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Financial Development and Economic Growth Nexus in the South Mediterranean Countries (SMCs):
New Insights From an Asymmetric ARDL

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ABSTRACT

This article investigates the presence of asymmetries in the short- and long-run relationships between financial development and economic growth covering four SMCs from 1984 to 2017 by applying the nonlinear ARDL. The authors factored three financial development measures that detected the financial depth and the credit to private sector taken one by one and together in four models. The empirical evidence provides significant evidence of both short-run and long-run asymmetries between the interest variables. The main conclusion drown from this paper is that in the event that policymakers place more emphasis on policies that develop financial depth and credit for private sector, a concomitant effect would positively impact long-run growth in Algeria, Egypt, Morocco, and Tunisia.

KEYWORDS

Asymmetry, Economic Growth, Financial Development, Nonlinear ARDL, SMCs

1. INTRODUCTION

Despite the abundance of research on the issue of growth drivers, it appears that the accumulation of capital in the underdeveloped countries has an undeniable primacy in the development of these countries. However, a given increase in the level of capital formation may not necessarily lead to an equally large increase in the growth rate. It is no less true that an upward movement in the economic growth curve, which should be preceded by a similar movement in the capital formation curve, is, in other words, an increase in the volume of savings. As a result, the savings made by households are of particular importance for developing countries. Normally, they exceed the investments of these households and this surplus becomes a source of capital for governments' and companies' investments.

The fundamental question that one has to raise at this level of analysis should focus on the myriad of techniques that are suitable to be deployed to mobilize the savings thus made by the households. In other words, do the techniques we are talking about allow the transfer of the actual resources generated by the household sector to the users of these sectors?

Starting from the idea that the financial system has largely a strong implication in the economic growth process, this brings us to consider the primary function of this system as being crucially linked to a better allocation of economic resources. The financial system thus appears to be a strategic sector for the whole economy, designed to facilitate its adjustment to a completely different competitive environment from its current.

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Nevertheless, it is not enough that the financial system is inherently efficient. It must also be consistent with the most comprehensive forms of economic regulation. Indeed, in recent years, financial systems have collapsed in several countries in transition, one after the other; instead of methodically financing production, trade and investment, these systems have become factors of financial and economic instability.

In the last fifty years, from the first empirical paper of Goldsmith (1969) passing by Levine the most motivated researcher in the nineties to Sobiech (2019) and Mhadhbi et al. (2020), various empirical studies have focused on diverse countries, times, econometric techniques, and proxy variables of financial system and economic growth to study the finance-growth nexus. Despite the proliferation of studies that have addressed this issue, it is clear that the empirical evidence is controversial, to say the least. In scrutinizing the same literature dealing with this, it happens that some work from Goldsmith (1969) through King and Levine (1993) to the works of Ibrahim and Alagidede (2016), Pradhan et al. (2016), Muhammad et al. (2016), Durusu-Ciftci et al. (2017), and Shahbaz et al. (2017) did indeed show a positive association between financial development and economic growth.

However, there are some other works, namely those of De Gregorio and Guidotti (1995), Arcand et al. (2012), Cecchetti and Kharroubi (2012), Narayan and Narayan (2013), Law and Singh (2014), Cournède and Denk (2015), and Ductor and Grechyna (2015), which showed rather a negative sign or insignificant impact as to the association between financial development and economic growth.

The common point for all these previous researches is that they employ models that assume a linear relationship between financial development and the economic growth. It was only in recent years that attempts have been made to study the nonlinear relationship between financial development and economic growth (Deidda & Fattouh, 2002; Chen et al., 2013; Beck et al., 2014; Law & Singh, 2014; Arcand et al., 2015; Adeniyi et al., 2015; Samargandi et al., 2015; Ductor & Grechyna, 2015; Demetriades & Rousseau, 2016; Ibrahim & Alagidede, 2018; Sobiech, 2019; Botev & Jawadi, 2019). The majority of these earlier studies shows a positive effect on growth only to a critical level, beyond which the positive effect of finance on growth disappears, hence the existence of a threshold into the finance-growth relationship. However, these studies are still inconclusive and have not empirically shown the sources of this nonlinearity.

To the best of our knowledge, this research is the first to devote such an analysis of the relationship between financial development and economic growth by using a nonlinear ARDL technique for SMCs.

For the last two decades, SMC governments have initiated programs to upgrade and restructure their financial systems, thus creating the ideal conditions for the growth and development of their financial sectors for a more active participation and a more important role in the economy. These reforms were carried out in varying degrees and on a large scale. In this respect, there are differences in the levels of financial development of the countries in the region. The relative financial development of SMCs lags behind other regions of the world, such as the Southeast Asian countries. According to experts who are interested in the financial situation of SMCs, one factor prevents the financial sectors from fully playing the role of catalyzing economic growth in these countries. This is the quality of the institutional and legal environment, which is not in synergy with the progress made in the financial sector. It is relevant to note that the financial sectors in most SMCs remain mainly governed by the banking system.

The rest of this paper is organized as follows. In Section 2, we outline the data, proxy measures of financial development, economic growth and empirical strategy. In Section 3, we analyze the results of our model. Finally, we summarize the main conclusions in Section 4.

2. DATA AND ECONOMETRIC STRATEGY

2.1. Data, Sample and Variables

To measure the impact of financial development on economic growth of the SMCs, we collected our data covering the period from 1984 to 2017 relying on sources from the World Bank "World

Development Indicators (WDI-data) online (2018)". We included four countries in our sample: Algeria, Egypt, Morocco and Tunisia. The choice of these countries is entirely based on two criteria. Firstly, we retained the countries with bank-based financial systems. Secondly, we opted for countries whose data availability ensures a sufficiently long study period.

In line with the existing empirical literature, the choice of financial development measures is a very important step in the study of the finance-growth relationship. This paper mainly focuses on the bank-based variables because, as we mentioned before, our sample of four SMC countries' financial system is based on the commercial banks. Therefore, we use bank-based variables to assess financial development most used in previous research (King & Levine, 1993a, b; Arestit & Demetriades, 1997; Luintel & Khan, 1999; Khan & Senhadji, 2003; Liang & Teng, 2006; Beck et al., 2007; Kar et al., 2011; Hsueh et al., 2013; Batuo et al., 2018 ; Botev & Jawadi, 2019). In our study, we employ three most common measures: (i) The ratio of liquid liabilities to GDP (henceforth Depth); (ii) Domestic credit to the private sector as a percentage of GDP (henceforth Private) and (iii) Domestic credit provided by the banking sector as a percentage of GDP (henceforth Privy).

Economic growth is proxied by GDP per capita growth (henceforth EG). In line with Demirguc-Kunt and Detragiache (2001), Gaytan and Ranciere (2004), Rousseau and Yalmazkuday (2009), and Pradhan (2011) who identified the importance of inflation and government expenditure in the finance-growth relationship, we include two control variables, namely, inflation represented by the annual percentage change in the consumer price index (henceforth Inf) and real gross government expenditure represented by the general government final consumption expenditure to GDP ratio (henceforth Gov).

2.2. Econometric Strategy

Asymmetry is a common feature among the economic variables, which is why several recent studies (Bildirici & Türkmen, 2015 ; Nusair, 2016; Pal & Mitra, 2016; Bildirici & Ozaksoy, 2017; Salisu et al., 2017; Oskooee & Saha, 2018 ; Al-hajj et al., 2018; Benkraiem et al., 2019; Lacheheb & Sirag, 2019 ; Hajilee & Niroomand, 2019) have used non-linear cointegration: the asymmetric ARDL (NARDL) model of Shin et al. (2014) in economic modelling to capture potential asymmetries in the relationship between several macroeconomic indicators. To that end and like these studies, there are several sudden events, such as the crisis and the government intervention, that render the finance-growth relationship nonlinear.

