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Abstract

This study aims to explore the fiscal sustainability and the relationship between government revenue and government expenditure in selected Arab countries. The unit root and cointegration tests allowing for structural breaks have been employed from 1990 to 2021. The multiple-break regression and the Granger causality test are conducted. The empirical findings reveal the existence of cointegration between revenue and expenditure in the selected Arab countries. Moreover, evidence of 'weak' and 'strong' sustainability with structural breaks is found in many countries in the sample. Importantly, due to the 'weak' or unsustainable budget deficit that appeared during the COVID-19 crisis, several Arab states are facing critical challenges in debt financing. Additionally, the causality test shows a one-directional causal relationship from government revenue to government expenditure in the majority of the sampled countries, supporting the revenue–spend hypothesis.

JEL: E62, H62, C22.

Keywords: government revenue, government expenditure, fiscal policy, sustainability, multiple-break regression.

1. Introduction

One of the most important issues for economic policy is the sustainability of government deficits (Bajo-Rubio et al., 2010). macroeconomic and microeconomic policies will quickly become unsupportable if the budget is out of control, necessitating modifications (Green et al., 2001). The constancy of larger government expenditures compared to its revenue could raise concerns regarding fiscal sustainability. The consistency of government revenue and expenditure indicates an efficient fiscal channel that can ensure macroeconomic stability and improve social welfare. The importance of maintaining a credible position of public finances over the long term emerges from avoiding continuous budget deficits and, consequently, excessive levels of debt and macroeconomic instability. The COVID-19 pandemic crisis has generated unprecedented pressures on fiscal positions in all countries around the globe as budget deficits and public debt reached incomparable levels.

The ability of a government to carry debt determines how sustainable its budget deficit is. Generally, if the budget deficit exceeds the government's ability to finance its shortfalls, then the deficit is unsustainable. In the long run, this may worsen the long-term government position

or its deficits and, ultimately, cause it to default on its debt obligations. The sustainability of a budget deficit depends on a variety of factors. Short-term fiscal policies, such as taxes, government expenditure, and the level of public debt, are essential to consider. Fiscal policies must be managed to ensure that the deficits do not lead to excessive debt levels. In addition, policies that create local and external sources of income, such as encouraging foreign direct investment, could help increase government revenue, which in turn strengthens budget sustainability.

A budget deficit happens when revenues are less than expenses over the course of a year. There are various definitions of fiscal sustainability; Slack and Bird (2004) note that fiscal sustainability can be defined as the capacity of a government to pay its expenditures from its receipts, regardless of transfers or borrowing. According to Edwards (2002), an economy reaches fiscal sustainability when the debt-to-GDP ratio for the public sector is stable and in line with the overall demand for both domestic and foreign government bonds. He also notes that calculating the primary balance of the public sector in accordance with a stable and manageable debt-to-GDP ratio is a key output of public sector sustainability analysis. Fiscal sustainability is also defined by the Treasurer of the Commonwealth of Australia (2002) as the capacity of the government to manage its finances in a way that enables it to fulfil its current and future spending commitments.

The government budget deficit in the current period is optimally financed with a future rise in taxes or expenditure cuts. This viewpoint and the intertemporal government budget constraint necessitate budget deficit sustainability. In other words, when a nation's intertemporal government budget constraint is satisfied, which implies that anticipated future primary surpluses offset the stock of existing debt, its fiscal policy is sustainable. A considerable amount of literature has been published on fiscal sustainability and the revenue–expenditure nexus (Ucal and Alici, 2010; Fan and Arghyrou, 2013; Narayan and Narayan, 2019; Rath and Sachan, 2022). These studies test the cointegration and long-run relationship between government expenditure and revenue. Additionally, an empirical analysis of the country's government revenue and expenditure decisions may be necessary to properly understand fiscal performance (Payne et al., 2008; Saunoris and Payne, 2010; Baharumshah et al., 2016).

