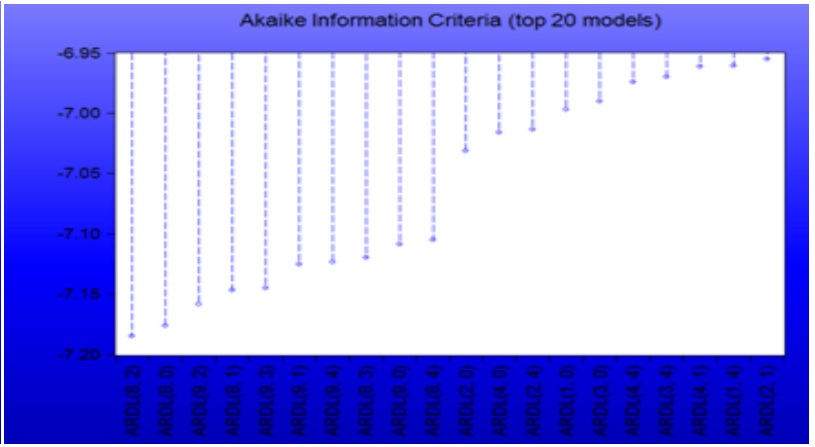
D(PST(-10))									-0.001054	0.023948	-0.043996	0.9661	0.001835	0.000998	1.838632	0.1633
D(PST(-11))									-0.038079	0.021243	-1.792502	0.1162				
D(PST(-12))									0.038079	0.021243	1.792502	0.1162				
C	0.233005	0.112317	2.074542	0.0473*	6.005503	1.393268	4.310371	0.0007*	6.762545	2.810899	2.405830	0.0471*	0.477848	0.185546	2.575369	0.0821**
Trend					0.007409	0.001738	4.263558	0.0008*								
Criteria of model:	R-squared 0.997914 . Adjusted R-squared 0.997370 F-statistic 2971.144 Prob(F-statistic) 5441.396				R-squared 0.998727 . Adjusted R-squared 0.997636 F-statistic 915.3369 Prob(F-statistic) 0.000000				R-squared 0.924207 . Adjusted R-squared 0.761792 F-statistic 5.690420 Prob(F-statistic) 0.013514				R-squared 0.976355 . Adjusted R-squared 0.810840 F-statistic 2971.144 Prob(F-statistic) 0.000009			

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

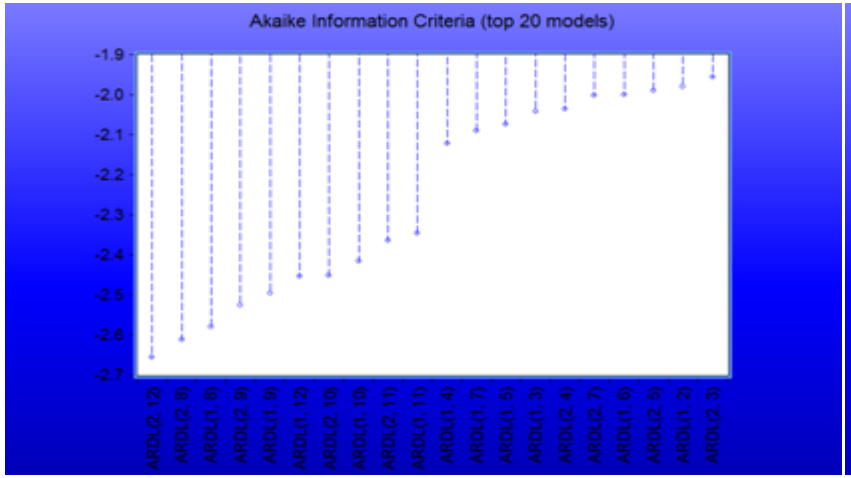
Fig.2. Akaike Information Criteria (AIC). * The probabilities may be invalid for this equation specification.
Source: estimate by the author using Eviews 9.