The NARDL model is an asymmetrical extension of the linear ARDL model of Pesaran et al. (2001). Formally, it is interesting to start by presenting the linear ARDL model. It is possible to write the ARDL model as follows to analyze the finance-growth nexus:

$$\begin{aligned} \Delta EG = \beta + \alpha\, EG_{t-1} + \theta\, FD_{t-1} + \xi\, Inf_{t-1} + \psi\, Gov_{t=1} + \\ \sum_{i=1}^{p=1} \delta_i \Delta EG_{t-i} + \sum_{i=0}^{q-1} \lambda_i \Delta FD_{i-j} + \sum_{i=0}^{s} \varphi_i \Delta Inf_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta\, Gov_{t-i} + \varepsilon_t \end{aligned} \tag{1}$$

where Δ denotes the first difference operator; EG represents the GDP per capita growth; FD is a vector of proxy measures for financial development that covers the three indicators we previously described; Inf and Gov are control variables to capture respectively the inflation rate and the government expenditure; β is the intercept; α, θ, ξ and ψ are the long-run coefficients; δ_i, λ_i, φ_i and γ_i represent the short-run coefficients; p, q, s and r are the respective lag orders for the dependent and explanatory variables and ε_t captures the error term having zero mean and constant variance.

We thus specify the nonlinear ARDL model of Shin et al. (2014) which uses positive and negative partial sum decompositions allowing detecting the asymmetric long- and short-run effects in the finance-growth relationship. It takes the following form:

$$EG_t = \beta_0 + \beta_1 FD_t^+ + \beta_2 FD_t^- + \beta_3 Inf + \beta_4 Gov + \varepsilon_t \tag{2}$$

$\beta = \left(\beta_0, \beta_1, \beta_2, \beta_3, \beta_4\right)$ is the cointegration vector (the long-run parameters) to be estimated. In equation (2), FD_t is decomposed as:

$$FD_t = FD_0 + FD_t^+ + FD_t^- \tag{3}$$

where FD_0 is the initial value, and FD_t^+ and FD_t^- denote partial sum processes which accumulate positive and negative changes in FD_t, respectively, and are defined as follows:

$$FD_t^+ = \sum_{i=1}^{t} \Delta FD_i^+ = \sum_{i=1}^{t} \max\left(\Delta FD_i, 0\right) \tag{4}$$

$$FD_t^- = \sum_{i=1}^{t} \Delta FD_i^- = \sum_{i=1}^{t} \max\left(\Delta FD_i, 0\right) \tag{5}$$

After inserting equations (4) and (5) into the linear $ARDL\left(p, q, s, r\right)$ (equation (1)), the asymmetric ARDL model of Shin et al. (2014) for specifying the long-run relationships between financial development and economic growth can be written as follows:

$$\begin{aligned}\Delta EG_t &= \beta + \alpha\, EG_{t-1} + \theta^+ FD_{t-1}^+ + \theta^- FD_{t-1}^- + \xi\, Inf_{t-1} + \psi\, Gov_{t-1} \\ &+ \sum_{i=1}^{p} \delta_i \Delta EG_{t-i} + \sum_{i=0}^{s} \phi_i \Delta Inf_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta Gov_{t-i} + \sum_{i=0}^{q}\left(\lambda_i^+\, \Delta FD_{t-i}^+ + \lambda_i^-\, \Delta FD_{t-i}^-\right) + \varepsilon_t\end{aligned} \tag{6}$$

From the above formulation, the long-run relation between economic growth and financial development increases is β_1, which is expected to be positive. Meanwhile, β_2 captures the long-run relation between economic growth and financial development reduction. Since they are expected to move in the same direction, β_2 is expected to be negative. We further posit that the financial development increases will result in increases and long-run changes in the economic growth. Thus, the long-run relation, as represented in the equation, reflects asymmetric long-run financial development pass through the economic growth.

Where $\beta_1 = -\dfrac{\theta^+}{\alpha}, \beta_2 = -\dfrac{\theta^-}{\alpha}$ are the aforementioned long-run impacts of financial development increase and reduction on the economic growth, respectively. $\sum_{i=0}^{q} \lambda_i^+$ measures the short-run impact of positive financial development changes on economic growth, while the short-run effect of negative changes in financial development on economic growth is measured by $\sum_{i=0}^{q} \lambda_i^-$. Hence, one of the advantages of the NARDL is that it enables us to capture the asymmetric effects not only in the long-run but in the short-run as well.

To address the different possibilities on how financial development affects real per capita economic growth, the financial development (FD) measures will be treated in four different ways for each of the SMCs (Algeria, Egypt, Morocco and Tunisia). Firstly, we take each of the three measures (Depth, Private and Privy) separately. Secondly, we consider the three measures of financial development together. Thereby, the four NARDL models to be estimated in the framework of our paper take the following form:

$$\Delta EG_t = \beta + \alpha EG_{t-1} + \theta^+ Depth^+_{t-1} + \theta^- Depth^-_{t-1} + \xi Inf_{t-1} + \psi Gov_{t-1} + \sum_{i=1}^{p} \delta_i \Delta EG_{t-i} + \sum_{i=0}^{s} \phi_i \Delta Inf_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta Gov_{t-i} + \sum_{i=0}^{q} \left(\lambda_i^+ \Delta Depth^+_{t-i} + \lambda_i^- \Delta Depth^-_{t-i} \right) + \varepsilon_t$$

Model 1

$$\Delta EG_t = \beta + \alpha EG_{t-1} + \theta^+ \Pr ivate^+_{t-1} + \theta^- \Pr ivate^-_{t-1} + \xi Inf_{t-1} + \psi Gov_{t-1} + \sum_{i=1}^{p} \delta_i \Delta EG_{t-i} + \sum_{i=0}^{s} \phi_i \Delta Inf_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta Gov_{t-i} + \sum_{i=0}^{q} \left(\lambda_i^+ \Delta \Pr ivate^+_{t-i} + \lambda_i^- \Delta \Pr ivate^-_{t-i} \right) + \varepsilon_t$$

Model 2

$$\Delta EG_t = \beta + \alpha EG_{t-1} + \theta^+ \Pr ivy^+_{t-1} + \theta^- \Pr ivy^-_{t-1} + \xi Inf_{t-1} + \psi Gov_{t-1} + \sum_{i=1}^{p} \delta_i \Delta EG_{t-i} + \sum_{i=0}^{s} \phi_i \Delta Inf_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta Gov_{t-i} + \sum_{i=0}^{q} \left(\lambda_i^+ \Delta \Pr ivy^+_{t-i} + \lambda_i^- \Delta \Pr ivy^-_{t-i} \right) + \varepsilon_t$$

Model 3

$$\Delta EG_t = \beta + \alpha EG_{t-1} + \theta_1^+ Depth^+_{t-1} + \theta_1^- Depth^-_{t-1} + \theta_2^+ \Pr ivy^+_{t-1} + \theta_2^- \Pr ivy^-_{t-1} + \theta_3^+ \Pr ivate^+_{t-1} + \theta_3^- \Pr ivate^-_{t-1} + \xi Inf_{t-1} + \psi Gov_{t-1} + \sum_{i=1}^{p} \delta_i \Delta EG_{t-i} + \sum_{i=0}^{s} \phi_i \Delta Inf_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta Gov_{t-i} + \sum_{i=0}^{q_1} \left(\lambda_i^{(1)+} \Delta Depth^+_{t-i} + \lambda_i^{(1)-} \Delta Depth^-_{t-i} \right) + \sum_{i=0}^{q_2} \left(\lambda_i^{(2)+} \Delta \Pr ivy^+_{t-i} + \lambda_i^{(2)-} \Delta \Pr ivy^-_{t-i} \right) + \sum_{i=0}^{q_3} \left(\lambda_i^{(3)+} \Delta \Pr ivate^+_{t-i} + \lambda_i^{(3)-} \Delta \Pr ivate^-_{t-i} \right) + \varepsilon_t$$

Model 4

It should be noted that for model 4, the two coefficients β_1 and β_2 of equation 2 are two vectors respectively as: $\beta_1 = \begin{pmatrix} \rho_1 \\ \rho_2 \\ \rho_3 \end{pmatrix}$ and $\beta_2 = \begin{pmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \end{pmatrix}$ where p, s, r, q_1, q_2 and q_3 are the respective optimal lag orders for the dependent and explanatory variables.

