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Public Debt in The Arab World: Asymmetric Effects on Economic Growth

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Abstract

The current study examines the asymmetric effect of public debt on economic growth rates in 10 Arab countries. The study relies on the regression of time series and cointegration analysis for ten countries selected based on the data availability. Specifically, it employs the non-linear autoregressive distributed lag model (NARDL) and a multiple structural breaks model. The outcomes of the analysis suggest the existence of asymmetric relationship between public debt and economic growth in many countries in the sample, both in the short- and/or the long-run. The asymmetric long-run findings demonstrate that the positive changes of public debt are negatively related to GDP growth rates in some countries, implying that more public debt reduces GDP growth rate. On the other hand, the negative changes in public debt are found to have a meaningful impact on economic growth in certain countries, meaning that the drop in debt levels leads to an increased GDP growth rate. The results of the regression with multiple breakpoints show the presence of structural breaks in the association between public debt and economic growth in a sizable number of countries. In general, we observe changes in the direction and/or the magnitude of the relationship between government debt and economic growth with respect to the structural breaks. The results imply that the interaction between debt and growth may not be consistent over time and could vary with respect to various economic conditions. As a result of this study, it is recommended that the impact of public debt on economic growth must be evaluated in a systematic manner and regularly to avoid adverse effects resulting from changes in the level of public debt.

Keywords: Public Debt, Economic Growth, Asymmetric Effect, NARDL, Breakpoints, Arab Countries

1. Introduction

The economic shock caused by the COVID-19 pandemic has affected all economic sectors across the globe. The amount of income lost, and the costs of recovery incurred by governments as a result of the COVID-19 shock resulted in a greater need for debt. It consequently increases countries' budget deficits, especially in low-resource and low-income countries. Experts predicted the joblessness and income losses resulting from the COVID-19 crisis would cause an economic depression that may last for years. As an example, the Arab economies attempted to address the COVID-19 pandemic crisis early on. In response to the outbreak of the pandemic, most Arab countries declared states of emergency, which included self-isolation, the closing of borders to foreigners, restrictions on citizens' movement, and curfews. A large fiscal stimulus packages were also announced to address the consequences of the COVID-19 health crisis. Despite the large fiscal packages allocated by Arab countries, the pandemic has already caused a dramatic economic shock, both due to negative demand/supply shocks and due to the decline in oil prices (Arezki and Nguyen, 2020). In addition, the Arab region's policymakers' appropriate response to the shock of COVID-19 might lead to a larger budget deficit than the expansion of relief and recovery efforts. In the Arab world, the growing debt ratio during the COVID-19 pandemic was very large, compared to their GDP, and could severely impact - living standards over the long term. It is imperative to determine how much government debt is considered excessive. Or do Arab countries have a "dumping point" at which debt becomes a major issue?

To answer the above questions, there are generally two schools of thought. The first school of thought believes the higher the debt-to-GDP ratio, the less likely the country will be able to repay its debt, which increases the risk of default and could cause a financial panic in the country. There are several macroeconomic channels through which large debt can negatively affect the economy. Recent research shows that higher debt-to-GDP ratios could cause much higher taxes, which would lower future incomes and create intergenerational inequity (De Rugy and Salmon, 2020). In particular, the rising level of debt may negatively affect the economy through increased long-term interest rates, inflation, higher distortionary tax rates, and a general constraint on countercyclical fiscal policies, which may result in heightened instability and slower economic growth (De Rugy and Salmon, 2020).

In contrast, the second school of thought argues that debt alone is not an indicative of a weak economy. Public debt, for example, provides a short-term stream of resources that can be used to boost economic growth. Several empirical studies emphasize the advantages of an additional debt in current favorable borrowing conditions, particularly when the borrowing rate is below the rate of economic growth (Leeper et al., 2016; Fatas et al., 2019; Yared, 2019). A study by Kose et al. (2020) states that borrowing may be appropriate in times of weak growth, to boost economic activity. The reason for this is that countries, especially those with low reserve currencies, may be able to borrow more and finance priority expenditure by taking advantage of low-interest rates (Kose et al., 2020). Additionally, Blanchard (2019) argues that interest rates on government bonds have typically been lower than nominal growth rates in the United States of America for several decades. Due to this, it is advantageous for the USA government to take on more debt to employ expansionary fiscal policy to stimulate the economy. Also, Kose et al. (2020) conclude that having more debt creates long-term growth, stabilizes short-term macroeconomic fluctuations, and provides safe assets.

One of the main challenges facing policymakers is determining the appropriate level of government debt that stimulates growth. It is a two-edged sword to deal with government debt. Using it wisely and responsibly by policymakers can enhance welfare, but it can also have catastrophic consequences if it is used irresponsibly (Cecchetti et al., 2011). In other words, it measures how efficiently government uses its debt. It is worth mentioning that there are views imply the existence of an inverted U-shape relationship public debt and economic growth rate. Therefore, a nonlinear relationship between the public debt and GDP growth rate is expected to take place between the variables (Casares, 2015; Omotosho, Bawa, and Doguwa, 2016).

Debate and discussion about the optimal level of debt and its impact on economic growth are still ongoing and the results of many empirical studies and research works are inconclusive. For example, a study by Reinhart and Rogoff (2010) found that a debt to GDP ratio above 90 percent is detrimental to a country's economic growth. According to Baumet al. (2013), the debt to GDP threshold level of 95 percent harms economic growth in European nations. Furthermore, Cecchetti et al. (2011) project an 85 percent rate for 18 countries from the Organisation for Economic Co-operation and Development (OECD) as a threshold of debt-to-GDP. The World Bank observed that countries with debt-to-GDP ratios exceeding 77 percent for long periods suffer considerable economic slowdowns. Specifically, a country's economic growth is slowed by 0.017 percentage points for every percentage point above this limit of

debt. A similar phenomenon occurs in developing countries and emerging economies, where every further percentage point of debt above 64 percent annually slows down economic growth by 0.02 percentage points.[1]

A report by the Fiscal Affairs Department of the International Monetary Fund (IMF) [2] provides an illustration of the "fiscal adjustments that would be necessary for developed countries, as well as developing and emerging economies, to reach suggested public debt-to-GDP ratios by 2030". In this report, it's projected that a 60% debt-to-GDP ratio is the optimal level for developed economies, while 40% is the optimal level for emerging and developing economies by 2030. Therefore, it would seem that these benchmarks are seen as "optimal determinants of the debt-to-GDP ratio" insofar as exceeding these limits would put fiscal sustainability at risk for these countries. This is in line with IMF's global macroeconomic model, which promotes fiscal policy's dual role of (1) smoothing business cycles in the short run; and (2) meeting long-term debt sustainability targets (Kumhof, Muir, Mursula & Laxton, 2010).

Concerning debt-to-GDP in the Arab world, statistical information indicates that, in some countries, the debt-to-GDP ratio exceeds 200 percent, which is considered a relatively high level. During the pandemic, the debt level in the Arab countries fluctuated greatly, and in some states, the debt-to-GDP ratio extended to an undesirable level. Thus, the study aims to examine the relationship between debt-to-GDP and economic growth ratio for Arab countries. Also, the potential asymmetries in the debt-growth nexus are investigated using nonlinear autoregressive distributed lag (NARDL) introduced by Shin et al. (2014). In addition, the study explores the possibility of a turning point in the relationship between public debt and GDP growth rate utilizing least squares with breakpoints according to Bai and Perron (2003).

The rest of the paper is laid out as follows: section 2 consists of an overview of relevant literature, section 3 discusses data sources and method of analysis, section 4 presents an analysis and discussion of the outcomes, and section 5 concludes with a summary and policy recommendation for relevant policymakers and authorities.

[1] "Finding The Tipping Point -- When Sovereign Debt Turns Bad" | Policy Research Working Papers (worldbank.org).
[2]. IMF, M. (2010). Fiscal Monitor: Navigating the Fiscal Challenges Ahead. Prepared by the Staff of the Fiscal Affairs Department.