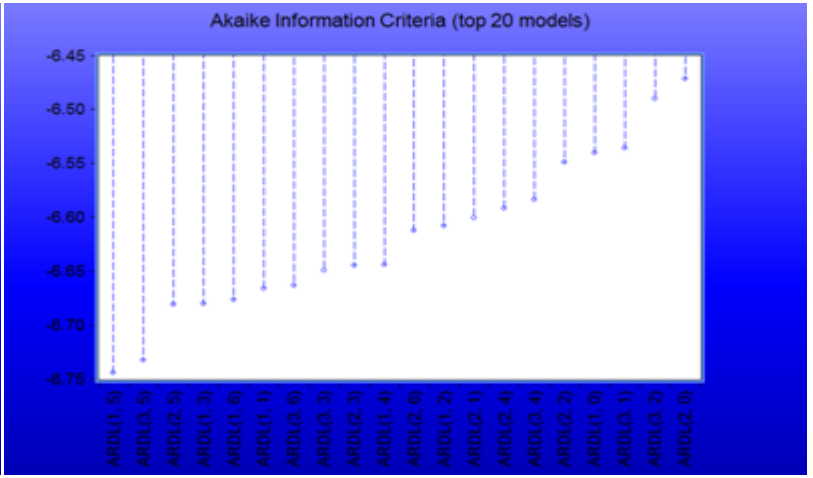
Egypt



Algeria



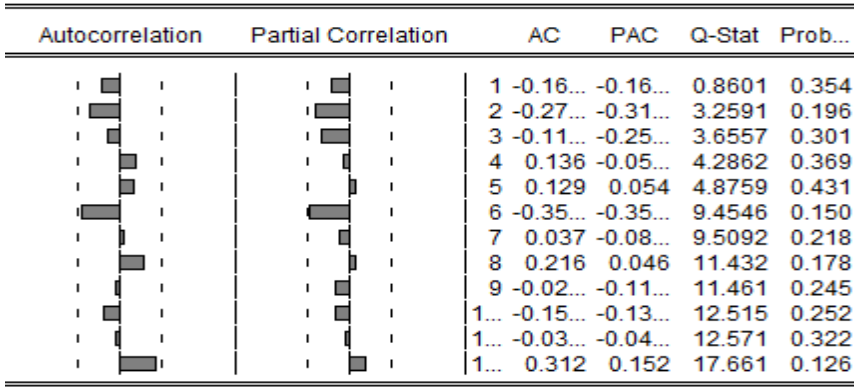
Libya



Tunisia

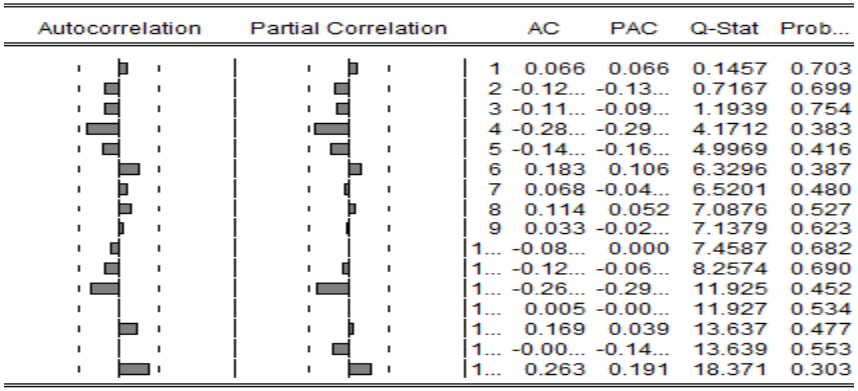
Table 4. Autocorrelation of residues.

Tunisia



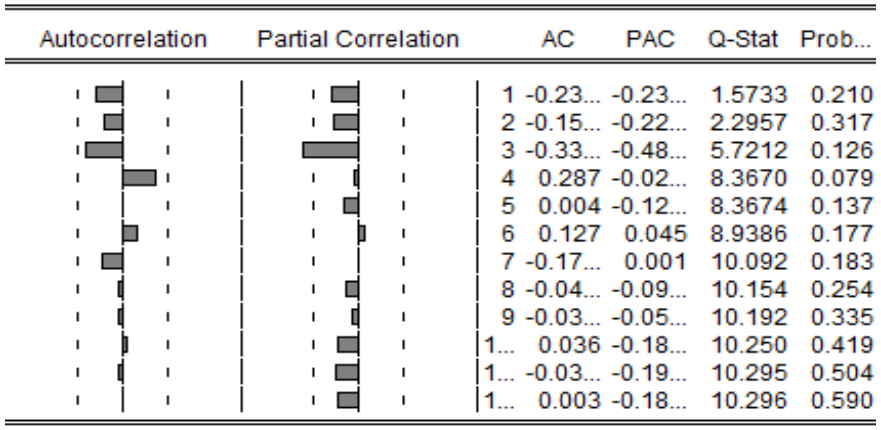
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob...
		1	-0.16...	-0.16...	0.8601	0.354
		2	-0.27...	-0.31...	3.2591	0.196
		3	-0.11...	-0.25...	3.6557	0.301
		4	0.136	-0.05...	4.2862	0.369
		5	0.129	0.054	4.8759	0.431
		6	-0.35...	-0.35...	9.4546	0.150
		7	0.037	-0.08...	9.5092	0.218
		8	0.216	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