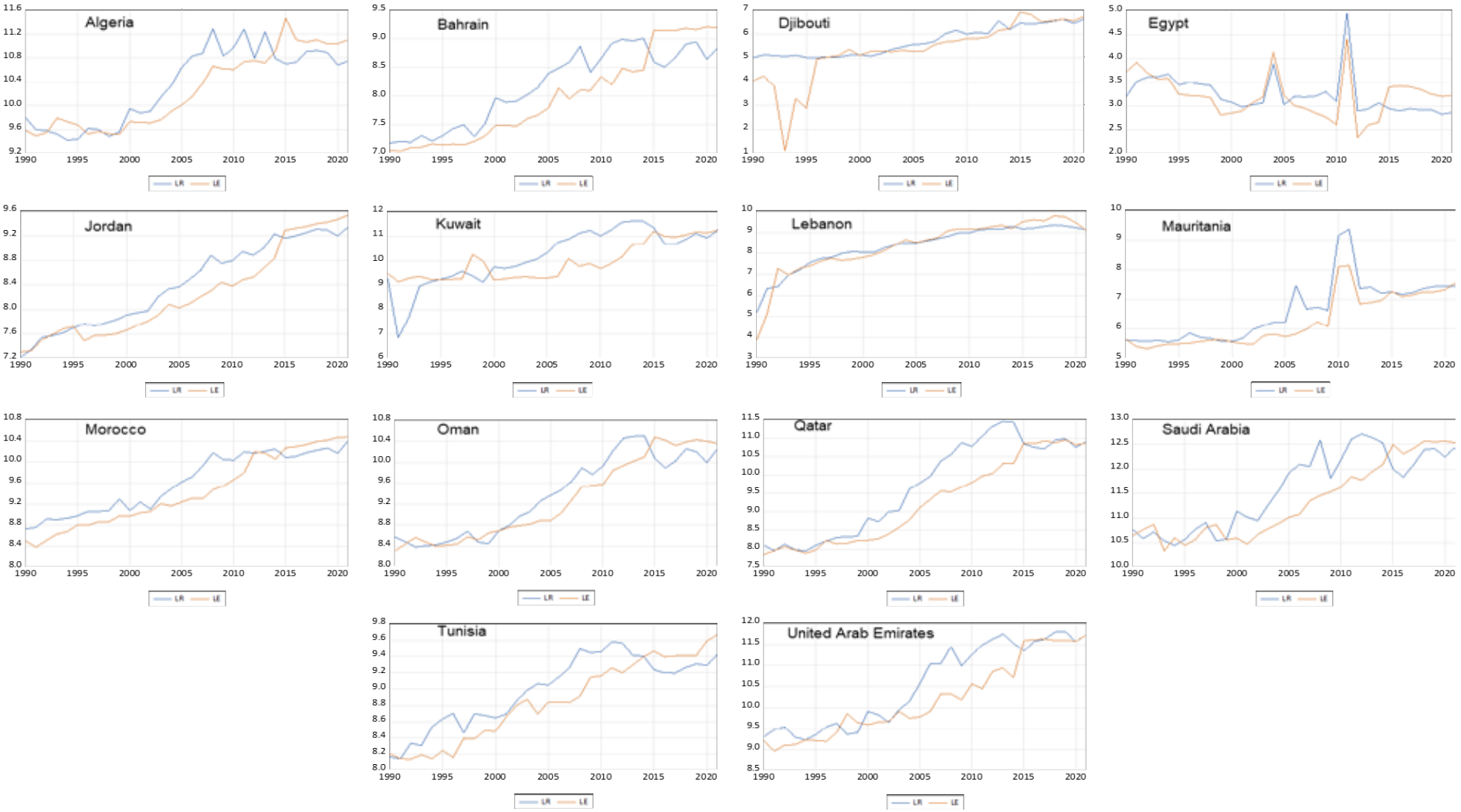
In many Arab countries, there were apparent symptoms of fiscal stress even before the COVID-19 pandemic started, especially in low-income and middle-income countries. Moreover, the region's budget deficit and debt risks have been exacerbated due to the pandemic and

commodity price fluctuations. Fiscal sustainability remains significant for all countries in the region, oil-exporting and important alike (Abdelraouf, 2021). It is worth noting that some Arab countries have experienced a budget surplus for quite a while before they encountered deficits, especially after 2015, as shown in Figure 1.

The study investigates fiscal sustainability and the relationship between government revenue and expenditure in Arab countries. The study uses annual time series data analysis for fourteen selected countries from 1990 to 2021. It applies time analysis for the purpose of specific policy recommendations for each country in the selected sample. Also, according to Bai and Perron (2003), the multiple-breaks regression will be adopted to test the relationship between the variables. The essence of taking structural changes into account in regression analysis arises from the dynamics and continuity of the economic shocks. In addition, the Granger causality test is used to verify the direction of the causal relationship or the revenue–expenditure nexus.

The rest of the study is organised as follows: Section 2 reviews the relevant previous empirical literature. Section 3 describes the model specification, the estimation method, and the data. Section 4 contains the results of the econometric analysis. Finally, the last section contains conclusions and policy recommendations.

Figure 1. Government Revenue and Expenditure (% GDP), 1990 – 2021



Source: Authors' calculation.

2. Literature Review

One of the most significant macroeconomic issues facing nations is the sustainability of budget deficits. Given that excessive public spending and a lack of enough public revenue are the main causes of the economy's instability, the country's fiscal sustainability is one of the most crucial macroeconomic challenges. Several studies have been documented in the literature under the intertemporal budget constraint. In the existing literature, fiscal policy sustainability is mainly addressed through the following questions. The first is the sustainability of "fiscal policy." The next question is whether there are any structural breaks[1] in the budgetary process for fiscal policy and whether non-linearities occur during fiscal adjustment.

Additionally, the Granger causality test is often used to evaluate the relationship between government revenue and expenditures. For instance, Payne et al. (2008) examined the dynamics of Turkish government revenues and expenditures as well as the sustainability of budget deficits. When a structural break was taken into account, the results revealed the existence of a cointegration relationship between government revenues and expenditures. However, the magnitude of the slope coefficient was less than one, suggesting difficulties in financing its future debt would emerge. Also, support for the tax-spend hypothesis was discovered. In a study by Mounts and Sowell (2005), who investigated how the budget process' institutional structural modifications have affected fiscal sustainability, a strong connection between sustainability and the institutional framework and budget process governance was found. Also, Correia et al. (2008) looked at Portugal's fiscal sustainability and the relationship between revenue and spending. They postulated that the deficit might be sustainable in some time frames but not others. Typically, a new regime comes into existence following a period of unsustainable deficits.