Before estimating the different long-run and short-run parameters for our four models, we started our analysis by conducting some pre-tests. In addition, like linear ARDL, nonlinear ARDL is a general technique for dealing with the relationship between stationary I (0) or integrated I (1), or the mixture of 1(0) and 1(1) variables (Nusair, 2016) and no variables integrated of order two I (2). This is why it is necessary to test the stationarity to avoid having I (2) series. To this end and to check the (non) stationarity, we perform two most well-known time series unit root tests, namely the Augmented Dickey-Fuller test (Dickey and Fuller 1979, henceforth ADF) and the Phillips and Perron test (1988, henceforth PP). Yet, these two tests do not take into account the presence of structural breaks in the series. Therefore, ignoring structural breaks may be misleading and result in a false acceptance of the unit root null hypothesis. To take into consideration these structural breaks in the dynamics of data series and to ensure the robustness of the results, we also perform unit root tests with structural breaks following Perron (1997). We performed this test only for the endogenous variable (EG) and the three measures of financial development because we assume in this paper that the source of non-linearity comes from financial development. Then, in the second stage, we estimated the equations (6) by standard OLS, based on the Akaike Information Criterion (AIC) and the information criterion SCI to fix the lag length. In the third stage, based on the coefficients estimated in the previous step, and following the approach of Pesaran et al. (2001), and Shin et al. (2011), we performed a test for the presence of cointegration among the variables using a bounds testing. It is a Wald test with the null hypothesis for models 1, 2 and 3:

$\alpha = \theta^+ = \theta^- = \xi = \psi = 0$ [1] and $\alpha = \theta_1^+ = \theta_1^- = \theta_2^+ = \theta_2^- = \theta_3^+ = \theta_3^- = \xi = \psi = 0$ [2]

for model 4 to examine the long-run symmetry. For the short-run asymmetry the null hypothesis: for models 1, 2 and 3: $\lambda_i^+ = \lambda_i^-$ for all $i = 1,........,q$ and for models 4: $\lambda_i^{(1)+} = \lambda_i^{(1)-}$ for all $i = 1,........,q_1$, $\lambda_i^{(2)+} = \lambda_i^{(2)-}$ for all $i = 1,........,q_2$ and $\lambda_i^{(3)+} = \lambda_i^{(3)-}$ for all $i = 1,........,q_3$.

Finally, with the presence of cointegration, the null hypothesis is rejected. Therefore, the long- and short-run asymmetries in the finance-growth relationship need to be examined. The short-run asymmetric impact of financial development on growth is also assessed by deriving the cumulative dynamic multiplier of a one percent change in FD_{t-1}^- and FD_{t-1}^+, respectively as:

$$dm_h^+ = \sum_{j=0}^{h} \frac{\partial EG_{t+j}}{\partial FD_{t-1}^+},\ dm_h^- = \sum_{j=0}^{h} \frac{\partial EG_{t+j}}{\partial FD_{t-1}^-} \qquad ,h = 0,1,2,.........$$

Note that as $h \to \infty, dm_h^+ \to \beta_1\ and\ dm_h^- \to \beta_2$

3. EMPIRICAL RESULTS

As indicated earlier, the first step is to examine the order of integration of all variables. Table 1 confirms that the standard ADF and PP unit root tests showed that all our variables for all countries for a model with trend and intercept are not I (2). To sum up: For Algeria, Morocco and Tunisia, two statistics appear to support stationarity on first differencing for all variables, except for the GDP per capita growth (EG) which is stationary in the level. For Egypt, the ADF and PP tests findings appear to support the stationarity of all variables at first difference, and thus all variables are I (1).

In accordance with the traditional unit root tests, Table 2 shows that the structural tests produce similar results; i.e., none of the variables is found to be I (2) even in the case of the structural breaks in the time series.

Having indicated the unit root test, we perform the cointegration test for linear and nonlinear ARDL. The results are presented in Table 3. From the table, we can see that there is no evidence of cointegration in the analysis of cointegration using the linear ARDL. The F-statistic values fall between the upper and lower bounds or less than the lower critical bound at 5% for all countries and all models. Thereby, the results are inconclusive for the acceptance of the null hypothesis of no cointegration. This result implies that there are no long-run linear (symmetric) relationships between the financial development and the economic growth for all SMCs. However, the result embodies the existence of a long-run relation when the ARDL is specified in a nonlinear fashion. Indeed, F-statistic values exceed the tabulated values of the upper bound at the 5% threshold of significance for all models and all countries.

Table 1. Standard ADF and PP unit root tests

	Level				**First differences**			
	Intercept		Intercept and trend		Intercept		Intercept and trend	
	ADF	PP	ADF	PP	ADF	**PP**	ADF	PP
Algeria								
EG	-3,110**	-3,188**	-3,653**	-3,745				
Depth	-1,065	-1,065	-1,341	-1,344	-4,366***	**-4,322*** **	-4,620***	-4,925***
Private	-1,922	-1,913	-0,959	-1,122	-4,141***	**-4,151*** **	-4,605***	-4,591***
Privy	-1,927	-1,916	-0,961	-1,123	-4,140***	**-4,149*** **	-4,604***	-4,590***
Inf	-1,636	-1,774	-2,050	-2,189	-4,891***	**-4,891*** **	-4,810***	-4,810***
Gov	-2,699*	-2,021	-2,650	-1,998	-3,562**	**-3,412** **	-3,460**	-3,456**
Egypt								
EG	-3,412**	-3,588**	-3,327*	-3,538*	-7,340***	**-9,045*** **	-4,210**	-8,650***
Depth	-4,632***	-2,303	-4,461***	-2,183		**-5,299*** **		-5,324***
Private	-3,121**	-1,421	-2,771	-1,205		**-3,436** **	-3,441**	-3,532**
Privy	-5,479***	-2,158	-5,266***	-1,924		**-4,566*** **		-4,538***
Inf	-1,760	-1,551	-1,263	-1,263	-6,781***	**-6,767*** **	-6,983***	-6,790***
Gov	-3,824***	-3,642**	-3,147	-3,061			-3,790**	-3,954**
Morocco								
EG	-11,835***	-10,886***	-11,656***	-10,687***				
Depth	-0,038	-0,108	-1,820	-2,011	-5,333***	**-5,330*** **	-5,231***	-5,224***
Private	-0,580	-0,705	-3,995**	-2,415	-4,664***	**-4,751*** **		-4,624***
Privy	-0,674	-0,778	-4,328***	-2,303	-4,691***	**-4,804*** **		-4,738***
Inf	-2,649*	-3,923***	-3,150	-4,604***	-7,772***		-7,716***	
Gov	-2,377	-2,443	-4,366***	-3,271*	-7,193***	**-14,695*** **		-17,491***
Tunisia								
EG	-5,469***	-5,558***	-5,408***	-5,478***				
Depth	0,308	0.045	-1,768	-1,336	3,527**	**-3,260** **	-3,616**	-3,547**
Private	-0,682	-0,720	-1,175	-1,216	-5,596***	**-5,596*** **	-5,676***	-5,690
Privy	0,213	-0,690	-0,666	-1,647	-5,420***	**-5,422*** **	3,472**	-5,752***
Inf	-2,851*	-2,765*	-1,456	-2,406	-9,297***	**-9,685**	-9,496***	-23,797***
Gov	-1,662	-1,673	-2,301	-2,241	-5,913***	**-5,903*** **	-5,118***	-5,891***