Alegria



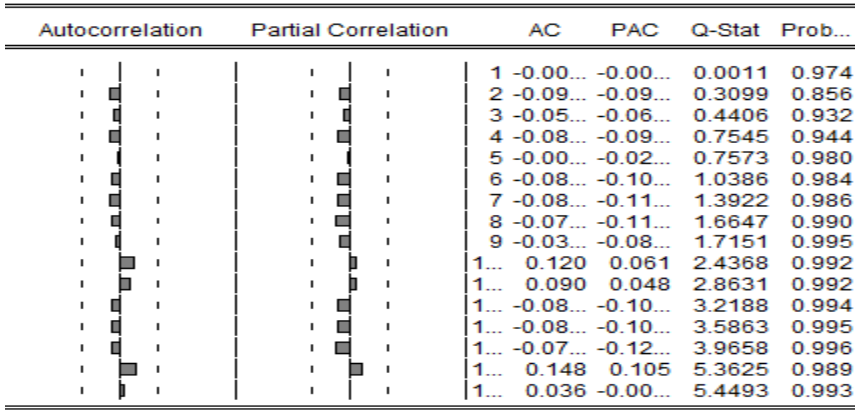
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob...
		1	0.066	0.066	0.1457	0.703
		2	-0.12...	-0.13...	0.7167	0.699
		3	-0.11...	-0.09...	1.1939	0.754
		4	-0.28...	-0.29...	4.1712	0.383
		5	-0.14...	-0.16...	4.9969	0.416
		6	0.183	0.106	6.3296	0.387
		7	0.068	-0.04...	6.5201	0.480
		8	0.114	0.052	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

Egypt



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

Libya



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**	**I0 Bound**	**I1Bound**	**I0 Bound**		**I0 Bound**	
10%	2.44	3.28	5.596.26		**I1Bound**		**I1Bound**	
5%	3.15	4.11	6.56	7.3	4.04	4.78	4.04	4.78
2.5%	3.88	4.92	7.468.27		4.945.73		4.94	5.73
1%	4.81	6.02	8.749.63		5.77	6.68	5.77	6.68
					6.84	7.84	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*	-0.72303	0.382590	-4.503617	0.0108*	-0.372098	0.102993	-3.612853	0.0013*

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*)		

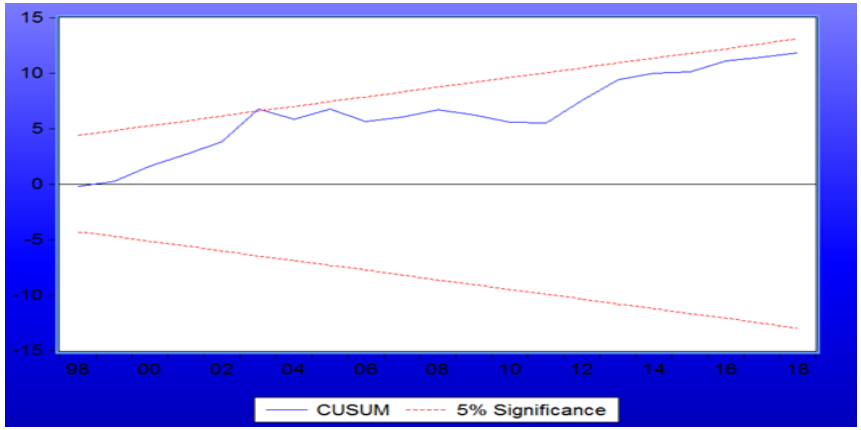
Source: Author's estimate using Eviews 9.
Note: *and ** denote significance at 5%and 10% level, respectively.