In Spain, over a century and a half (1850–2000), the sustainability of the budget deficit was tested by Bajo-Rubio et al. (2010). The findings demonstrated that the budget deficit was long-term sustainable. The nonlinear behaviour of fiscal authorities, who have only addressed the budget deficit when it has exceeded roughly 4.5% of GDP, has also contributed to achieving fiscal sustainability. In the same context, Ucal and Alici (2010) examined whether fiscal policy satisfies Turkey's intertemporal government budget constraint. Their analysis showed that

[1] A structural break refers to a change in the behaviour of an economic indicator. Such break could happen due to several factors, for example, economic crisis, technological advancement, policy and regime changes.

fiscal policy was unsustainable before 2001 and sustainable between 2001 to 2008. Moreover, Misra and Khundrakpam (2010) investigated the relationship between government revenue and expenditure and the sustainability conditions of budget deficit in India, especially after the enormous fiscal stimulus by the central government following the global financial crisis of 2008-09 that led to the weakening its finances. Splitting the sample into two, they found that before the crisis, the revenue and expenditure of the central government were sustainable. However, after the crisis, no evidence of a stable long-run relationship between expenditure and revenue was found.

Between 1955 and 2006, Fan and Arghyrou (2013) evaluated the UK's budget deficit sustainability. They discovered signs of sustainability in the early 1970s, early 1980s, and late 1990s after accounting for probable structural breaks. The UK's fiscal policy, however, proved unsustainable from 1973 to 1981. They made the observation that while the UK fiscal authorities did not respond to minor deficits, they did so promptly in the case of major deficits. Neaime (2015) analysed the sustainability of debts and deficits in selected European Union (EU) countries. The findings suggested that some EU countries could be in the direction of a debt and/or fiscal crisis that may well result in a banking crisis. Thus, appropriate fiscal adjustment measures are urgently required. Similarly, Gocer and Mercan (2016) examined the sustainability of budget deficit in 17 European countries using panel cointegration with multiple structural breaks from 1996 to 2012. They found cross-section dependence across countries, indicating that any economic shock in one or more countries affects the rest.

In a developing country such as Nigeria, Jibrilla (2016) looked at the dynamics of government revenue and expenditure from 1961 to 2014. He also examined at the sustainability of the fiscal deficit. He discovered evidence of a cointegration relationship between government revenue and expenditure with a long-run slope that was less than one, pointing to possible challenges in long-term public debt financing. The author came to a conclusion by demonstrating evidence of a two-way causal relationship between government revenue and expenditure (fiscal synchronisation hypothesis). In Algeria, Chibi et al. (2019) empirically tested the sustainability of fiscal policy using a nonlinear approach. The results revealed that the budget balance is nonstationary and consequently the budget deficit is unsustainable in Algeria. They suggested that Algerian fiscal authority should be more efficient in controlling the budget deficit to avoid debt crisis. Narayan and Narayan (2019) used the intertemporal budget constraint concept to assess the sustainability of the budget deficit in Fiji. Their research revealed that there is cointegration between government revenue and expenditure, indicating a sustainable budget

deficit. They claimed that increasing government capital spending would guarantee a larger revenue stream and reduce the likelihood of a budget deficit escalation.

Using an error correction model (ECM), Iiyambo and Kaulihowa (2020) examined the link between Namibian government spending, revenue, and public debt from 1980 to 2018. They discovered a strong correlation between government spending and revenue. Additionally, their findings showed that rising public debt boosted government spending. Furthermore, the Granger causality test revealed that Namibia's situation does support the tax-spend hypothesis. The fiscal sustainability of the fiscal policy of the Indian central government was examined by Rath and Sachan (2022). The results showed that revenue and expenditure had a cointegration relationship before the year 2004[2] but that there was no long-run link after that year, raising questions about the fiscal sustainability of the country. In India, asymmetric adjustment budgeting processes were discovered, which supported the revenue-expenditure hypothesis.

3. Methodology

3.1 Model specification

The major concern of the research on the sustainability of budget deficits is whether or not the government's intertemporal budget constraint[3] is violated. Hamilton and Flavin (1986) assert that the government's intertemporal budget constraint is consistent with the budget deficit's stationarity. Others have approached this issue by using the cointegration methodology to examine the long-term relationship between tax revenues and spending of the government. The cointegration of revenues and expenditures has been one way to assess the intertemporal budget constraint. The theoretical justification for the cointegration methodology starts with the single -period budget limitation of the government as follows:

$$GP_t + (1 + i_t)GD_{t-1} = R_t + GD_t \tag{1}$$

where GP_t refers to government purchases and transfers, GD_t is government debt, R_t is government revenues, and i_t is real interest rate. Solving Eq. (1) results in

$$GD_0 = \sum_{t=1}^{\infty} r_t \, (R_t - GP_t) + \lim_{n \to \infty} r_n \, GD_n \tag{2}$$

[2] In 2004, India adopted "The Fiscal Responsibility and Budget Management (FRBM) Act."
[3] The intertemporal budget constraint indicates that over the long-run government spending cannot exceed it revenue, valuated in a present value.

where $r_t = \prod_{s=1}^{t} \prod \sigma_s$ and $\sigma_s = (1 + i_s)^{-1}$. Intertemporal budget soundness dictates that future surpluses must be used to pay off existing debt. This indicates that the last term on the right-hand side of Eq. (2), $\lim_{n\to\infty} r_n \, GD_n$, corresponds zero. In the absence of this condition, the government is running a Ponzi scheme in which new debt is issued to pay off existing debt that is about to mature. If the condition holds, the budget deficit will be manageable if the economy grows at a rate that is generally faster than the stock of government debt.

The intertemporal budget constraint stipulates that the government balances the intertemporal budget by equating the discounted value of the anticipated future budget surplus with the debt's current market value.