Note: This table reports the results of ADF and PP unit root test for each series. The test statistics for the null hypothesis of a unit root are presented for both the series in the level and in the first difference. Intercept and intercept and trend are included in test models and the optimal lag order is selected based on SIC criterion in the ADF. The asterisks *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

The estimates of the asymmetric ARDL regression of the four models and four countries are presented in Table 4. However, the maximum lag order considered is 3 for the desired specification and all insignificant stationary regressors are dropped. In practice and according to Katrakilidis and Trachanas (2012), an asymmetric ARDL specification that contains insignificant lags may result in inaccurate analysis and can create noise in dynamic multipliers.

Table 2. Unit root tests with structural break.

	level		First differences	
	Intercept	Intercept and trend	Intercept	Intercept and trend
Algeria				
EG	-4,909**	-5,266**		
Depth	-1,970	-3,387	-5,109***	-5,150**
Private	-1,859	-1,081	-4,893**	-4,795**
Privy	-1,863	-1,082	-4,892**	-4,794**
Egypt				
EG	-3,538	-4,411	-7,121***	-4,916**
Depth	-4,831**	-4,819*		-5,810***
Private	-3,428	-3,463	-5,157***	-4,815**
Privy	-5,957***	-5,629***		
Morocco				
EG	-12,044***	-13,367***		
Depth	-2,558	-4,147	-6,519***	-7,804***
Private	-2,671	-4,453	-5,030***	-5,273**
Privy	-2,512	-4,796*	-5,149***	-5,434***
Tunisia				
EG	-6,089***	7,311***		
Depth	-2,122	-2,852	-4,341**	-4,552**
Private	-3,338	-3,703	-6,240***	-6,155***
Privy	-2,324	-2,922	-5,501***	-6,787***

Note: This table reports the results of the unit root tests with structural tests for seriesthat measure the economic growth and financial development. The test statistics for the null hypothesis of a unit root are presented for both the series in the level and in the first difference. Intercept and intercept and trend are included in test models and the optimal lag order is selected based on SIC criterion with max lag is 8. The asterisks *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

At first glance, the results confirm the findings of the bound test shown in Table 3. The coefficient of the lagged EG (GDP per capita growth) is negative and statistically significant at 1% threshold whatever the country and the model; which indicates the existence of cointegration. This result shows that economic growth will be mobilized towards the long-run target.

In addition, before estimating and making inferences of the long-run relationship of positive and negative variations in financial development on economic growth, we conducted some diagnostic tests to assess the adequacy of the dynamic model. The outcomes of these diagnostic tests are displayed in the bottom panel of Table 4. The R^2 value varies between 0.7 and 0.98, which shows the high power of the financial development and the two control variables (inflation and government expenditure) in explaining the changes in the economic growth for all countries and models. Moreover, the Breusch-Godfrey Serial Correlation LM test presented by Breusch (1978) and Godfrey (1978) reveals the absence of autocorrelation[3] in the residuals. Likewise, the heteroscedasticity statistic, calculated from the autoregressive conditional heteroscedasticity ARCH, shows that the residuals are homoscedastic[4]. The Jarque-Bera or normality test confirms that the estimated models' residuals are normally distributed. The cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) tests developed by Brown et al. (1975) presented in Fig. 1 (see Appendix) show that the blue line lays

Table 3. Bounds test for cointegration in the symmetric and the asymmetric models

Models	F-statistic	95% lower bound	95% upper bound	Outcome
Algeria				
Model 1				
Symmetric ARDL (4, 4, 4, 4)	3,448	3.272	4.306	Inconclusive
Asymmetric ARDL model	6,574	3.058	4.223	Cointegration
Model 2				
Symmetric ARDL (1, 3, 3, 0)	4,211	3.272	4.306	Inconclusive
Asymmetric ARDL model	6,918	3.058	4.223	Cointegration
Model 3				
Symmetric ARDL (1, 3, 2, 1)	4,268	3.272	4.306	Inconclusive
Asymmetric ARDL model	6,636	3.058	4.223	Cointegration
Model 4				
Symmetric ARDL (3, 4, 4, 4, 4, 4)	1,740	2.910	4.193	No cointegration
Asymmetric ARDL model	8,531	2.32	3.50	Cointegration
Egypt				
Model 1				
Symmetric ARDL (4, 2, 1, 1)	4,201	3.272	4.306	Inconclusive
Asymmetric ARDL model	6,193	3.058	4.223	Cointegration
Model 2				
Symmetric ARDL (1, 1, 3, 1)	3,366	3.272	4.306	Inconclusive
Asymmetric ARDL model	6,032	3.058	4.223	Cointegration
Model 3				
Symmetric ARDL (4, 0, 1, 3)	4,124	3.272	4.306	Inconclusive
Asymmetric ARDL model	6,034	3.058	4.223	Cointegration
Model 4				
Symmetric ARDL (4, 2, 1, 3, 3, 2)	3,541	2.910	4.193	Inconclusive
Asymmetric ARDL model	6,738	2.32	3.50	Cointegration
Morocco				
Model 1				
Symmetric ARDL (3, 2, 0, 4)	3,853	3.272	4.306	Inconclusive
Asymmetric ARDL model	5,155	3.058	4.223	Cointegration
Model 2				
Symmetric ARDL (3, 4, 0, 4)	3,695	3.272	4.306	Inconclusive
Asymmetric ARDL model	4,628	3.058	4.223	Cointegration
Model 3				
Symmetric ARDL (3, 3, 4, 0)	3,181	3.272	4.306	Inconclusive
Asymmetric ARDL model	4,822	3.058	4.223	Cointegration

Table 3 continued on next page

Table 3 continued

Models	F-statistic	95% lower bound	95% upper bound	Outcome
Model 4				
Symmetric ARDL (3, 4, 3, 4, 4, 4)	4,072	2.910	4.193	Inconclusive
Asymmetric ARDL model	29,479	2.32	3.50	Cointegration
Tunisia				
Model 1				
Symmetric ARDL (2, 0, 4, 3)	1,929	3.272	4.306	No cointegration
Asymmetric ARDL model	27,084	3.058	4.223	Cointegration
Model 2				
Symmetric ARDL (1, 4, 4, 4)	3,650	3.272	4.306	Inconclusive
Asymmetric ARDL model	15,218	3.058	4.223	Cointegration
Model 3				
Symmetric ARDL (4, 1, 4, 2)	2,566	3.272	4.306	No cointegration
Asymmetric ARDL model	11,124	3.058	4.223	Cointegration
Model 4				
Symmetric ARDL (3, 4, 4, 3, 4, 4)	3,617	2.910	4.193	Inconclusive
Asymmetric ARDL model	12,698	2.32	3.50	Cointegration

Note: This table displays the results of the bounds testing procedure for cointegration in the linear ARDL and NARDL. The numbers in parentheses are the lag order of the ARDL model. The optimal lag order based on the Akaike Information Criterion (1981). F-statistic values are calculated by bounds testing approach by Pesaran et al. (2001) and Shin et al. (2014). The critical values are from Narayan (2005) unrestricted intercept and no trend.

within the 5% level of significance for both tests (CUSUM and CUSUMSQ) and the four models. Thereby, there is a long-run stability between the variables and a stability of the model over time in our models for the four countries. The results of these diagnostic tests lead us to retain all our models for the four countries.