Table 8. Robustness test

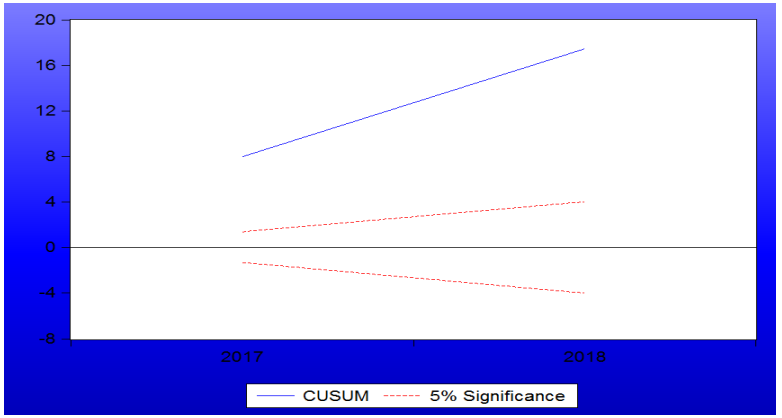
	Tunisia	Alegria	Egypt	Libya
Breusch-Godfrey Serial Correlation LM Test				
	0.281 (0.757)	**2.217 (0.145)**	**1.051 (0.567)**	**0.294 (0.747)**
Heteroskedasticity Test: Breusch-Pagan-Godfrey				
	0.401 (0.919)	**1.106 (0.413)**	**2.722 (0.222)**	**0.343 (0.924)**
Jarque-Bera (test de normalité)				
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

Fig. 3. CUSUM test.