In accordance with the relevant studies, Eq. (1) can be transformed into the following long-run model to represent the link between government revenue and expenditure:

$$LR_t = \alpha + \beta LE_t + \varepsilon_t \tag{3}$$

where LR is log of government revenue, LE is the log of government expenditure, α and β denote the intercept and the slope, respectively, t refers to time, and ε is the stationary residual. Hence, the intertemporal budget restriction is tested for viability using this fundamental equation. In this equation, the intertemporal budget constraint can be met, and budget deficits are sustainable if the variables LE (government expenditures, including interest payments) and LR (government revenues) are cointegrated and $\beta = 1$. However, if the variables LR and LE are not cointegrated, the intertemporal budget constraint cannot be met, and the deficits are not sustainable.

There are two forms of sustainability. The deficit may exhibit “strong sustainability” if LE and LR are cointegrated and $\beta = 1$, and “weak sustainability” if LE and LR are cointegrated and $0 < \beta < 1$ (Quintos, 1995; Martin, 2000; Cunado et al., 2004; Payne et al., 2008). While the deficit is “unsustainable” if $\beta \leq 0$ (Martin, 2000; Rath and Sachan, 2022). The government’s ability to market its debt in the long run is incompatible with the “weak” type of sustainable budget deficits. The risk of default rises as spending outpaces revenues, which forces the government to give higher interest rates in order to service its debt.

Examining the link between government revenues and expenditures may reveal more about the dynamics of the budgetary process. The spend-revenue hypothesis, the revenue-spend hypothesis, the fiscal synchronisation hypothesis, and the institutional separation hypothesis are among the hypotheses that have been put out in the literature to explain the behaviour of

government revenue and spending. According to the spend-revenue hypothesis, a government's choice to spend money results in public revenue or taxation, and expenditure causes revenue. While the revenue-spend hypothesis asserts that government revenue affects how much money a government spends, and a causality running from revenue to expenditure is expected. According to the fiscal synchronisation hypothesis, a government simultaneously selects the desired set of spending plans and the revenues required to pay for those plans, suggesting a two-way causal relationship between the variables. In contrast, the institutional separation hypothesis states that government revenue and expenditure decisions are unrelated, thus no casual association is anticipated. The Granger causality test is used to examine the revenue–expenditure nexus in the fourteen Arab countries, as the following models are specified

$$\Delta LR_t = \delta_0 + \sum_{i=1}^{n} \delta_i \, \Delta LR_{t-i} + \sum_{i=1}^{n} \gamma_i \, \Delta LE_{t-i} + u_{1t} \tag{4}$$

$$\Delta LE_t = \theta_0 + \sum_{i=1}^{n} \theta_i \, \Delta LR_{t-i} + \sum_{i=1}^{n} \rho_i \, \Delta LE_{t-i} + u_{2t} \tag{5}$$

In the case where government expenditure causes government revenue, $\sum_{i=1}^{n} \gamma_i \neq 0$, the spend-revenue hypothesis holds. Where if government revenue causes expenditure, $\sum_{i=1}^{n} \rho_i \neq 0$, revenue-spend hypothesis stands. For fiscal synchronisation hypothesis to exist, a bidirectional causality, $\sum_{i=1}^{n} \gamma_i \neq 0$ and $\sum_{i=1}^{n} \rho_i \neq 0$, should be true. Finally, in the absence of any causality between revenue and expenditure, $\sum_{i=1}^{n} \gamma_i = 0$ and $\sum_{i=1}^{n} \rho_i = 0$, the institutional separation hypothesis prevails.

3.2 Estimation method

As common procedures in macroeconomic time series data analysis, testing for stationarity and cointegration of the data are essential pre-testing steps. The augmented Dicky-Fuller (ADF) and Philips-Perron (PP) tests are commonly used to identify the series order of integration. However, the previously mentioned unit root tests lack power and are not appropriate if the time series data contain one or more structural breaks. Several unit root tests that take such breaks in the series into account have been introduced in the last few years. Unit root tests with a structural break are used to analyse whether a time series data is stationary or nonstationary. These tests used a series of statistical analyses to identify potential structural breaks in the data, which may be indicative of a change in the dynamics of the data. In this research, we test for the stationarity of the variables, taking into account the potential structural break in the data.

The null hypothesis is that there is no structural break, and the series contains a unit root. If the test rejects the null hypothesis, then the series does not contain a unit root. If a structural break is identified, then the series is typically considered stationary. If no structural break is identified, then the series is considered nonstationary.

Regarding the cointegration methodology, standard tests assume that the cointegration vectors are time-invariant. Therefore, a shift in the cointegrating vector throughout the duration of the sample period may be the cause of the rejection of the cointegration. Gregory and Hansen (1996) proposed a residual-based cointegration test that allows for the occurrence of a one-time shift in the cointegrating vector. Gregory and Hansen (1996) noted that the presence of a structural break reduces the power of common cointegration tests such as the Engle-Granger and Johansen cointegration tests. Gregory and Hansen (1996) propose three specifications for the residual-based test: level shift, level shift with the trend, and regime shift.

Multi-structural breaks can occur in macroeconomic time series. To that purpose, Bai and Perron (2003) performed a thorough examination of various problems within the framework of multiple structural change models and developed certain tests that detect the number and location of breaks. Although the method allows for up to five breaks, the maximum number of breaks is set equal to three due to short observations, and the minimum number of observations in each segment is determined by a trimming of 0.15. In a model with one break, two regimes are estimated. Three sets of parameters were estimated for the two-break model. Whereas in the three-break equation, four sets of parameters were estimated. What is interesting is the ability of the multiple breaks regression technique to show the connection between government expenditure and its revenue in different time periods given the structural break(s). In particular, whether the fiscal deficit is "strong" or "weak" sustainable can be tested in each time period.