2. Literature Review

A number of economists and researchers in both advanced and developing countries have empirically researched the impact of government debts on economic growth. In developing countries, Reinhart and Rogoff (2010) examined the impact of changes in public debt on a long-term real GDP growth rate over the period (1790-2009) for a sample of 20 countries. Results indicated that government debt below a threshold level of 90% had a positive effect on economic growth, while debt above a threshold level of 90% had a negative effect. Similarly, Woo and Kumar (2015) found that public debt levels exceeding 90% had a significant negative impact on economic growth in developing countries. Furthermore, Pattillo et al. (2002) used panel data analysis to assess the impact of external debt on per-capita GDP growth for 93 developing countries during the period (1969-1998). The authors found that external debts exceeding 35 to 40 percent of the GDP growth rate are negatively related. Similarly, Clements et al. (2003) investigated the relationship between external debt and per-capita growth rates for 55 low-income countries over the period (1970-1999). Their findings indicated that external debt to GDP growth rates over 20 to 25 percent negatively influenced economic growth in developing countries.

Taher (2016) utilized data from 1990 to 2014 to examine the impact of public debt on economic growth in the Gulf Cooperation Council Countries (GCC), which includes Saudi Arabia, United Arab Emirates, Bahrain, Kuwait, Oman, and Qatar. The results suggested that public debt had varied effects on GDP per capita growth for various GCC countries. In Saudi Arabia and Kuwait, the findings indicated that public debt negatively affected economic growth, even though it was statistically insignificant. In the case of Bahrain, Oman, Qatar, and the United Arab Emirates, the findings showed that debt had a positive impact. Alshammary et.al (2020) analyzed the existence of a debt-to-GDP growth threshold for 20 of the Middle East and North Africa (MENA) countries over the (1990-2016) period using threshold estimation. According to the study, public debt has a stimulatory effect on economic growth in MENA countries when the debt-to-GDP ratio is less than 58%. However, if public debt exceeds the specified threshold level, there will be a negative impact. As a result, the study suggested policymakers should be more cautious when establishing public debt policies.

In addition, Omrane et al. (2017) used Panel Threshold Regression to examine the relationship between debt-to-GDP growth for Tunisia, Turkey, Morocco, and Egypt throughout (1970-2010). The study results showed that the debt-to-GDP threshold should be set at 39.5%. However, once the debt-to-GDP threshold was exceeded, the debt had a negative impact on

economic growth in all countries studied. Similarly, Khanfir (2019) examined the debt-to-GDP threshold for Tunisia, Algeria, Morocco, and Egypt over the period (2003–2012) by using Panel Threshold Regression. A threshold ratio of 42 percent was found to be beneficial to economic growth, and the ratio was positively associated with it. Beyond this threshold ratio, however, debt has a negative impact on the economy in these selected countries. Using the Generalised Method of Moments (GMM) approach, Boukhatem and Kaabi (2015) examined the relationship between public debt-to-GDP growth rates for 19 MENA countries from 1990 to 2011. In the study, it was found that debt levels that are less than fifteen percent tend to boost economic growth.

During the COVID-19 health crisis, public or government debt has increased dramatically across the world, particularly in Arab countries and this is expected to increase further in the future. Recent studies have focus on identifying a debt threshold level or turning point that may help policymakers to decide if governments should finance budget through borrowing. Most of the above studies revealed that once a country's debt level has reached a certain level, it reduces economic growth. The estimated debt-to-GDP growth threshold levels, however, varied from study to study and can provide some insight into what the optimal level of public debt might be. In fact, there is no single threshold level that could be applied to all countries because different countries have different economic resources and debt structures. In the Arab region, further investigation is needed to analyse the impact of debt on growth considering the possibility of the existence of a turning point, based on specific country data instead of panel data.

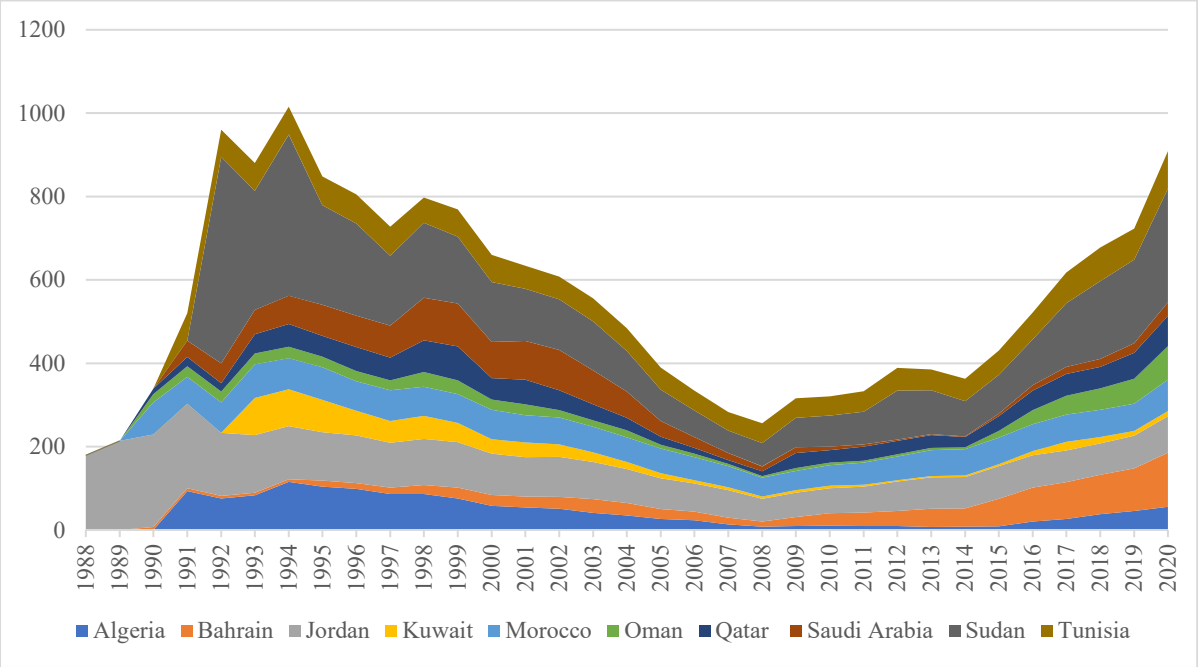
3. Methodology

3.1 Data Sources and Variables Measurement

In this study, we utilize the annual frequency time series data of Gross Domestic Product (GDP) growth rate, total government debt to GDP ratio, foreign direct investment net inflows, Gross capital formation rate as a percentage of GDP, inflation rate measured by the change in consumer price index (CPI), and population growth rate over varied periods of times for each country, starting from 1988 to 2020. The sample size of the study included 10 countries: Algeria, Bahrain, Jordan, Kuwait, Morocco, Oman, Qatar, Saudi Arabia, Sudan, and Tunisia. A selection of countries was based on data availability over the study period. GDP represents the dependent variable in the model, while the rest of the variables played the role of independent variables under the current study. All the variables' data under study were

obtained from the International Monetary Fund (IMF) statistical database. In which, GDP growth rate is the change in economic output from year to year as a measure of how fast an economy is growing. While the debt to GDP ratio is a measure of a country's public debt compared to its gross domestic product (GDP). Foreign Direct Investment (FDI) is an economic indicator that measures the value of cross-border transactions involving direct investments by non-residents during a given period, usually one year. Furthermore, the gross capital formation rate is determined by gross fixed capital formation divided by gross value added. Measuring it helps us determine the proportion of total factor income reinvested in new fixed assets over time. Meanwhile, a population growth rate is a rate at which the population grows by the number of people within each country.

Figure 1. Government Debt (% GDP)



3.2 Method of Analysis

3.2.1 Preliminary Tests

In this study, descriptive statistical tests were applied to describe the preliminary behavior of the variables. This includes measures of central tendency characteristics such as mean, minimum, maximum, and dispersion characteristic (standard deviation). The descriptive analysis includes variance and standard deviation. The data distribution is examined further using skewness, kurtosis, and Jarque-Bera normality tests. Additionally, all-time series are pre-tested for unit root to ensure a non-spurious estimation, and to estimate the time series

efficiently and time-invariantly. To be sure that the cointegration bounds test is valid, the stationarity of the time series must also be checked to make sure none of the variables are integrated beyond one *I*(1). For this, we employ the augmented Dickey-Fuller Test (ADF) (1979) that allows for a structural break. Table 1 presents a summary of descriptive statistics for the variables under study. Overall, the results revealed some degree of heterogeneity across countries for all indicators.