Algeria

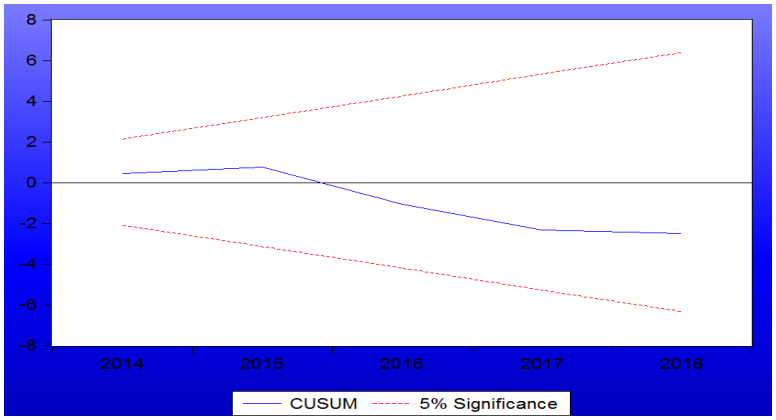


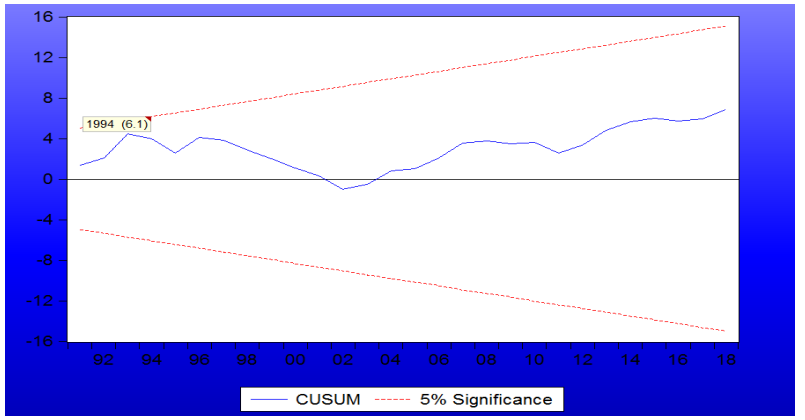
Libya



Egypt

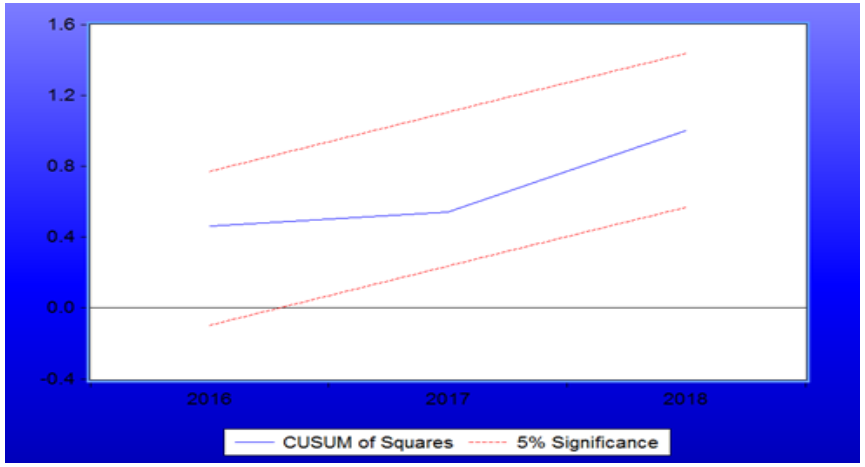
Tunisia

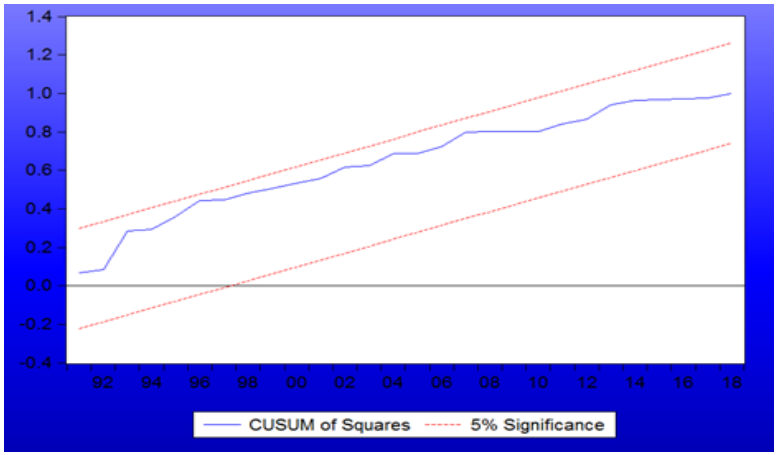




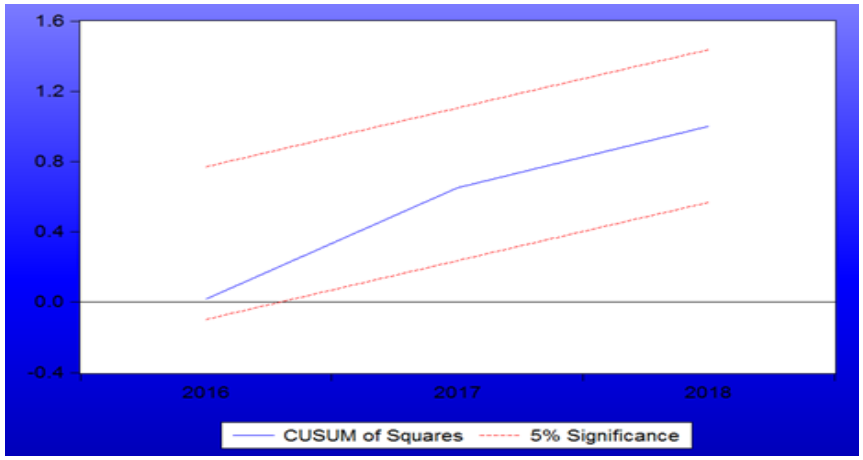
Source: estimate by the author using Eviews 9.

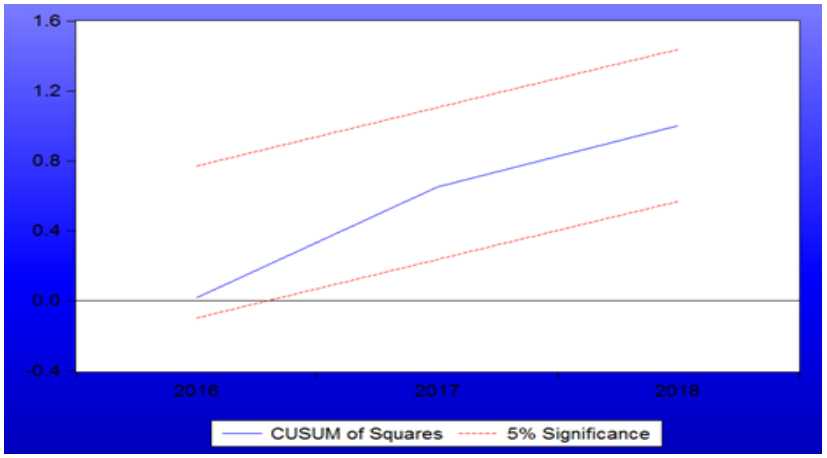
Fig. 4. CUSUMSQ test.





Egypt. **Tunisia**





. **Libya** **Algeria**

Source: estimate by the author using Eviews