The causal relationship between government expenditure and revenue, commonly known as the "revenue-expenditure nexus," is normally assessed via the Granger causality test. In general, the Granger causality test can be used to determine if a cause-and-effect relationship between two variables exists. To test this, the data on government expenditure and government revenue for each country in the sample of the study are used. The test statistic is calculated to determine whether the lagged value(s) of one variable helps to predict the current value of the other (i.e., whether one variable "granger causes" the other). Through this, the presence or absence of a relationship can be determined. The test has a null hypothesis that "the

independent variable did not cause the dependent variable", which can be rejected if the Chi-square probability value is less than 0.05 or 0.1.

3.3 The data

The current study assesses the fiscal sustainability by controlling for two auxiliary variables the government revenue and expenditure for a panel of fourteen Arab countries over the 1990 -2021 period. The time series data are collected from the joint Arab Economic Report. The revenue and expenditure are measured in millions of US dollars. Note that the series are transferred into natural logarithm.

4. Empirical results

Table 1 shows the results of the unit root with structural break test. The government revenue is found to be nonstationary containing a unit root in level for countries except Egypt, but the series becomes stationary after taking the first-difference. This suggests that LR is a nonstationary I(1) series for all countries, but stationary I(0) for Egypt. The results also reveal the presence of a unit root in level for LE in all countries except Egypt. However, the series LE is stationary in the first-difference for all countries, suggesting that LE is an I(1) for all countries except Egypt[4], where series were found to be stationary at level or I(0).

The following preliminary step is to test for the cointegration relationship among the variables.[5] Table 2 presents the findings of Johansen cointegration test. The test reveals the presence of a long-run relationship between LR and LE in seven countries out of fourteen, namely, Algeria, Djibouti, Lebanon, Mauritania, Morocco, and Oman. In the unit root process, the break in the government revenue and expenditure could be due to policy change, economic shock, innovation, or any other country specific events that result in a sudden jump or decline of the series. Although it is possible to trace the potential reasons behind the break in each country, however, we believe it would make more sense to do such an exercise to the break of the long-run relationship. The cointegration relationship could be hidden due to a structural break, thereby a cointegration test that takes it into consideration is employed. Table 3 reports the results of Gregory and Hansen (1996) cointegration with a structural break test. The outcomes reveal that at least in one of the Gregory-Hansen specifications cointegration does exist between LR and LE in all the countries. These findings imply that the cointegration relationship may be hidden if structural break(s) prevail in the linear combination. Therefore, the main

[4] This result is also confirmed by the ADF unit root test (not reported here but available upon request).
[5] Note, Egypt is not likely to be subject to spurious regression since LR and LE are stationary I(0) variables. Therefore, it is not included in the cointegration analysis.

conclusion from unit root and cointegration tests is that regression outcome between the variables in not spurious.

Table 1. Unit Root with Structural Break Test

Country	LR		ΔLR		LE		ΔLE	
	t-stat	Break	t-stat	Break	t-stat	Break	t-stat	Break
Algeria	-3.635	2004	-8.832***	2011	-3.632	2006	-7.122***	2015
Bahrain	-4.860	2014	-6.477***	2000	-4.338	2006	-10.345***	2015
Djibouti	-4.102	2007	-10.162***	2017	-2.841	2017	-8.525***	1996
Egypt	-11.381***	2011	-10.484***	2011	-6.031***	2011	-10.765***	2011
Jordan	-3.501	2002	-7.818***	2002	-3.679	1995	-7.266***	2015
Kuwait	-2.850	2003	-6.521***	2015	-4.618	1999	-7.412***	1998
Lebanon	-4.498	2019	-14.121***	1996	-3.146	2001	-6.046***	1994
Mauritania	-3.844	2005	-7.878***	2010	-3.302	2001	-7.647***	2012
Morocco	-3.916	2005	-8.974***	2008	-2.783	2005	-8.194***	2014
Oman	-4.608	2010	-6.520***	2015	-3.135	2002	-7.030***	2015
Qatar	-4.080	2014	-7.072***	2013	-3.013	2019	-6.585***	2002
Saudi Arabia	-4.251	2014	-6.394***	2008	-3.554	1998	-8.295***	2015
Tunisia	-3.890	2014	-7.202***	1997	-4.527	2015	-7.690***	2004
United Arab Emirates	-4.429	2005	-6.093***	2013	-4.892	2003	-8.098***	1998

Note: ***, ** denote 1%, 5% significance levels.

Table 2. Johansen Cointegration Test

	Trace statistic	Max-Eigen statistic
Algeria	18.186**	14.662**
Bahrain	8.114	6.429
Djibouti	34.787***	34.786***
Jordan	5.597	4.761
Kuwait	11.531	7.774
Lebanon	26.338***	22.440***
Mauritania	17.663**	11.229
Morocco	21.633***	21.368***
Oman	18.110**	17.315**
Qatar	10.880	9.411
Saudi Arabia	11.985	11.813
Tunisia	6.764	5.269
United Arab Emirates	5.459	5.400

Note: ***, ** denote 1%, 5% significance levels.