3.2.2 Non-Linear-Autoregressive Distributed Lage (NARDL) model

Once the order of variables is established by unit root testing and the optimal lag length is determined using the relevant criteria such as (Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn Criterion (HQC)), the bounds test within a NARDL model that developed by Shin et al. (2014) can be used to determine whether there is cointegration between the variables. The null hypothesis states that there is no long-run relationship between the variables in the model, while the alternative hypothesis states it exists. Statistically, this can be tested by restricting the long-run coefficients to jointly equal zero using Wald test.

The cointegration between the variables is determined if the F-statistic exceeds the critical values of the upper bound using Narayan (2005), who provided the upper and lower bounds F-statistics for a short sample size (30 – 80 observations).

3.2.3 Long Run and Short-Run Impacts Estimation

After cointegration is confirmed by the Bound test, long run and short-run asymmetric impacts of public debt on economic growth are estimated. By including both the positive, "$debt_t^+$" and negative "$debt_t^-$" changes in the public or government debt as explanatory variables in the aggregate production function, the asymmetric impact of public or government debt on economic growth can be accounted and explained. Assume $debt_t^+$ and $debt_t^-$ measure the positive and negative changes in government debt, respectively. This can be expressed using the following formula:

$$debt_t^+ = \sum_{i=1}^{t} \Delta\, debt_t^+ = \sum_{i=1}^{t} \max(debt_i\ , 0) \qquad (1)$$

$$debt_t^- = \sum_{i=1}^{t} \Delta\, debt_t^- = \sum_{i=1}^{t} \max(debt_i\ , 0) \qquad (2)$$

The NARDL can be specified in an unrestricted error correction model (UECM) as follows:

$$\Delta \mathrm{GDPG}_t = \beta_0 + \beta_1 \mathrm{GDPG}_{t-1} + \beta_2 debt_{t-1}^+ + \beta_3 debt_{t-1}^- + \beta_4 \mathrm{FDI}_{t-1} + \beta_5 GCF_{t-1} + \beta_6 \mathrm{INF}_{t-1} + \beta_7 \mathrm{PGR}_{t-1} + \sum_{i=1}^{m1} \alpha_1\ \Delta \mathrm{GDPG}_{t-i} + \sum_{i=0}^{m2} \alpha_2\, \Delta debt_{t-i}^+ + \sum_{i=0}^{m3} \alpha_3\, \Delta debt_{t-i}^- +$$

$$\sum_{i=0}^{m4} \alpha_4 \Delta \mathrm{FDI}_{t-i} + \sum_{i=0}^{m5} \alpha_5 \Delta GCF_{t-i} + \sum_{i=0}^{m6} \alpha_6 \Delta \mathrm{INF}_{t-i} + \sum_{i=0}^{m7} \alpha_7 \Delta \mathrm{PGR}_{t-i} + \mu_t \quad (3)$$

Where $GDPG$ refer to the yearly growth rate in gross domestic product of each country under study, $debt$ denotes for public or government debt, FDI refers to foreign direct investment, GCF refers to gross capital formation the rate, INF denotes for Inflation rate, PGR indicates for yearly population growth rate for each selected country, Δ refers to first-difference, α_0 denotes the constant term, β_1, …, β_7 are the coefficients describing the unrestricted long-run equation, α_1, …, α_7 are the short-run coefficients, m_1, ..., m_7 represent the lag orders for each variable in the model, μ_t stands for the residual error term, *t*- is the time, and *i* is the time of the previous observation value. According to Pesaran et al. (2001) the null hypothesis no cointegration ($H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$) is tested against the alternative of cointegration ($H_0: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$). In case the F-statistic is greater than the upper critical bound, the null hypothesis can be rejected and cointegration exist. The symmetry test is conducted in the long-run ($H_0: \beta_2 = \beta_3$) and the short-run ($H_0: \alpha_{2i} = \alpha_{3i}$) using Wald-test. The rejection of the H_0 implies the relationship between government debt and growth is an asymmetric and the ARDL model is estimated accordingly. The short-run effect is explained by the coefficient α_1, …, α_7, and the error correction term (ECT) that measures the speed of adjustment coefficient is captured by β_1. Where the long-run impact of the independent variables on GDP growth rate is computed as, $-\frac{\beta_i}{\beta_1}$.

3.2.4 Diagnostic tests

Finally, several diagnostic tests need to be conducted to determine whether the NARDL models are valid and stable. A serial correlation test was done to test that the regressors do not share a serial correlation, a normality test was done to ensure residuals are normally distributed, and ultimately a heteroscedasticity test was conducted to ensure the model is free of any ARCH effect. In addition, the NARDL models were also tested for stability using Cumulative Sum of Recursive Residuals (CUSUM), and Cumulative Sum of Squares of Recursive Residuals (CUSUMsq).

3.3 A Multiple Structural Breaks Model

A model of multiple structural breaks of Bai and Perron (2003) is further examined in order to robust if there is a nonlinear relationship between government debt and economic growth for each selected country under study. Using the following formula, we present the linear model

of multiple structural breaks of public government debt on economic growth, which includes T periods and m structural breaks, which create m + 1 regimes:

$$Y_t = \delta_i Debt_t + \vartheta_i X_t + \mu_t, i, = 1, \dots, m+1, t = T_{i-1} + 1, \dots, T_i \qquad (4)$$

In which Y_t represents the GDP growth rate, X_t refers to a vector of the control variables under study, $Debt_t$ is denoted for public or government debt for each country under study, δ_i refers to the corresponding vectors of regime-dependent coefficients, ϑ_i denotes regime-independent coefficients for , $i, = 1, \dots, m+1, t = T_{i-1} + 1, \dots, T_i$, while μ_t denotes the error term.

4. Results of the Study

Table 2 presents the findings of the unit root test. Although the study employed the ARDL cointegration approach that accommodates *I*(0) and/ or *I*(1) variables, the main purpose of unit root test is to avoid any *I*(2) series. The results of the ADF unit root test[3] indicated that all the variables are integrated of order one or order zero and none of the variables are integrated of the second order. Table 3 shows the findings of the symmetry (equality) test for the ten countries. Also, the bound test and optimal lag length are presented in the table. The symmetry test was conducted using Wald F-test, both in the short- and long-run. The results indicated that the symmetry assumption in the long run was rejected for five countries, namely, Jordan, Kuwait, Qatar, Sudan, and Tunisia. However, the short-run symmetry was rejected for four countries, specifically, Algeria, Jordan, Qatar, and Sudan. Hence, only Jordan, Qatar, and Sudan can be estimated asymmetrically in the long- and short-run. While Kuwait and Tunisia can be estimated in an asymmetric fashion with respect to government debt in the run long run, but in a symmetric way in the short run. Regarding Algeria, the ARDL model can be estimated symmetrically in the long run and asymmetrically in the short run. The results revealed that all other countries, namely, Bahrain, Morocco, Oman, and Saudi Arabia should be estimated symmetrically both in the short and long-run after not being able to reject the symmetry test. The analysis of asymmetric/symmetric ARLD shall be based on the outcomes of the symmetry test results shown in Table 3. Also, the bound test for cointegration is an important indicator to verify the existence of a long-run relationship among the variables of the model. The results of the bound test showed the existence of cointegration relationship among the variables for all countries.

3 Note that we used unit root with structural break test, which is more robust compared to the conventional ADF, we didn't report the break dates.

Table 4 presents the asymmetric and/or symmetric ARDL results for all the selected countries. The unrestricted ARDL models were estimated separately for each country using maximum lag of 2 as suggested by Narayan (2005). In addition, the optimal lag order was reached using general-to-specific approach. The error correction terms for all countries were negative and statistically significant suggesting the existence of cointegration relationships. The established long-run relationship was re-verified by the bound test, shown in the bottom of the table for all countries. The short-run coefficients revealed that positive changes in government debt had a negative effect on GDP growth rates in Algeria, Jordan, and Qatar suggesting that an increase in debt is associated with a decline in economic growth, whereas it had a positive lag effect on growth in Sudan indicating that higher debt may result in higher growth. However, the decline in government debt was found to have a different impact on growth since it was positive and significant in the case of Algeria but insignificant for Qatar, while it had a negative effect in the case of Jordan, Bahrain, and Sudan. The positive sign of the negative change in debt would imply an increase in the growth rate, whereas a positive change may suggest a drop in the economy's growth rates. For the other countries, the symmetric effect of government debt on GDP growth rates was negative in six of the sampled countries and statistically significant in four countries implying that the growth rates of real GDP are reduced/improved by the increase/decrease in government debt in the short run.