According to the short-run estimates, we notice that a positive or negative shock of financial development carries at least one significant coefficient at the 10%, 5% or 1% thresholds on economic growth in all the countries and in the first three models. However, for model 4, all the coefficients of positive and negative change of financial development are significant at least at the 5% threshold on economic growth. Based on the results of Table 5, we can estimate the long-run asymmetric equation for four models. Table 5 reveals the arguments for valid long-run relationships among the financial development variables and economic growth. Thereby, in the fourth model, where we consider the three financial development variables (Depth, Private, Privy) together, a shock to financial development has a significant effect on economic growth for all four countries. However, a positive change in financial development, whatever the measure and the country, has a positive and significant effect on economic growth. These findings are in line with the majority of research on the finance-growth nexus, from Goldsmith (1969) to Ibrahim and Alagidede (2018). However, the negative component of financial development has a significant and negative impact on economic growth whatever the measure used only for Algeria, whereas for the three countries (Egypt, Morocco and Tunisia) this negative impact is only for the measures of the credit activity (Private and Privy). Furthermore, the negative component of the financial depth (Depth) has a positive and significant impact on economic growth. This inverse relationship can be explained by the lack of sound monetary policies in these three countries especially those that witness inflationary tendencies. For the first model (Depth as financial development variable), the results suggest that the depth positive changes carry a positive and significant impact; while the depth negative changes have a negative and significant impact in the cases of Morocco, Egypt and Tunisia. However, depth shows marginal significance for this country.

In the case of Algeria, the changes of depth are not significant. This is principally because the level of financial depth is not uniform among these four countries. This finding is consistent with the results of Bakhouche (2007), and Ben Naceur and Ghazouani (2007) that concluded no significant impact of Algerian financial system on growth. These results also corroborate the findings of Demetriades and Rousseau (2016) who discovered that financial depth is no longer a determinant of long-run economic growth. For the second and third models (Private and Privy as financial development variables respectively), long-run significant coefficients become negative for the positive variation, while the opposite is true for the negative variation in all four countries. This implies an inverse relationship in the long-run between credit activity of financial system and economic growth. This inverse linkage has also been empirically supported by, among others, Cecchetti and Kharoubi (2012), Grassa and Gazdar (2014), Cournède and Denk (2015), and Ruiz (2018).

The most important remark is that in order to have a significant and positive effect of financial development on growth, it is necessary to take into account the two main activities of the financial sector; namely granting credit and financial depth. Furthermore, if a country does not improve both activities in the same way, there is a risk that the effect of financial development on economic growth will become negative.

With regard to the two control variables, inflation and government expenditure are consistent with previous studies. In most cases, inflation has a negative and significant coefficient and government expenditure has a positive and significant coefficient.

After analyzing the long- and short-run impacts of financial depth on growth, we use the tests for long-run asymmetry proposed by Shin et al. (2014). Table 6 displays the Wald statistics that suggest the rejection of the null hypothesis of the long-run symmetry in all models and countries between the positive and negative components of the examined financial development variables with the exception of the model 1 for Algeria where Depth is used as a proxy.

4. CONCLUDING REMARKS

The relationship between financial development and growth is a subject that has been widely debated and whose controversy in the empirical literature is more pronounced since different econometric techniques, linear and nonlinear regressions and distinct data samples have shown divergences with regard to the sign and the intensity of this relationship. The threshold effects as well as the recent global financial crises have sparked an interesting debate about possible asymmetries of finance-growth nexus. In this context, this study examines the presence of asymmetries in the short- and long-run relationships between economic growth and three measures of financial development in four SMCs using annual data from 1984 to 2017. To investigate the asymmetric nexus among the variables, the nonlinear and asymmetric ARDL cointegration approach recently developed by Shin et al. (2014) is utilized. Our empirical findings confirmed the presence of asymmetries effects in the long-run as well as in the short run.

Precisely, when considering the three measures of financial development together (model 4), the findings reveal that in the long run, positive changes in financial development tend to lead to the increase in growth while negative changes tend to lead a decrease in growth.

Similarly, the results provide evidence that Depth, taken alone (Model 1), has a significant positive effect on economic growth in Egypt, Morocco and Tunisia. It seems that money supply has a healthy effect on growth in these economies. We also find that the long-run coefficient estimates, when considering each Private Credit as financial development measure separately (Models 2 and 3), confirm the hypothesis that the effect of financial development becomes clearly negative or insignificant on economic growth.

From these results, the principal policy recommendation for policymakers is to prioritize improvements in all depth and credit activities of financial sector development to ensure sustainable economic growth.

Table 4. Nonlinear ARDL estimation results

	Algeria				Egypt				Morocco				Tunisia			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	1,086	-3,196	-3,225	11,098**	4,539	2,169**	-2,171**	2,118***	4,860***	4,096***	5,437***	4,590**	-9,407***	3,310	3,144	-3,442***
EG(-1)	-1,293***	-1,076***	-1,078***	-2,124***	-1,329***	-1,144***	-1,142***	-3,922***	-1,493***	-0,570***	-0,608***	-3,651***	-1,605***	-0,930***	-0,927**	-1,203***
Inf(-1)	0,303**	-0,077	-0,076	0,491***	0,074	-0,450***	-0,449***	-0,630**	0,434	-0,284	-0,042	-0,480*	-0,569***	0,081	-0,332***	-0,057
Gov(-1)	-0,376	0,115	0,116	0,452***	0,257	0,242	0,240	0,322	-0,567***	0,194***	0,187***	-1,713**	0,174***	0,182	0,225**	0,462***
$Depth^{+}(-1)$	0,063*			0,147*	0,126**			0,258**	0,017			0,066*	-0,094***			0,101**
$Depth^{-}(-1)$	0,043			-0,210***	0,131***			0,390*	-0,116**			0,208***	-0,102***			-0,114***
$Private^{+}(-1)$		-0,077*		0,195***		-0,071***		0,318**		-0,035*		0,308***		-0,075**		0,105***
$Private^{-}(-1)$		0,089***		-0,170***		0,089		-0,270**		-0,046**		-0,299**		0,067		-0,112**
$Privy^{+}(-1)$			-0,078*	0,194***			-0,069***	0,212**			-0,009	0,201***			-0,073***	0,115***
$Privy^{-}(-1)$			0,090***	-0,165***			0,101*	-0,368**			-0,027***	-0,301***			0,061***	-0,055***
ΔEG(-1)	-0,669			0,741***	0,444*			5,027***	-0,983***	-0,934***	-0,950***	0,569***				
ΔEG(-2)	-0,457*	-0,210	-0,213		0,370**	0,696***	0,702***	2,850***	-0,775***	-0,776***	-0,797***		-0,227*			
ΔEG(-3)	0,327*					0;512**	0,511						-0,223*		0,308***	
$\Delta Depth^{+}$	0,166							0,112				0,425**	0,393**			
$\Delta Depth^{+}(-1)$	0,246**				-0,159**			1,287**					1,338***			0,582*
$\Delta Depth^{+}(-2)$	0,490***				-0,419**			0,478**					0,582**			
$\Delta Depth^{+}(-3)$					-0,339**				-0,278				0,648**			
$\Delta Depth^{-}$				-0,535***				-0,723**	-0,723				-2,994***			-3,254***
$\Delta Depth^{-}(-1)$				1,043***				0,551**	1,331**			-0,702	0,727			-1,142**
$\Delta Depth^{-}(-2)$								1,050**	1,186*							
$\Delta Depth^{-}(-3)$									1,255**							
$\Delta Private^{+}$				-0,122***		0,281		0,770**				4,352***				-0,759***
$\Delta Private^{+}(-1)$				0,057***		0,818***		0,546**		-0,235*		-0,212		-0,223		0,971**
$\Delta Private^{+}(-2)$		0,303						-0,636								
$\Delta Private^{+}(-3)$						-0,250										
$\Delta Private^{-}$				-0,300***				-2,450**		-0,435*		-8,659**		-1,120***		
$\Delta Private^{-}(-1)$		0,140**		0,800***		-0,546***		-4,222***						-0,657***		-0,523