Table 3. Gregory-Hansen Cointegration Test

	Level shift	Break date	Level & trend shift	Break date	Regime shift	Break date
Algeria	-4.436*	2003	-4.554	2012	-4.743*	2006
Bahrain	-5.470***	2013	-5.819***	2014	-5.593***	2014
Djibouti	-3.521	2006	-4.833*	2006	-4.839*	2003
Jordan	-4.648**	2013	-4.477	2004	-4.997**	2006
Kuwait	-5.056**	2002	-6.759***	2015	-5.087**	2002
Lebanon	-6.038***	1995	-7.434***	1994	-6.598***	1995
Mauritania	-4.107	2012	-4.722*	2012	-4.141	2012
Morocco	-4.642**	2004	-4.736*	2005	-5.324**	2004
Oman	-4.629**	2013	-4.636	2013	-4.856*	2008
Qatar	-5.385***	2013	-6.181***	2014	-5.036**	2013
Saudi Arabia	-4.379*	2013	-5.189**	2013	-4.141	2003
Tunisia	-4.638**	2013	-4.445	2013	-4.645*	2013
United Arab Emirates	-5.223***	2004	-4.710*	2004	-5.358**	2004

Note: ***, **, * denote 1%, 5%, 10% significance levels. The critical values for level shift are -5.13 (1%), -4.61 (5%), -4.34 (10%). The critical values for level and trend shifts are -5.45 (1%), -4.99 (5%), -4.72 (10%). The critical values for regime shift are -5.47 (1%), -4.95 (5%), -4.68 (10%).

The regression analysis can be done following the unit root and cointegration tests. Table 4 compares the outcomes of the multiple breaks' regression using Bai and Perron's methodology (2003). Two breaks are observed in the model of Algeria, 2000 and 2009, according to the regression. Therefore, three sets of parameters, based on the endogenous breaks, are estimated. The slope coefficient of the connection between LE and LR between 1990 and 1999 is negative but insignificant, indicating that the changes in government revenue are not affected by any variations in government spending. However, from 2000 to 2008, the government's spending had a beneficial impact on its revenue; the coefficient's value is 1.455, suggesting a strong sustainability of the budget deficit during that period. But from 2009 to 2021, there is a negative and significant impact on LR (-0.432) as a result of changes in LE. It could be argued that the fluctuations in oil price, which plays a vital role in an oil exporting country like Algeria, especially during the second revenue-expenditure regime affected the economy and therefore the non-oil revenue of the government. To a large extent, this may be true if the procyclicality of fiscal policy prevails.

In the case of Bahrain, one structural break in 2010 has been identified, leading to the estimation of two models. The positive and statistically significant association between LE and LR over the time period between 1990 and 2009, with a coefficient of 1.399, suggests a high sustainability of the budget deficit. For the period from 2010 to 2021, the coefficient of LE is, nevertheless, negative but insignificant. On the other hand, two structural breaks are noted for a country like Djibouti, occurring in 2003 and 2014. The coefficient of LE is positive, less than one, but statistically insignificant from 1990 to 2002. For the period from 2003 to 2013, the effect of LE on LR, however, only becomes important when the coefficient is equal to one, indicating strong sustainability of the budget deficit. Additionally, over the years from 2014 to 2021, LE significantly improves LR with a coefficient of magnitude smaller than one, indicating weak sustainability.

Three structural breaks occurred in Egypt, in 1999, 2008, and 2012. Although the coefficient sign is positive, there is initially no evidence of a meaningful link between LE and LR from 1990 to 1998. Importantly, the association between the two variables is significant between 1999 and 2007, with a value smaller than one, indicating a weak form of sustainability. More crucially, LE significantly affects LR from 2008 to 2011, and the coefficient value is one, indicating a deficit with strong sustainability. However, from 2012 through 2021, the correlation between the variables was shown to be statistically negligible.

Table 4 includes the results for Jordan as well. Two breaks are noted in 1996 and 2008, using Bai and Perron's (2003) least squares with breaks approach. The association between LE and LR is positive and significant for the model from 1990 to 1995, with a coefficient of 0.991. Additionally, for the time period from 1996 to 2007, the link between the variables appears to be positive and significant with a coefficient value of roughly 1.254. While LE has a positive and significant impact on LR from 2008 to 2021, the coefficient is less than one. According to Jordan's regression results, there is a consistently positive and substantial link between government spending and revenue. However, the improvement in the budget deficit sustainability position that was demonstrated between 1996 – 2007 turned to a weak sustainability after the year 2008 onwards.

The findings show that Kuwait's instance exhibits three breaks, specifically in 1994, 2005, and 2015; as a result, four-period parameters are estimated. Between 1990 and 1993, a coefficient that is significantly bigger than one shows a substantial positive association between LE and LR (7.26). However, LR has not been significantly impacted by changes in LE between 1995 and 2004. The association between the two variables from 2005 to 2014 is shown to be positive

and statistically significant. A value of roughly 0.775 for the estimated coefficient denotes weak sustainability. The findings also indicate a positive relationship between LE and LR, with a coefficient greater than one from 2015 to 2021. This supports the strong ability of the government to finance any potential future budget deficits.

One structural break is discovered in Lebanon in 1995. The regression results demonstrate that LE's connection with LR between 1990 and 1994 is positive, significant, and less than one. Similarly, the results demonstrate a positive correlation between LE and LR from 1995 to 2021. Although the coefficient's magnitude (0.744) is more than that of the initial period (0.448), both values are less than one, indicating that the budget deficit is not likely to be sustained over the long term. This is consistent with the economic crisis that took place in the country, which started in 2019.

The results show that Mauritania experienced two breaks (in 2002 and 2012), and three sets of coefficients are consequently estimated. The findings indicate that from 1990 to 2001, there is no statistically significant association between LE and LR. However, LE seems to be significant and positive (1.216) in its relationship with LR from 2002 to 2011. This predicts the strong sustainability of the budget deficit over the timeframe (2002 – 2011). In contrast, from 2012 to 2021, no changes in LR are seen as a result of LE variations. Regarding to Morocco's results, one break was found in 2007. For the period from 1990 to 2006, LE has positive and significant coefficient that is close to one (0.955). However, for the years 2007 to 2021, the correlation between LE and LR turns out to be negligible.