Also, the short-run results for other independent variables are shown in Table 4. The findings revealed that the gross capital formation as a percentage of GDP had insignificant short-run effects on growth except it was negatively and positively related to the dependent variable in Qatar and Tunisia, respectively. Where the effect of population growth on GDP growth was negative and significant in the case of Algeria and Oman, where it was positive and significant in Jordan, Sudan, and Tunisia. The FDI net inflows had a negative and significant effect on GDP growth in the case of Algeria and Tunisia, whereas the effect was positive in Jordan and Saudi Arabia, but negative but insignificant in Qatar and Sudan. Regarding the short-run impact of inflation on economic growth, we found it to be positive and significant in Kuwait, but negative and significant in Morocco and Qatar, whereas it was insignificant for the other countries.

Finally, the diagnostic tests are conducted to show the efficiency of the estimated models. The results of the normality test revealed that the errors are normality distributed for all estimated models. The Lagrangian Multiplier (LM) test was used to show the absence of autocorrelation in the error terms for the estimated models. Moreover, the autoregressive conditional

heteroskedasticity (ARCH) test results revealed that the errors were homoscedastic for all countries' models. Also, the stability test of CUSUM of squares showed that all models were stable.

Table 5 shows the estimation of the valid long-run models for all countries. The symmetric effects of government debt as a percentage of GDP on economic growth rates were mainly insignificant (Algeria, Morocco, Oman, Saudi Arabia), except it was negative and significant in the case of Bahrain. However, in Jordan, Kuwait, Qatar, Sudan, and Tunisia the effects of government debt on GDP growth were asymmetrical in nature. In particular, the positive changes in government debt were negative but insignificantly related to GDP growth rates in Jordan and negative and significant in Kuwait and Qatar. But the positive changes in debt had a positive insignificant influence on economic growth in Sudan and Tunisia. The negative impact of positive changes indicates that more public debt could be translated into a lower GDP growth rate. In addition, the negative changes in government debt were negative and statistically significant in Jordan, Kuwait, and Sudan suggesting that the reduction in debt levels would result in higher economic growth rates. Nonetheless, the negative changes in government debt were positive and significantly associated with GDP growth rates in Tunisia, which implied that the increase in government debt has no impact on economic growth, while the reduction in debt levels reduces GDP growth.

The control variables' results showed that gross capital formation as a percentage of GDP had a positive and significant impact on economic growth in Bahrain, and a negative significant effect on Morocco and Qatar suggesting that the accumulation of physical capital hinders growth. But the impact of gross capital formation on growth was and insignificant for the remaining countries. Moreover, population growth rates were negative and statistically related to GDP growth rates in Algeria and Kuwait, but positive and significant in Morocco and Tunisia. The negative effect that population growth has on GDP growth implies that more population put extra pressure on resources and thereby reduces economic growth. However, the FDI inflows as a share of GDP were negatively related to growth in Algeria and positively stimulated GDP growth in the case of Qatar and Tunisia. Also, the inflation rate had a positive and significant effect on economic growth in Algeria, Oman, and Sudan, but the has a negative and significant impact in Kuwait and Morocco.

We computed the dynamic multiplier of government debt increase or decrease on economic growth rates as shown in Figure 2. Note that we focused on the significant effect of debt

increase or decrease and ignored the countries that exhibit an asymmetric relationship between debt and growth in the long- and short-run. It is interesting to note that the decrease in debt took about 3 years to be fully transmitted to the GDP growth levels and converged to the long-run coefficient in Jordan and Tunisia but required roughly 5 years in Sudan. In Kuwait's case, it took around 4 years for the effect of positive and negative changes in government debt to be fully felt. Where the impact of positive changes in debt took about 2 years to be translated to improved growth rates in Qatar. Finally, the positive changes converged to the short-run value of -0.36 within 1 to 2 years but the effect, in the long run, was insignificant in the case of Algeria.

Table 6 demonstrates the findings of the regression with multiple breaks according to Bai and Perron (2003). It is important to note that two breaks were set as maximum due to the limitation of the sample as suggested by Antoshin et al. (2008). [4] Importantly, one breaking regressor (government debt) was assumed together with the intercept, while the remaining control variables were used as non-breaking regressors. The results revealed a breakpoint in the year 2010 for the case of Algeria, thus two growth regimes with respect to government debt were estimated. Before the break, debt was positive but insignificantly related to GDP growth. This may be explained by the decline of government debt during the first regime (1991–2009), which was related to its early repayment of public debt in 2007 (see Chibi et al., 2022). However, in the second regime (2010–2020) we found a negative and significant relationship between government debt and economic growth. This finding is quite surprising especially debt had an average of 9 percent of GDP between 2010 and 2015 before it rises to 56 percent in 2020.

In the same vein, there was one breakpoint in the year 1994 for Bahrain, thereby two regimes with regard to government debt were valued. In regime 1, there was a negative and statistically significant relationship between public debt to GDP and economic growth. Similarly, the relationship between the variables (debt and growth) was negative and significant in the second regime (1994–2020), and this could be due to the dramatic increase in government debt, especially between the year 2008 to 2020 since it reached 130 percent of GDP. Moreover, we found two breakpoints, in 1993 and 2009, for Jordan's case, thus three GDP growth regimes with respect to government debt were estimated. In regime 1 (1988–1993), government debt had a negative and significant impact on the GDP growth rate. In addition, the coefficient of

[4] Although the small sample described by Antoshin et al. (2008) is about 50 observations, however, such amount of data is not available for Arab countries.

government debt was negative in regime 2 (1994–2008). There was a huge reduction in government debt as a share of GDP between 1988 and 2008, which could justify the improvement in economic growth rates. During the periods of the first two regimes (1988–2008), the debt levels ranged from 222 as a percentage of GDP in 1990 to 54 percent in 2008, before it started to increase slightly to reach 88 percent in 2020. This may explain the positive insignificant relationship between government debt and economic growth in the third regime (2009–2020).

The results of break points regression for Kuwait showed no break was detected, therefore only one regime was estimated for all the variables in the model. The coefficient of government debt was positive but with no statistical significance, suggesting the changes in GDP growth rate remained invariant to shift in public debt levels. The level of government debt in Kuwait has dramatically declined from 89 percent in 1993 to about 3 percent in 2014, and it remained low after that. In the contrary, a one break was found in the case of Morocco in the year 2017. The first regime (1990–2016) findings suggested a negative but insignificant relationship between government debt and economic growth. However, there was a positive and significant relationship between the variables in the second regime (2017–2020), indicating that that higher government debt stimulates economic growth in Morocco during this period. Looking at government debt trends during regime 1, we found that it declined from about 81 percent in 1993 to 45 percent in 2008, before it raises after again. Although the levels of debt continued to increase during the second regime, but it remained below 75 percent. It is worth mentioning that the results obtained by NARDL suggested the absence of asymmetric relationship between debt and growth for Morocco, but the evidence of a structural break may imply the asymmetry in the relationship with respect to the break since the sign and magnitude have changed.

The findings revealed that two breaks were found in the case of Oman in the years 1994 and 2002, thus three growth regimes with respect to government debt were estimated. For the first regime, there was a positive and significant association between government and GDP growth. During the period of regime 1, the country had a moderate and stable level of government debt, which may justify the positive relationship in this regime. Nevertheless, there was a negative and significant relationship between the variables and that could be due to the drop in public debt levels from 35 percent in 1998 to 26 percent in 2001. Also, the government debt was insignificant in its relationship with the GDP growth rate in regime 3 (2002–2020). The government debt was declining between 2002 (18 percent) and 2014 (5 percent), before it rose sharply after 2014 and reached about 81 percent in 2020.