Table 4. (continued)

ΔPrivate$^-$(-2)		0,117*				-1,498***		-0,801**						-0,424**		
ΔPrivate$^-$(-3)						-0,250*								-1,459***		
ΔPrivy$^+$				0,123***				0,773**				-5,149***			-0,324***	-0,130
ΔPrivy$^+$(-1)				-0,057***			0,819***	0,548**								-0,353**
ΔPrivy$^+$(-2)			0,317					-0,638**								
ΔPrivy$^+$(-3)																
ΔPrivy$^-$								-2,456**			-0,409*	8,908**			1,078***	-0,403***
ΔPrivy$^-$(-1)			-0,141**	-0,799***			-0,547***	-4,224***				0,586**			0,501***	-0,759***
ΔPrivy$^-$(-2)			-0,118*				-1,499***	-0,803**								
ΔPrivy$^-$(-3)							-0,251								0,280**	
ΔInf				0,146				-0,663**					1,486***	0,963***		-0,546
ΔInf(-1)	-0,206**			-0,254***	0,151	1,205***	1,204***		-0,561*					1,130***	-1,074**	
ΔInf(-2)	-0,131	0,099	0,100		0,239***	1,046***	1,047	0,244***	-0;679***	0,283	-0,483***		1,759***		-0,703**	
ΔInf(-3)	-0,200*					0,481**	0,482**						1,688***			
ΔGov	-0,616*	-0,510	-0,514*		-0,982	-2,581**	-2,579**	1,065	-2,518***	-2,213***	-2,407***	-4,094***		-1,188**	-1,887***	
ΔGov(-1)	0,528	0,305	0,307		1,034*	-0,947	-0,948	2,454**	1,515*	1,992***	2,134***	-1,941***			2,910***	-2,510**
ΔGov(-2)	-0,463	-0,511*	-0,515*		1,097**	0;663	0,661	2,076**	1,024	1,493**	1,249**			-2,575***	2,498***	
ΔGov(-3)	1,196***								2,312***	2,344***	2,553***		-1;377	0,964	2,993***	
R^2	0,878	0,700	0,701	0,954	0,979	0,896	0,898	0,985	0,986	0,984	0,979	0,989	0;953	0;938	0,958	0,981
$\chi^2_{SC}(1)$	1,626	0,136	0,149	1,296	0,329	0,496	0,490	1,296	0,457	0,958	0,139	1,589	1,830	1,773	0,923	0,074
$\chi^2_{SC}(2)$	0,753	0,334	0,346	1,403	0,289	0,218	0,199	0,304	0,851	1,451	0,252	0,224	0,860	0,943	0,743	0,550
$ARCH(1)$	0,134	0,003	0,001	1,980	0,432	0,326	0,320	1,980	0,663	0,202	0,239	0,537	0,185	0,064	0,129	0,001
$ARCH(2)$	0,067	0,731	0,780	1,791	0,739	0,295	0,290	1,791	1,216	0,324	0,230	0,290	0,361	0,102	2,477	0,987
J-B	0,781	0,341	0,322	0,309	3,609	0,258	0,256	0,309	1,278	0,398	1,134	0,579	1,047	0,036	1,726	0,418

Note: This table reports the results of the estimationNonlinear ARDL model: short-run coefficient estimatesand diagnostic tests. The superscripts "+" and "−" denote positive and negative partial sums, $\chi^2_{SC}(.)$, $ARCH(.)$ and J-B denote the LM tests for serial correlation, autoregressive conditional heteroskedasticity andthe Jarque-Bera test for normality of residuals. The lag order given in the parenthesis.The asterisks *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 5. Long-run relations

	Algeria				Egypt				Morocco				Tunisia			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	0,839	-2,970	-2,992	5,225***	3,415	1,895*	-1,901*	0,540**	3,255	7,186	8,942	1,257**	-5,861**	3,559	3,391	-2,861**
Depth+	0,048			0,069***	0,094***			0,065**	0,011**			0,018**	-0,058***			0,083**
Depth-	0,033			-0,098*	0,098***			0,099**	-0,077			0,056***	-0,063***			-0,094***
Private+		-0,071*		0,091***		-0,062***		0,081**		-0,061		0,084***		-0,080*		0,087***
Private-		0,082***		-0,080***		0,077***		-0,068*		-0,080		-0,081***		0,072		-0,093***
Privy+			-0,072*	0,091***			-0,060***	0,054**			-0,014**	0,055***			-0,078***	0,095*
Privy-			0,083***	-0,077***			0,088*	-0,093**			-0,044	-0,081***			0,065***	-0,045***
Inf	0,234	-0,071**	-0,070*	-0,231***	-0,055*	-0,393***	-0,393***	-0,160**	0,290	-0,498	-0,069*	-0,131*	-0,354***	0,087	-0,358***	-0,047
Gov	-0,290	0,106	0,107	0,212***	0,193	0,211	0,210	0,082*	-0,379	0,340*	0,307**	-0,469	0,108***	0,195*	0,242***	0,384***

Note: This table reports the results of the estimation long-run coefficient. The asterisks *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 6. Testing the presence of asymmetries

	Algeria				Egypt				Morocco				Tunisia			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Depth	0,945			30,091***	3,60*			34,463***	0,706			10,443***	60,971***			15,327***
Private		1,328		35,768***		25,148***		16,028**		2,946*		0,945		11,216***		11,846***
Privy			1,370	35,772***			25,151***	4,196*			2,936*	0,195			19,103***	9,554**

Note: This table presents the results of the Wald test of long-run symmetry. The asterisks *, ** and *** indicate a rejection of the null hypothesis of symmetry at the 10%, 5% and 1% levels, respectively

From a policy perspective, empirical evidence is of major importance to policymakers in the sense that these could represent a strong argument for the initiation of a financial reform on long-run policies aimed at expanding financial depth, as well as enhancing efficiency of credit to the private sector in parallel. These findings call for attention from policymakers in these four SMCs economies to abstain from a financial policy to improve credit activity without being accompanied by a policy of promoting money supply. If this is the case, their policy will give results contrary to those expected, which is not desirable for the smooth running of their policy.

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ENDNOTES

1 The critical values are from Narayan (2005) given the small sample size and the number of explanatory variables is less than eight.
2 The asymptotic critical values are from Pesaran et al. (2001), given the number of explanatory variables is equal to eight.
3 Autocorrelation up to lag (2) order.
4 Heteroscedasticity up to lag (2) order.