In Oman, the results in Table 4 also show two breaks, specifically in 2002 and 2015. Positively signed less than one coefficient is discovered in the first period from 1990 to 2001, despite it is only 10% significant. A substantial persistence of the deficit over time is indicated by LE's positive and significant coefficient of one for the second period, which runs from 2002 to 2014. But from 2015 to 2021, the impact of LE on LR becomes insignificant. There are two breaks in Qatar's results (2000 and 2015). The relationship between LE and LR is positive and significant over the years 1990 to 1999, with a coefficient value that is near unity (0.919). Furthermore, from 2000 to 2014, there is a positive link between the two variables, with a value of 1.332. This result shows that government deficit is quite likely to continue. After 2015, though, the relationship becomes insignificant.

The findings show that Saudi Arabia has three breaks during the research period, specifically in 2000, 2009, and 2015. Although LE has a positive significant effect on LR in the first period, from 1990 to 1999, the value of the coefficient is less than one, indicating weak sustainability throughout those years. The link is demonstrated to be substantial and positive for the second

time period from 2000 to 2008 with a coefficient of 1.628. Similar to the second period, the third period from 2009 to 2014 shows a positive connection between the variables with a coefficient of 1.279. Additionally, the value of the coefficient rises to 2.068 starting in 2015, further demonstrating the persistence of the positive link between LE and LR. The findings of Saudi Arabia are intriguing since they demonstrate great sustainability and a significant capacity to finance any future debt.

The findings imply that Tunisia has two structural breaks (2007 and 2015). Results for the 1990–2006 time span show a less than one magnitude positive and significant connection between LE and LR. While the correlation between the variables is revealed to be insignificant from 2007 to 2014, the influence of LE on LR seems to be significant and positive, similar to the first era (1990 to 2006), and the value of the coefficient is less than one between 2015 and 2021. These findings speak to the difficulties the fiscal authority will face in managing and financing its upcoming debt.

Finally, the results indicate that the United Arab Emirates experienced one structural break, specifically in 2005, leading to the estimation of two period models. The LE is determined to be statistically significant and positive for the time span between 1990 and 2004. Similar to this, from 2005 to 2021, LE has a positive and significant impact on LR. However, the calculated LE coefficients are less than one in both eras, indicating weak sustainability of the budget deficit.

Table 5 provides the results obtained from the Granger causality analysis of LR and LE. It is apparent from this table that the null hypothesis of LE does not Granger cause LR cannot be rejected for the fourteen countries. However, the null hypothesis of LR does not Granger cause LE is rejected for all countries, except Djibouti and Mauritania where a support for institutional separation hypothesis is found since no causation is observed. These findings suggest the presence of revenue-spend hypothesis in 86 percent of the sampled countries. The results indicate consistency in the relationship between government revenue and expenditure in Arab countries. Put it differently, the changes in government revenues lead to changes in government expenditures and not the other way around.

Table 4. Regression with Multiple Breaks Results

Country	α	β	Diagnostic tests	
Algeria*:				
(1990-1999)	14.162 (0.003)	-0.479 (0.312)	Normality	0.23
(2000-2008)	-4.129 (0.009)	1.455 (0.000)	LM	0.82
(2009-2021)	15.526 (0.000)	-0.423 (0.016)	BPG	0.11
Bahrain[&]:				
(1990-2009)	-2.652 (1.851)	1.399 (0.000)	Normality	0.33
(2010-2021)	10.593 (0.000)	-0.202 (0.414)	LM	0.09
			BPG	0.02
Djibouti:				
(1990-2002)	5.046 (0.000)	0.010 (0.435)	Normality	0.51
(2003-2013)	-0.567 (0.426)	1.145 (0.000)	LM	0.94
(2014-2021)	4.091 (0.007)	0.360 (0.099)	BPG	0.09
Egypt:				
(1990-1998)	3.319 (0.000)	0.051 (0.7474)	Normality	0.12
(1999-2007)	1.274 (0.000)	0.609 (0.000)	LM	0.72
(2008-2011)	0.348 (0.003)	1.043(0.000)	BPG	0.32
(2012-2021)	3.058 (0.000)	-0.044 (0.325)		
Jordan:				
(1990-1995)	0.048 (0.959)	0.991 (0.000)	Normality	0.23
(1996-2007)	-1.717 (0.007)	1.254 (0.000)	LM	0.14
(2008-2021)	5.488 (0.000)	0.402 (0.000)	BPG	0.72
Kuwait:				
(1990-1993)	-59.498 (0.000)	7.260 (0.000)	Normality	0.93
(1994-2004)	12.522 (0.000)	-0.315 (0.300)	LM	0.69
(2005-2014)	3.435 (0.048)	0.775 (0.000)	BPG	0.31
(2015-2021)	-15.114 (0.000)	2.348 (0.000)		
Lebanon*:				
(1990-1994)	3.689 (0.000)	0.448 (0.000)	Normality	0.04
(1995-2021)	2.180 (0.000)	0.744 (0.000)	LM	0.12
			BPG	0.00
Mauritania:				
(1990-2001)	4.913 (0.845)	0.131 (0.977)	Normality	0.00
(2002-2011)	-0.625 (0.056)	1.216 (0.000)	LM	0.17
(2012-2021)	6.048 (0.628)	0.179 (0.917)	BPG	0.50

Note: * denotes using HAC standard errors and covariance. [&] denotes using White heteroskedasticity-consistent standard errors and covariance. Bai-Perron tests of L+1 vs. L sequentially determined breaks are used.