The breakpoints regression results showed the absence of any breaks in the case of Qatar, Saudi Arabia, and Sudan. There was a positive but insignificant relationship between government debt and economic growth in Qatar. In viewing the levels of public debt in Qatar, we observed that it has been fluctuating over the sample period ranging from 82 percent in 1999 to 9 percent in 2007. This may indicate that the government debt in Qatar was still below the level where it could lead to a negative and meaningful effect on GDP growth rates. In addition, the government debt had a negative insignificant effect on GDP growth in Saudi Arabia. Over the initial period of estimation, the government debt was relatively high as it exceeded 100 percent in 1998 and 1999 before it witnessed a dramatic decline starting from 2002. This particular result is critical for Saudi Arabia since it reflects the strong ability of the economy to avoid the potential adverse impact of government debt on economic growth. In addition, there was a negative but insignificant association between government debt and economic growth in a heavily indebted country like Sudan. For most of the sample period, the level of government debt was above 100 percent, and it was ranged from 495 percent in 1992 to 54 percent in 2007, before rising again to reach 273 percent in 2020.

Finally, we found one break in the year 2017 in the case of Tunisia, and two regimes were estimated accordingly. Regime 1 findings revealed that public debt had a positive insignificant impact on GDP growth. However, we found a negative and statistically significant relationship between debt and economic growth in regime 2 (2017–2020), indicating that higher government debt levels hinder the economy's progress in Tunisia. Interestingly, we observed that government debt ranged from 66 percent in 1991 to about 64 percent in 2016, but it rose from 74 percent in 2017 to 90 percent in 2020. This may suggest that the increase in government debt level beyond 74 percent translated into a reduction in GDP growth rates in regime 2.

5. Conclusion and Policy Recommendations

During the latest COVID-19 crisis, many governments have intensively used various debt instruments to finance the comprehensive fiscal interventions, which translated into historic levels of government debt-to-GDP. In this study, we examined the effect of government debt on economic growth rates in 10 selected Arab countries using time series and cointegration analysis. In addition, we have explored the potential asymmetries and structural breaks in the debt-growth nexus using the NARDL and regression with multiple breakpoints, respectively.

The results of the NARDL revealed an asymmetric association between government debt and economic growth in the short- and/or the long-run in six countries within the sample. On the one hand, the symmetric effects of government debt on economic growth, in the long run, were insignificant in the case of Algeria, Morocco, Oman, and Saudi Arabia. Whereas the effect was negative and significant in Bahrain, suggesting that higher debt is harmful to growth. On the other hand, the asymmetric long-run findings showed that the positive changes of government debt on growth were negative but insignificantly related to GDP growth rates in Jordan and negative and significant in Kuwait and Qatar, indicating that more government debt reduces GDP growth rate. The positive changes in debt were positive and insignificantly related to economic growth in Sudan and Tunisia. Moreover, the negative changes in government debt were negative and statistically meaningful in Jordan, Kuwait, and Sudan, suggesting that the decline in debt levels would lead to in higher economic growth. Nonetheless, the negative changes in government debt were positive and significantly linked to GDP growth rates in Tunisia, which implied that the increase in government debt had no impact on economic growth, while the reduction in debt levels reduce GDP growth.

The findings of the breakpoint's regression revealed the existence of one structural break in the relationship between government debt and economic growth in Algeria, Bahrain, Morocco, and Tunisia, while two structural breaks were found in Jordan and Oman. Overall, changes in the direction and/or the magnitude of the relationship between government and economic growth with respect to the structural break were observed. The implication of these findings is that the link between the two variables of our interest may vary with respect to various economic circumstances, and it does not necessarily follow a consistent pattern over time.

These findings suggest that in general government debt has heterogeneous impacts on economic growth in the sampled countries. In most countries, debt has asymmetric effects on growth in long- and/or short-run. Also, the results suggest that debt-growth associations may vary according to structural changes that take place in a country. These findings have significant implications for the understanding of how government debt interacts with the main macroeconomic indicator, the GDP growth rate.

The empirical analysis provided some evidence for systematic differences results in the relationship between public debt and growth across Arab countries. There was no common result indicating positive or negative effects of public debt on GDP growth and the various channels of transmission. A careful reading of the existing evidence calls for caution when it

comes to “one-size-fits-all”. The cases with negative effects of higher public debt on growth do not imply that sampled states are unable to sustain any level of public debt. It is important to note that the non-linear findings produce dissimilar results with respect to different structural breaks. Structural factors such as economic reforms, new policies, and economic crises, could reduce or increase the negative effect of debt on growth. Explaining how public debt affects economic growth may change over time (before and after breakpoints). Also, it is suggested that the government can mitigate the high and unsustainable level of debt if interest payments increase strongly and better manage the risks by reducing the primary fiscal balance and boosting the growth of real GDP to exceed the real interest rate. Therefore, countries should aim to keep their debt ratios at sustainable levels, where the effect of growth is not negative. Another main finding is that given the further increase in public debt to GDP ratios related to the crisis of COVID-19 in our sample, there is no evidence for a general urgency to bring down public debt to avoid a drag on growth since some countries have larger fiscal space.

Future research should, in addition to observing the effect of high debt on growth levels, take a more in-depth assessment of country-specific factors, and control for institutional quality and environmental aspects. There is a need to explore the various channels through which public debt may hinder economic growth. Due to the data limitation, we were unable to take the current COVID-19 crisis into consideration, thereby future studies should aim to do the task. Importantly, there is a great impact in the case of Arab countries for the variables that are related to the global macroeconomic environment and the fluctuations in commodity prices on both the debt and growth level that could explain some of the observed relationships between government debt and economic growth need to be considered by future studies.

References

Alshammary, M. D., Karim, Z. A., Khalid, N., & Ahmad, R. (2020). Debt-Growth Nexus in the MENA Region: Evidence from a Panel Threshold Analysis. *Economies*, *8*(4), 1-12.

Antoshin, S., Berg, A., & Souto, M. (2008). *Testing for structural breaks in small samples*.

Arezki, R., & Nguyen, H. (2020). Coping with a dual shock: COVID-19 and oil prices. *Economics in the Time of COVID-19. CEPR Press VoxEU. org eBook*.

Bai, J., & Perron, P. (2003). Computation and analysis of multiple structural change models. *Journal of applied econometrics*, 18(1), 1-22.

Bai, J. and Perron, P. (2003), "Computation and analysis of multiple structural change models", Journal of Applied Econometrics, Vol. 18 No. 1, pp. 1-22.

Baum, A., Checherita-Westphal, C., & Rother, P. (2013). Debt and growth: new evidence for the euro area. *Journal of international money and finance*, *32*, 809-821.

Boukhatem, Jamel, and Malek Kaabi. 2015. Public Debt, Institutional Quality and Economic Growth in MENA Countries: A GMM Approach. MPRA Paper No. 65756. Available online: https://mpra.ub.uni-muenchen.de/65756/.

Casares, E. R. (2015). A relationship between external public debt and economic growth. *Estudios Económicos (México, DF)*, *30*(2), 219-243.

Cecchetti, S., Mohanty, M. S. and Zampolli, F. (2011). The Real Effects of Debt, Bank for International Settlement Working Papers No. 352.

Chibi, A., Chekouri, S. M., Benbouziane, M., & Boulila, H. (2022, February). Essays on Fiscal Sustainability in Algeria. In Economic Research Forum Working Papers (No. 1540).

Clements, B., Bhattacharya, R., & Nguyen, T. Q. (2003). External debt, public investment, and growth in low-income countries. Working Paper 03/249. International Monetary and Funds. Accessed October 12, 2016. http://www.imf.org/external/pubs/cat/longres.aspx?sk=17074.

De Rugy, V., & Salmon, J. (2020). *Debt and growth: A decade of studies* (No. 10445).

Dickey, D.A. and Fuller, W.A. (1979), "Distribution of the estimators for autoregressive time series with a unit root", Journal of the American Statistical Association, Vol. 74 No. 366a, pp. 427-431.

Fatás, A., Ghosh, M. A. R., Panizza, U., & Presbitero, M. A. F. (2019). *The motives to borrow*. International Monetary Fund.

Jarque, G.M. and Bera, A.K. (1980), "Efficient test for normality, homoscedasticity, and serial independence of regression residuals", Economics Letters, Vol. 6 No. 3, pp. 255-259.

Khanfir, W. (2019). Threshold effect of public debt on economic growth: An empirical investigation for selected North African countries. *Economic Alternatives*, *3*, 429-436.

Kose, M. A., Ohnsorge, F., & Sugawara, N. (2020). Benefits and Costs of Debt: The Dose Makes the Poison.