APPENDIX

Algeria

Figure 1. Model 1

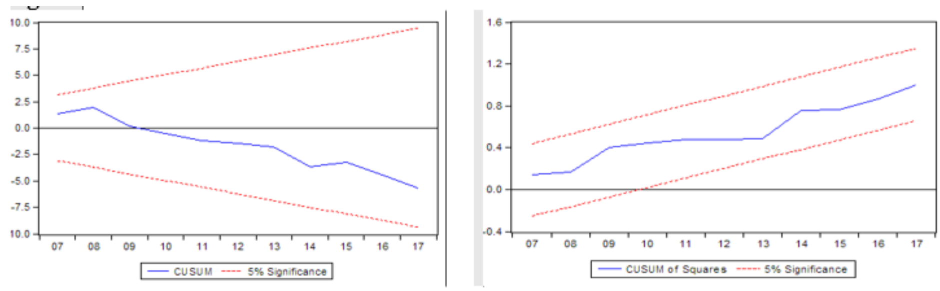


Figure 2. Model 2

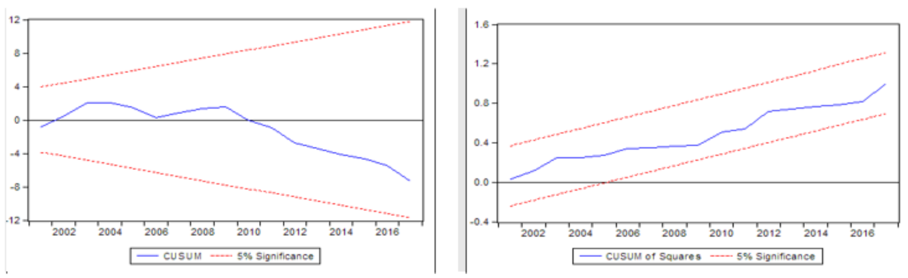


Figure 3. Model 3

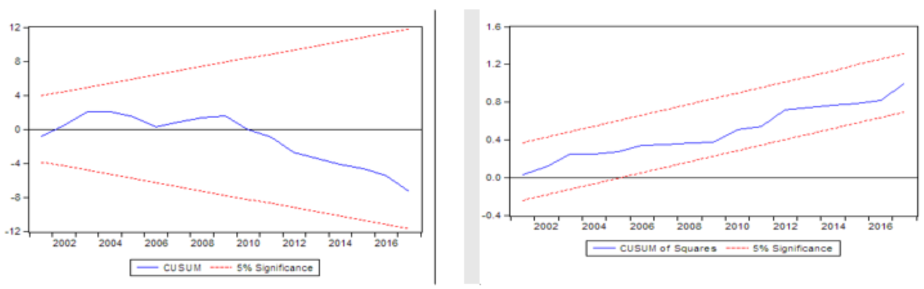
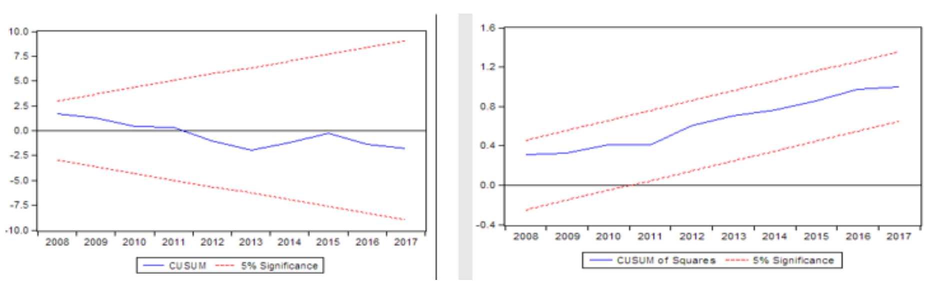


Figure 4. Model 4



Egypt

Figure 5. Model 1

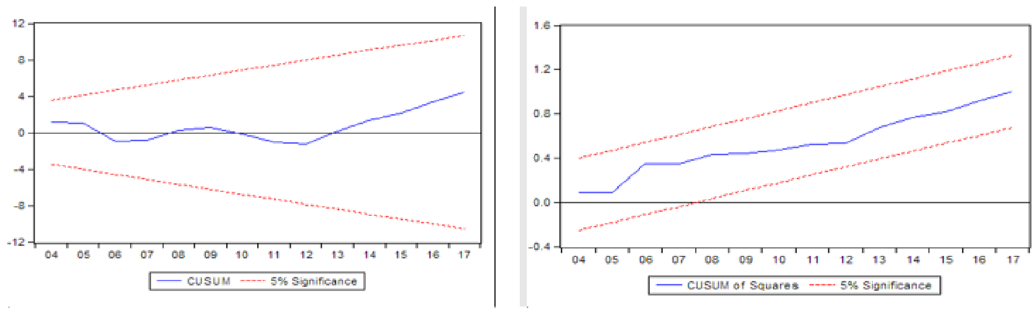
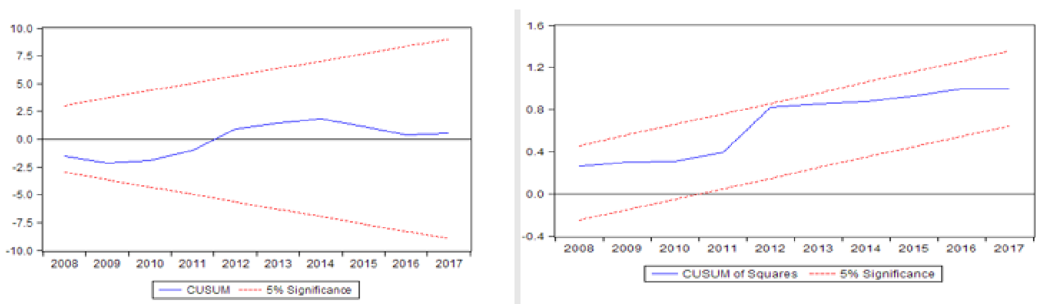


Figure 6. Model 2



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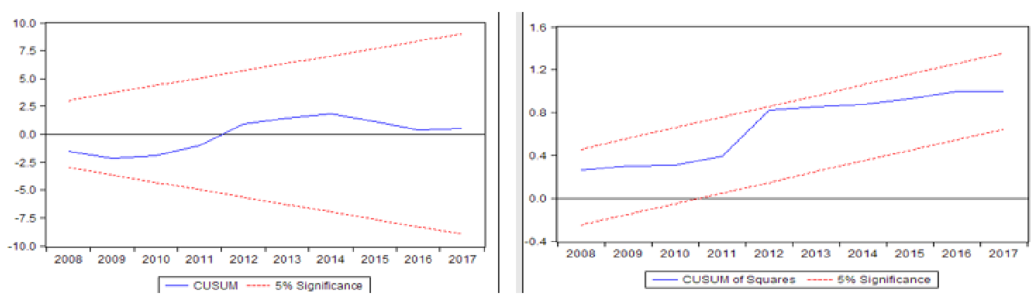
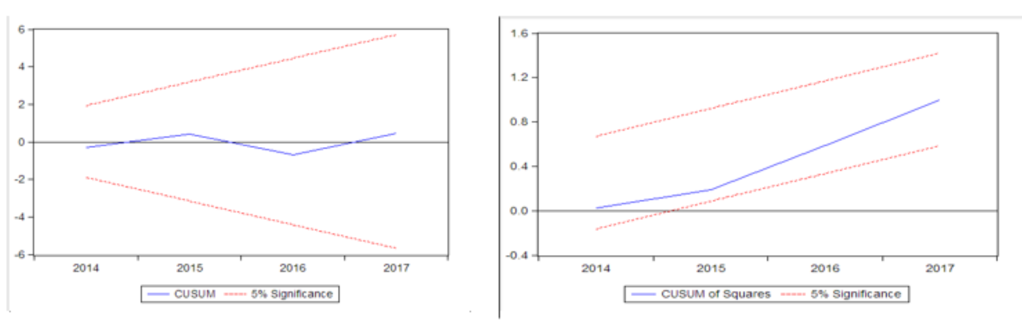