Table 4. Regression with Multiple Breaks Results (continued)

Country	α	β	Diagnostic tests	
Morocco:				
(1990-2006)	0.653 (0.470)	0.955 (0.000)	Normality	0.68
(2007-2021)	8.250 (0.000)	0.190 (0.003)	LM	0.85
			BPG	0.11
Oman:				
(1990-2001)	4.262 (0.096)	0.501 (0.096)	Normality	0.51
(2002-2014)	-0.479 (0.478)	1.090 (0.000)	LM	0.94
(2015-2021)	13.912 (0.032)	-0.366 (0.539)	BPG	0.37
Qatar:				
(1990-1999)	0.748 (0.754)	0.919 (0.004)	Normality	0.93
(2000-2014)	-2.243 (0.000)	1.332 (0.000)	LM	0.62
(2015-2021)	1.661 (0.889)	0.844 (0.445)	BPG	0.46
Saudi Arabia:				
(1990-1999)	7.646 (0.014)	0.281 (0.309)	Normality	0.69
(2000-2008)	-6.161 (0.012)	1.628 (0.000)	LM	0.14
(2009-2014)	-2.688 (0.668)	1.279 (0.022)	BPG	0.51
(2015-2021)	-13.620 (0.069)	2.068 (0.001)		
Tunisia[&]:				
(1990-2006)	0.839 (0.533)	0.925 (0.000)	Normality	0.81
(2007-2014)	7.541 (0.001)	0.209 (0.385)	LM	0.43
(2015-2021)	3.902 (0.024)	0.567 (0.002)	BPG	0.03
United Arab Emirates:				
(1990-2004)	4.584 (0.018)	0.529 (0.010)	Normality	0.68
(2005-2021)	7.082 (0.000)	0.398 (0.000)	LM	0.34
			BPG	0.09

Note: * denotes using HAC standard errors and covariance. [&] denotes using White heteroskedasticity-consistent standard errors and covariance. Bai-Perron tests of L+1 vs. L sequentially determined breaks are used. Between ( ) the p-values.

Table 5. Granger causality test

Dependent variable Country	LR (H_0: LE does not Granger cause LR)	LE (H_0: LR does not Granger cause LE)
Algeria	0.047 (0.828)	6.989 (0.008)
Bahrain	0.793 (0.373)	4.429 (0.035)
Djibouti	2.955 (0.398)	2.705 (0.439)
Egypt	0.684 (0.408)	6.818 (0.008)
Jordan	0.004 (0.950)	5.249 (0.022)
Kuwait	0.001 (0.976)	3.619 (0.057)
Lebanon	0.797 (0.371)	18.983 (0.000)
Mauritania	0.344 (0.557)	0.0002 (0.990)
Morocco	0.475 (0.490)	6.614 (0.010)
Oman	0.003 (0.955)	18.873 (0.000)
Qatar	0.263 (0.608)	12.375 (0.000)
Saudi Arabia	0.247 (0.618)	6.532 (0.010)
Tunisia	1.126 (0.288)	4.410 (0.035)
United Arab Emirates	0.663 (0.717)	8.922 (0.011)

Note: the number between () are the chi-square p-values.

5. Conclusion and Recommendations

The main goal of the current study was to investigate budget deficit sustainability in selected Arab countries over the period from 1990 to 2021. The second aim of the study was to examine the dynamics of government expenditure and revenue. The unit root and cointegration tests that take structural breaks into consideration were employed. Moreover, the multiple breaks regression of Bai and Perron (2003) was used to capture the association between government revenue and expenditure. Also, the Granger causality test was utilised to assess the revenue–expenditure nexus. The results of this investigation showed that all the countries had experienced at least one structural break in the estimated relationship between government revenue and expenditure. The most obvious finding that emerged from this study was that the relationship between revenue and expenditure is not at the same pace. For instance, a budget deficit in a country could be sustainable in a certain period and unsustainable in another, depending on the structural changes that run into the economy. One of the more significant

findings was that various countries faced and possibly still facing significant challenges in servicing their debt. Regarding the Granger causality test, the analysis revealed a unidirectional causality running from revenue to expenditure in most of the countries in the sample, suggesting that government revenue induced government expenditure decisions, which support the revenue–spend hypothesis. The study contributes to our understanding of fiscal policy sustainability and the dynamics of the relationship between government revenue and expenditure in the Arab region.

The results of this study have several important implications for current and future practice. First, the COVID-19 crisis-related fiscal slump caused a sharp rise in spending and a sharp decline in revenue, which caused budget deficits in many Arab countries and posed a danger to the fiscal sustainability of those economies. In other words, a structural break due to economic crisis, policy change, technological shift, natural disaster, is very important and needs to be considered when studying government revenue-expenditure nexus. Also, it might be beneficial to consider the possibility of more than one structural break in the unit root and cointegration processes. Moreover, it is important for government expenditure policies in Arab countries to be counter-cyclical in the sense that the spending is higher in times of recession and lower when the economy flourishes. In addition, increasing tax revenues should be done through expanding the tax base rather than rising tax rates.

Fiscal imbalances will force the economy to undergo larger and more difficult adjustments if the required corrective policies on budget imbalances are not put into place. It is acknowledged that procedures regarding debt sustainability and adequate fiscal policies are necessary, considering the negative repercussions of perpetual deficits. In this context, it will be helpful to implement fiscal rules in Arab countries and establish independent supervisory and regulatory institutions like the fiscal councils implemented in the European region to assess publicly and independently the fiscal policies.

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