Kumhof, M. M., Muir, M. D., Mursula, S., & Laxton, M. D. (2010). *The global integrated monetary and Fiscal model (GIMF)–theoretical structure*. International Monetary Fund.

Leeper, E. M., & Leith, C. (2016). Understanding inflation is a joint monetary–fiscal phenomenon. In *Handbook of Macroeconomics* (Vol. 2, pp. 2305-2415). Elsevier.

Narayan, P. K. (2005). The saving and investment nexus for China: evidence from cointegration tests. *Applied economics*, 37(17), 1979-1990.

Omotosho, B. S., Bawa, S., & Doguwa, S. I. (2016). Determining the optimal public debt threshold for Nigeria. *CBN Journal of Applied Statistics*, *7*(2), 1-25.

Omrane, B., Mohamed, C., & Foued, G. (2017). Effets non-linéaires de la dette publique sur la croissance économique des pays MENA: Évaluation empirique à l'aide d'un modèle PSTR. *Revue Économique et Monétaire*, *21*, 7-24.

Pattillo, C., H. Poirson, and L. Ricci. 2002. "External debt and growth." Working paper 02/69. *International Monetary Fund*. Accessed May 5, 2016. https://www.imf.org/external/pubs/ft/wp/2002/ wp0269.pdf.

Pesaran, M.H., Shin, Y. and Smith, R.J. (2001), "Bounds testing approaches to the analysis of level relationships", Journal of Applied Econometrics, Vol. 16 No. 3, pp. 289-326.

Phillips, P.C.B. and Perron, P. (1988), "Testing for a unit root in time series regression", Biometrika, Vol. 75 No. 2, pp. 335-346.

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt, in «American Economic Review». In *Papers and Proceedings* (Vol. 100, No. 2, pp. 1-9).

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. *American economic review*, *100*(2), 573-78.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modeling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in Honor of Peter Schmidt* (pp. 281-314). Springer, New York, NY.

Taher, H. (2016). The Impact of Public Debt on the Economic Growth for the Gulf Cooperation Council Countries. *International Journal of Euro-Mediterranean Studies*.Vol. 9 (2), Pp (27-44).

Woo, J., & Kumar, M. S. (2015). Public debt and growth. *Economica*, *82*(328), 705-739.

Yared, P. (2019). Rising government debt: Causes and solutions for a decades-old trend. *Journal of Economic Perspectives*, *33*(2), 115-40.

Appendices

Table 1. Descriptive Statistics Results

		GDPG	DEBT	K	PG	FDI	INF
Algeria	Mean	2.5006	5.9627	5.842	0.7734	9.00E+07	0.3341
	Min	-5.481	7.094	22.447	1.2751	-5.38E+08	0.3392
	Max	7.2	15.419	0.78072	2.4603	8.20E+10	31.6697
	St.Dev.	0.5371	4.3279	8.6876	0.3329	3.31E+10	0.3647
Bahrain	Mean	2.5006	45.9627	35.842	1.7734	7.09E+09	8.3341
	Min	-5.481	7.094	22.447	1.2751	-5.38E+08	0.3392
	Max	7.2	115.419	50.7807	2.4603	1.82E+11	31.6697
	St.Dev.	2.5371	34.3279	8.6877	0.3329	3.31E+10	9.3647
Jordan	Mean	3.6656	102.6956	25.3802	3.5791	1.03E+09	4.5016
	Min	-10.7292	54.24	11.8849	0.9992	-33548530	-0.8769
	Max	14.3498	222.029	36.6296	5.61454	3.54E+09	25.7127
	St.Dev.	3.9897	45.1901	6.1167	1.4503	1.00E+09	5.2663
Kuwait	Mean	4.1117	26.5043	18.1624	4.0163	1.61E+09	2.7717
	Min	-8.13	3.092	10.6652	1.1462	-1.12E+08	0.1297
	Max	33.9904	88.906	29.9588	6.8285	3.09E+10	10.5827
	St.Dev.	8.0276	26.6602	4.8806	1.7873	5.81E+09	2.1105
Morocco	Mean	3.465	64.1569	30.3138	1.3411	1.71E+09	2.4406
	Min	-7.1172	45.443	24.4714	1.1078	1.65E+08	0.3034
	Max	12.3729	80.842	39.0891	1.8382	3.54E+09	7.9862
	St.Dev.	4.0476	9.2801	3.776	0.2136	1.16E+09	2.0792
Oman	Mean	3.2374	23.0865	22.4555	3.4709	1.14E+09	1.8322
	Min	-6.3	3.667	12.3484	0.0933	-2.17E+09	-1.2
	Max	9.045	81.156	36.4783	7.3496	5.94E+09	12.3754
	St.Dev.	3.4319	17.934	6.3871	2.0394	1.59E+09	3.0723
Qatar	Mean	8.7475	42.0313	3.21E+10	6.6585	1.20E+09	3.3941
	Min	-1.498	9.365	1.81E+09	1.1036	-2.81E+09	-4.8633
	Max	28.082	81.846	7.71E+10	17.5122	8.12E+09	15.0502
	St.Dev.	8.0999	18.6883	2.79E+10	5.2718	2.25E+09	4.6072
Saudi Arabia	Mean	2.8988	43.4079	24.3062	2.5431	7.98E+09	1.9269
	Min	-4.1066	1.562	18.5712	1.5788	-1.88E+09	-2.0933
	Max	15.0079	102.992	34.1726	3.2658	3.95E+10	9.8702
	St.Dev.	4.3812	34.5676	4.5239	0.4735	1.13E+10	2.6677
Sudan	Mean	4.9389	156.4545	19.5681	2.5566	1.05E+09	41.3684
	Min	-1.5622	53.692	5.7865	2.1407	-160000	1.9353
	Max	11.5219	495.201	29.3206	3.7799	2.31E+09	150.3227
	St.Dev.	3.2735	101.9838	6.6471	0.4426	7.29E+08	42.219
Tunisia	Mean	3.2387	60.5176	23.5739	1.2012	8.88E+08	4.2188
	Min	-8.6003	44.794	17.7408	0.7471	1.25E+08	1.9833
	Max	7.8057	89.739	29.2396	2.2237	3.24E+09	8.1937
	St.Dev.	3.0573	11.1345	2.8665	0.4182	6.75E+08	1.5391

Table 2. Unit Root test Results

		GDPG	DEBT	K	PG	FDI	INF
Algeria	Level	-3.4391	-1.5489	-3.4681	-6.2391*	-4.4028	-7.2668*
	1st Diff	-8.7495*	-7.1539*	-5.9646*	-	-8.3444*	-
Bahrain	Level	-4.5573	-1.1482	-6.8079*	-7.6658*	-4.6282	-4.7951
	1st Diff	-10.724*	-5.3349*	-	-	-5.7457*	-8.5754*
Jordan	Level	-2.3494	-4.7508	-4.5617	-5.6107*	-3.3277	-7.9377*
	1st Diff	10.1512*	-6.5849*	-6.5144*	-	-8.3905*	-
Kuwait	Level	-3.3609	-3.2009	-4.1817	-5.6929*	-4.9858*	-4.6922
	1st Diff	-7.4040*	-5.7969*	-6.2318*	-	-	-
Morocco	Level	-1.5933	-2.057	-3.3568	-5.4399*	-6.9903*	-6.2976*
	1st Diff	-20.441*	-8.3381*	-7.3079*	-	-	-
Oman	Level	-4.7412	-1.3779	-3.8902	-5.8049*	-6.4998*	-4.8555
	1st Diff	-8.1539*	-5.8750*	-6.7201*	-	-	-
Qatar	Level	-4.8525	-3.5383	-4.5053	-7.9089*	-3.4666	-4.9817*
	1st Diff	-9.7568*	-7.3443*	-5.9247*	-	-7.5223*	-
Saudi Arabia	Level	-4.1479	-4.2127	-5.1034*	-2.8059	-4.0522	-4.8947*
	1st Diff	-7.0646*	-9.5379*	-	-9.8568*	-6.3034*	-
Sudan	Level	-3.6397	-3.8987	-3.5712	-4.3979	-3.8394	-2.7769
	1st Diff	-6.0451*	-18.416*	-7.5221*	-11.704*	-7.5752*	-10.278*
Tunisia	Level	-3.5538	-0.5649	-4.2438	-6.3465*	-5.2748*	-5.1454*
	1st Diff	-8.6178*	-6.8262*	-7.7558*	-	-	-

Note: * denotes significant at 5%. The unit root test with break point was used to test for stationarity of the variables, but the break dates were not reported here to save space, and they are available upon request.