Figure 8. Model 4



Morocco

Figure 9. Model 1

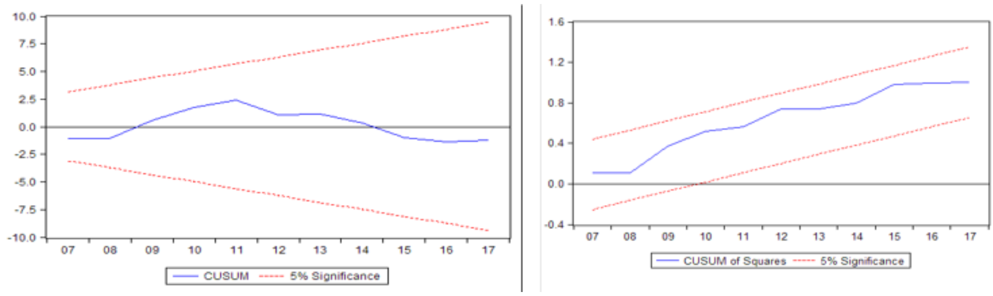


Figure 10. Model 2

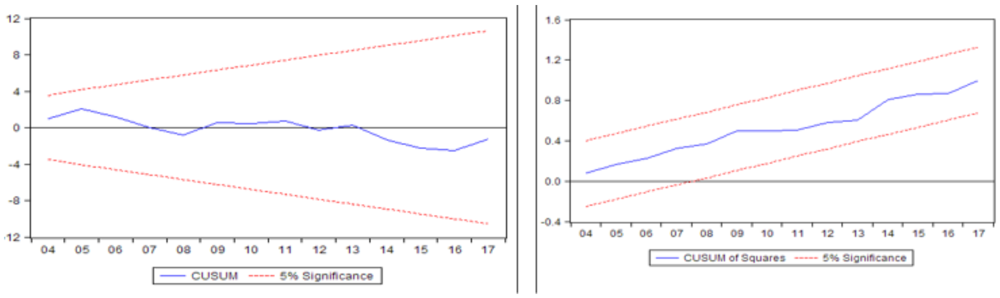


Figure 11. Model 3

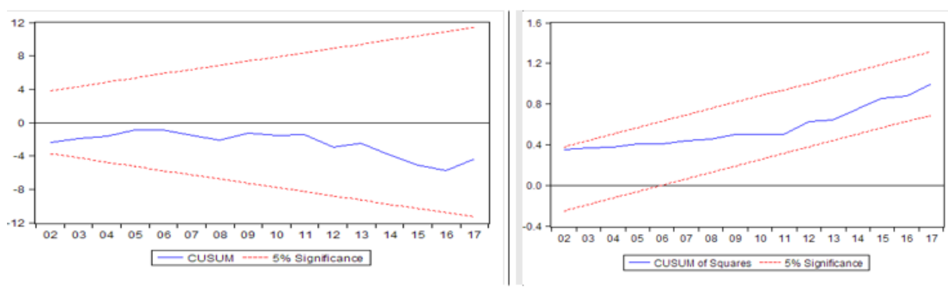
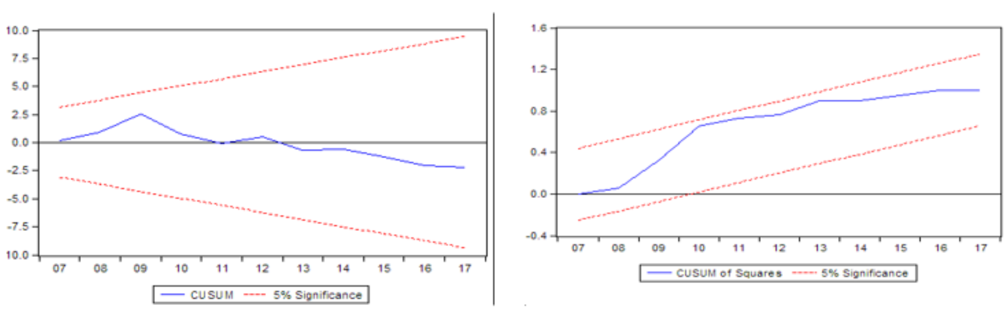


Figure 12. Model 4



Tunisia

Figure 13. Model 1

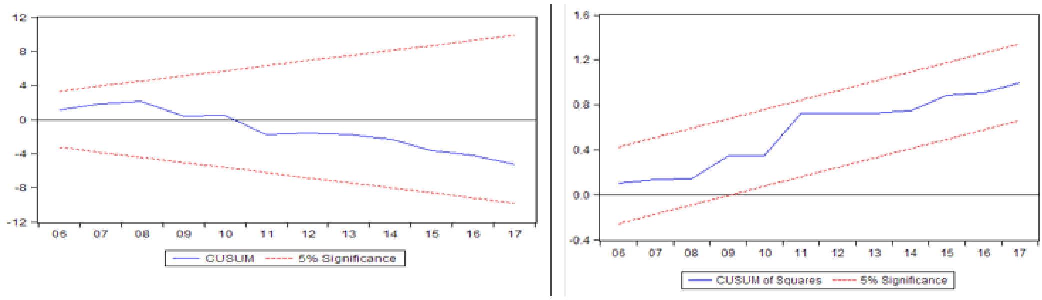


Figure 14. Model 2

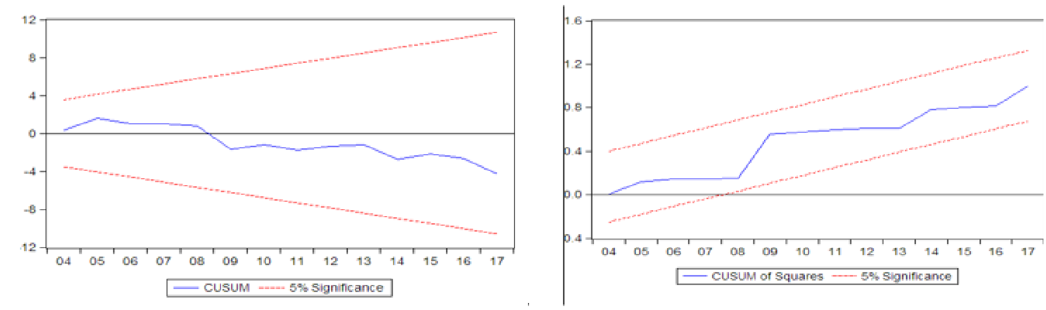


Figure 15. Model 3

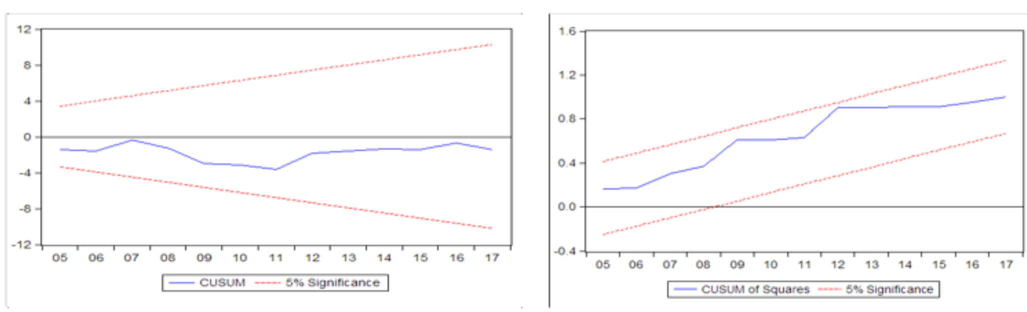


Figure 16. Model 4

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