Table 3. Symmetry, Bound, and Optimal lag Determination Tests Results

Country	Long-run	Short-run	Bound Test	Optimal Lag (AIC)
Algeria	0.4687	15.5758*	9.0475*	(1, 2, 2, 1, 2, 1, 0)
Bahrain	0.2531	4.3183	8.4371*	(1, 2, 1, 2, 1, 1, 2)
Jordan	6.8559*	55.6301*	22.6804*	(1, 0, 1, 0, 2, 0, 0)
Kuwait	19.6154*	2.5481	10.0286*	(2, 2, 2, 0, 2, 2, 2)
Morocco	0.6285	0.7377	57.3139*	(1, 1, 1, 0, 1, 0, 1)
Oman	0.1115	3.6169	4.8884*	(2, 2, 0, 2, 2, 1, 2)
Qatar	12.8041*	9.4157*	6.4613*	(1, 1, 1, 1, 2, 2, 2)
Saudi Arabia	5.2241	1.6318	9.8729*	(2, 2, 1, 2, 2, 1, 2)
Sudan	17.0910*	5.7460*	13.0403*	(1, 2, 2, 0, 2, 2, 1)
Tunisia	18.5229*	1.6261	21.7077*	(1, 2, 2, 2, 2, 2, 0)

Note: * denotes significant at 5%. The Wald test is used to test for the equality test, and the values represent F statistic. Also, the maximum lag length was set as two according to Narayan (2005)

Table 4. Asymmetric/Symmetric ARDL Results

	Algeria	Bahrain	Jordan	Kuwait	Morocco	Oman	Qatar	Saudi Arabia	Sudan	Tunisia
C	20.3638*	-0.0498	0.8578	-2.7032	28.1859*	7.0918*	131.947*	-16.9288	-425.696*	10.9032
GDPG(-1)	-1.3356*	-1.5965*	-0.9719*	-1.4540*	-1.5326*	-1.1789*	-1.7083*	-1.6767*	-0.7374*	-1.8577*
DEBT(-1)	-0.1102	-0.1199*			-0.2728	-0.0657		0.0756		
$DEBT^{+}(-1)$			-0.0606	-1.4443*			-3.8287*		0.0234	0.1384
$DEBT^{-}(-1)$			-0.0529*	-0.2294*			1.0833		-0.4817*	0.3378
K(-1)	0.1091	0.6033*	-0.0301	0.6838	-0.6431*	-0.1566	-5.41E-09	0.2583	0.2825	-0.3196
PG(-1)	-8.3162*	-0.3305	0.2845	-1.7727*	12.1265*	0.3903	-7.5731	3.8862	89.1908*	9.1737*
FDI(-1)	-1.01E-09*	-6.67E-12	-1.13E-09	1.55E-09	4.83E-10	-5.01E-10	1.65E-08*	1.84E-10	7.61E-09	5.03E-09*
INF(-1)	0.2818*	-0.9398	0.0887	-2.6282*	-1.0023*	0.7992*	5.7403	-0.1724	0.1006*	-1.2887*
ΔGDPG(-1)	-0.2191					0.3808*		0.3385		
ΔDEBT		-0.2935*		-0.4806*	-0.7854*	-0.2168*		-0.0985		-0.1068
ΔDEBT(-1)		0.105						-0.1771		
$\Delta DEBT^{+}$	-0.3642*		-0.4380*				-1.9342*		0.0896	
$\Delta DEBT^{+}(-1)$	-0.1439		-0.3025						0.1553*	
$\Delta DEBT^{-}$			-0.2111*				0.6391		-0.2299*	
$\Delta DEBT^{-}(-1)$	0.1903*								0.0389	
ΔK	-0.0869	0.0873			-0.1329		-3.40E-09*			0.3029
ΔK(-1)		-0.1539	-0.1875	-0.8351						0.9618*
ΔPG		2.5565*			27.8459		-13.822	-9.6333	214.417*	122.539*
ΔPG(-1)	-42.544*		2.7433*	0.8331		-2.5482*	8.4269		-157.618*	-99.5384*
ΔFDI	-4.08E-11*			-3.25E-10			5.02E-09	1.33E-10	3.06E-12	
ΔFDI(-1)			1.20E-09*	2.12E-09			-1.37E-08*	-4.67E-10*	-5.01E-09*	-3.10E-09*
ΔINF	0.0809	-0.0149			-0.8562*		2.4878		0.054399	
ΔINF(-1)		0.3964		1.1876*			-3.7098*			0.7462
Normality	0.8421	0.8874	0.8529	0.4431	0.7125	0.7171	0.6721	0.1852	0.9249	0.3024
LM	0.8762	0.2476	0.1352	0.064	0.6719	0.7235	0.0589	0.2384	0.0678	0.0565
ARCH	0.5012	0.4232	0.1714	0.3772	0.143	0.9256	0.881	0.4392	0.1354	0.3555

Note: * denotes significant at 5%. The standard errors are not reported to save space. For all models above, we follow Narayan (2005) and set maximum lag equals two, where the optimal lag length are reached by applying General-to-Specific approach. For the case of Tunisia, robust standard errors are obtained using Heteroskedasticity and Autocorrelation Corrected (HAC) standard errors & covariance since the LM test indicates the possibility of serial correlation. For Sudan's case, we found the effect of ΔDEBT+ and ΔDEBT+(-1) to be positive insignificant (0.2172).

Table 5. Asymmetric/Symmetric long-run Results

	Algeria	Bahrain	Jordan	Kuwait	Morocco	Oman	Qatar	Saudi Arabia	Sudan	Tunisia
DEBT	-0.0825	-0.0751*			-0.1779	-0.0557		0.0451		
$DEBT^{+}$			-0.0624	-0.9933*			-2.2413*		0.0317	0.0745
$DEBT^{-}$			-0.0545*	-0.1578*			0.6341		-0.6533*	0.1818*
K	0.0817	0.3779*	-0.0309	0.4703	-0.4196*	-0.1329	-3.17E-09*	0.154	0.3831	-0.1721
PG	-6.2263*	-0.207	0.2927	-1.2191*	7.9121*	0.331	-4.4333	2.3177	120.959	4.9383*
FDI	-7.57E-10*	-4.18E-12	-1.16E-09	1.07E-09	3.15E-10	-4.25E-10	9.66E-09*	1.09E-10	1.03E-08	2.71E-09*
INF	0.2110*	-0.5887	0.0912	-1.8076*	-0.6539*	0.6779*	3.3603	-0.1028	0.1364*	-0.6937

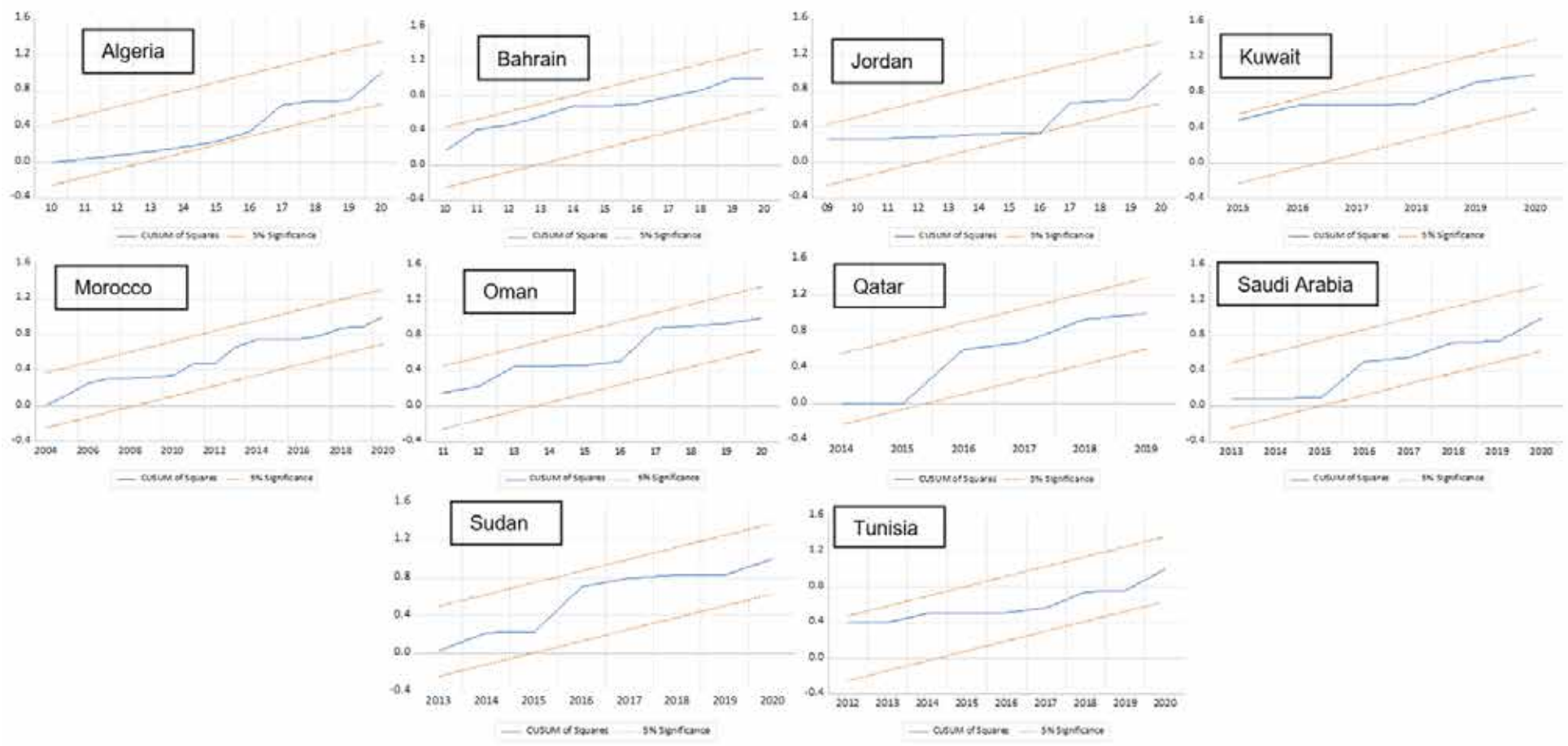
Note: * denotes significant at 5%.

Table 6. Regression with Multiple Breaks Results

	Algeria		Bahrain		Jordan			Kuwait	Morocco		Oman			Qatar	Saudi Arabia	Sudan	Tunisia	
Breaks	One break (2010)		One break (1994)		Two breaks (1993, 2009)			No break	One break (2017)		Two breaks (1994, 2002)			No break	No break	No break	One break (2017)	
Years	1991–2009	2010–2020	1990–1993	1994–2020	1988–1993	1994–2008	2009–2020	1993–2020	1990–2016	2017–2020	1990–1993	1994–2001	2002–2020	1994–2020	1990–2020	1992–2020	1991–2016	2017–2020
C	13.6734*	17.3619*	42.0777*	2.7032	21.7927*	10.7433*	-8.2303	8.2299	40.4729	-27.7781*	-27.7781*	-27.7781*	-8.2303	2.516654	4.3167	3.245	-17.4213*	37.26776
DEBT	0.0008	-0.0717*	-5.0518*	-0.0226*	-0.1279*	-0.1278*	0.0645	0.0886	-0.3392	0.9949*	0.9949*	-0.7649*	0.0645	0.0291	-0.056	-0.0242	0.1446	-0.6108*
Non-breaking variables																		
K	0.0774*		-0.0126		0.3024*			-0.2492	-0.6517		0.3682*			-5.95E-11	-0.3908	0.153	0.5979*	
PG	-8.8378*		0.4591		0.3326			-0.1253	1.9486		0.6218*			0.7682	-1.06E-10	1.7762	-2.704717	
FDI	-3.54E-11*		-1.71E-10		-6.33E-10			-3.18E-10	7.27E-10		3.53E-10			5.15E-10	0.3736	-2.27E-09*	1.00E-09	
INF	0.1402		0.5077		-0.4506*			-0.3343	0.3059		0.0136			0.3503	4.1833*	0.0079	0.208076	

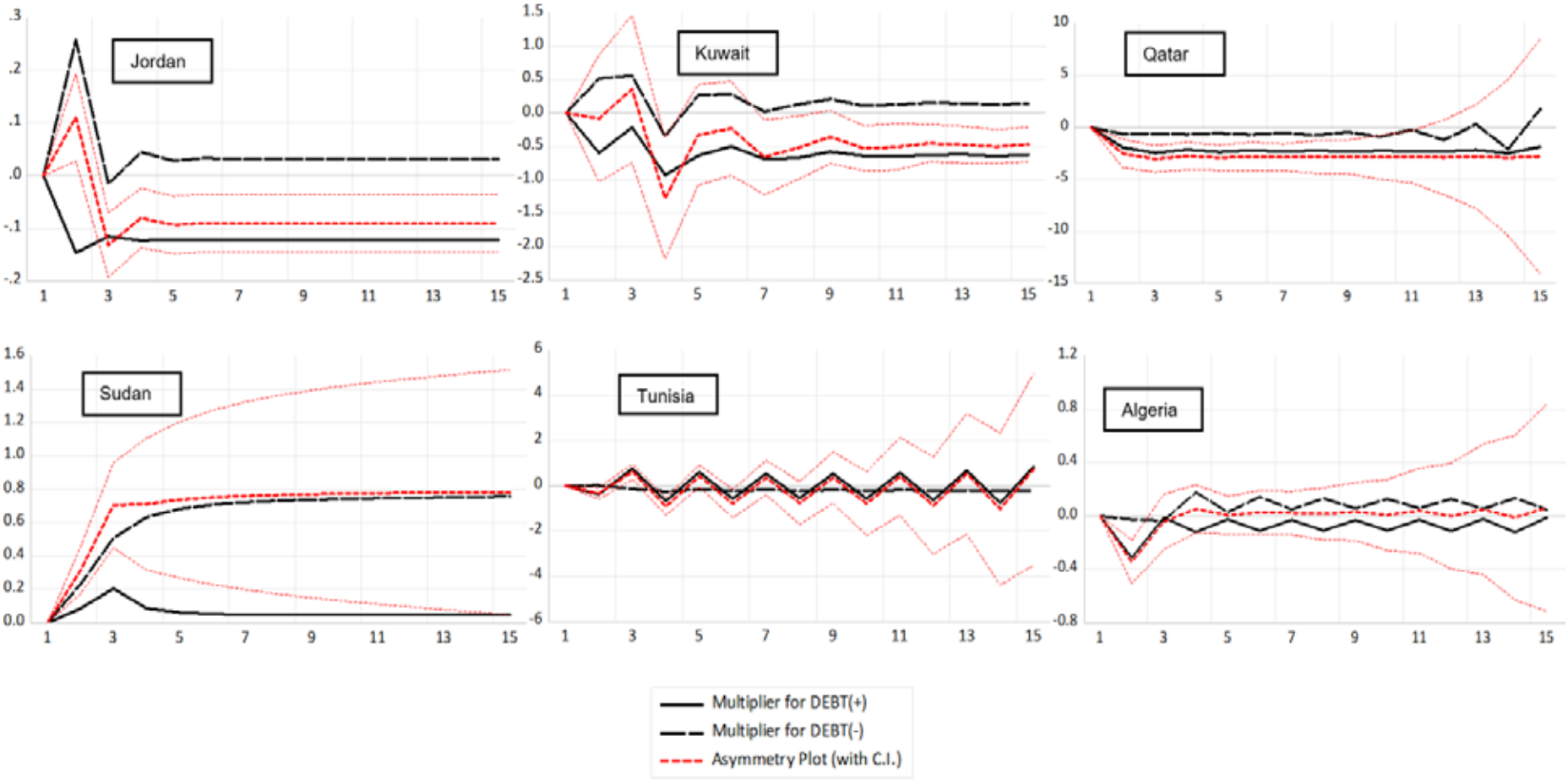
Note: * denotes significant at 5%. The standard errors are not reported to save space. Bai-Perron tests of L+1 vs. L sequentially determined breaks are used.

Figure 1. CUSUM of Squares Test Results



Source: authors' calculations.

Figure 2. Multiplier Effects of Government Debt



Source: authors' calculations.

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