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Send correspondence to:
Moez Ben Tahar
Faculty of Economics and Management of Sousse, Tunisia
moez_bentahar@yahoo.fr

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Abstract

This paper deals with fiscal sustainability by estimating fiscal reaction functions (FRF) for a panel of 15 MENA countries over the period 1990-2019. In investigating the question, this paper used various methods including the System General Method of Moments (System GMM), and the common correlated effects mean group (CCEMG) estimator. Our findings reveal that MENA countries are fiscally responsible, as evidenced by the positive and significant response in the primary balance to changes in the lagged debt-to-GDP ratio, and those countries adjust along the expenditure margin. Moreover, we find robust evidence of a nonlinear fiscal policy response to debt accumulation. We also show that the fiscal policy stance tends to be countercyclical, but government spending has a procyclical bias. Further, fiscal authorities in oil-exporting countries respond more strongly to rising debt levels than in net oil-importing countries.

Keywords: Fiscal policy, Debt accumulation, MENA countries

JEL Classifications: G1

ملخص

تتناول هذه الدراسة الاستدامة المالية من خلال تقدير خصائص التفاعل المالي (FRF) على مجموعة مكونة من 15 بلدًا في منطقة الشرق الأوسط وشمال إفريقيا خلال الفترة 1990-2019. وعند التحقيق في هذه المسألة، استخدمت هذه الدراسة عدة طرق، بما في ذلك طريقة العزوم المعممة (System GMM) وأسلوب تقدير مجموعة متوسط التأثيرات المترابطة المشتركة (CCEMG). تكشف نتائج البحث التي توصلنا إليها أن بلدان منطقة الشرق الأوسط وشمال إفريقيا مسؤولة ماليًا، كما يتضح من الاستجابة الإيجابية والمهمة في الميزان الأولي للتغيرات في نسبة الدين المتأخر إلى إجمالي الناتج المحلي، كما تكشف أن تلك البلدان تتكيف مع هامش الإنفاق. وعلاوة على ذلك، وجدنا أدلة قوية على استجابة السياسات المالية غير الخطية لتراكم الديون. كما يظهر البحث أن وضع السياسات المالية يميل إلى مواجهة التقلبات الدورية، لكن للإنفاق الحكومي تحيز مساير للدورات الاقتصادية. وعلاوة على ذلك، تستجيب السلطات المالية في البلدان المصدرة للنفط استجابةً أقوى لمستويات الديون المتزايدة مقارنة بالبلدان المعتمدة فقط على إستيراد النفط.

1. Introduction

Economies in the Middle East and North Africa (MENA) are facing unprecedented dual shocks from the spread of COVID-19 and the collapse in oil prices. The pandemic has caused severe negative demand and supply shocks. Falling oil prices depress income. The decline is felt directly by oil exporters and indirectly by oil importers through reduced remittances, foreign investment, and sovereign lending (Arezki et al., 2020).

The combination of low growth, shocks to oil prices, and rising spending needs, particularly in countries affected by the Arab uprisings, has adversely affected fiscal buffers and public debt burdens. Deteriorating fiscal positions reduce fiscal space and render the region vulnerable to shocks and (for some countries) unsustainable debt dynamics.

It is worth noting that the patterns of debt build-up vary across countries. For instance, net oil-importing countries have experienced multiple episodes of socio-economic and political shocks since 2011, adversely affecting the current fiscal balances. On the other hand, oil-exporting countries have eroded their fiscal spaces, which were already high during the oil boom, because of the low oil prices since 2014. In either case, these adverse developments in the global and regional context expanded fiscal deficits and raised debt levels in all countries in the region.

While the dynamics of debt accumulation present heterogeneous patterns, several common structural characteristics could create an environment that may have been propitious to accumulating debt. Specifically, rigid expenditures, a volatile revenue base, and weak fiscal institutions have made it difficult to implement a prompt fiscal response to shocks.

The rapid rise in public debt has exacerbated debt sustainability issues, putting governments in danger of making costly mistakes of accumulating public debt to unsustainable levels. Governments are being urged to take appropriate actions to reduce fiscal deficits and public debt. The fiscal actions taken by governments to stabilize or reduce the public debt burden are commonly known as fiscal consolidation measures and are assessed using fiscal reaction functions. The fiscal reaction function is a built-in mechanism used by governments to ensure debt stability. It is the adjustment in primary fiscal balance to manage and stabilize debt over time.

The emerging literature on fiscal reaction functions (FRF) has focused on developing countries. This paper fills a gap and extends that work to MENA countries. We apply the model-based fiscal reaction function approach to fiscal sustainability developed by Bohn (1998, 2007). The advantage of this approach is that it provides a straightforward and powerful method to conduct empirical tests that are sufficient to satisfy fiscal solvency.

This paper deals with the topic of fiscal sustainability by estimating fiscal reaction functions (FRF) for a panel of 15 MENA countries over the period 1990-2019. It contributes to the

literature in several ways. First, it empirically examines the sustainability of public debt for the MENA region, while existing work covers only a partial selection of countries.[1] Second, we extend the conventional model to include other important factors, such as output gap, expenditure gap, inflation, trade openness, and oil price shocks. Third, we extend the analysis to consider the composition of fiscal adjustment. We estimate separate fiscal reaction functions for government revenue and primary spending to test whether fiscal adjustment is likely to be revenue- or spending-based. Fourth, we consider the reaction of fiscal policy to rising debt as nonlinear and conditional on debt level. Our focus is to test the fiscal fatigue hypothesis in line with Ghosh et al. (2013). Fifth, in order to examine the differential responses of fiscal policies across country groupings, we split the sample of countries into oil-exporting and oil-importing countries. Finally, to control for cross-section dependence and heterogeneity, we employ the common correlated effects mean group (CCEMG) estimator in Pesaran (2006).

The main objective of this study is to assess fiscal sustainability for MENA countries using the approach developed by Bohn (1998) and expanded by Ghosh et al. (2013). The methodology uses compromises estimating panel fiscal reaction functions using a System General Method of Moments (System GMM) approach and the common correlated effects mean group (CCEMG) estimator.

The paper proceeds as follows. Section II provides a discussion of the literature. A description of our empirical strategy is presented in Section III. The results are discussed in Section IV. Section V summarizes the findings and concludes with some policy implications.

2. Literature review

The concept of fiscal deficit sustainability has long been a focus of research and policy debate in economics and public finance. Although fiscal sustainability is often considered critical for the country's economic stability, there is no universally accepted definition or method for assessing it. In fact, many research publications in the field of sustainability present their own criteria of sustainability, which are comparable but not identical in many respects.

Theoretical literature provided various definitions of fiscal sustainability. It is defined as the state wherein the government budget can be smoothly financed without generating explosive increases in public debt over time (Blanchard, 1990). It can also be defined as whether the government will be able to generate surpluses in the future in order to pay off previous debt or whether it finances the debt and interest payments by issuing new debt (Bergman, 2001).

[1] For instance, Neaime (2010) examines the sustainability of public debt for five MENA countries: Egypt, Jordan, Morocco, Tunisia, and Turkey. El Mahmah and Kandil (2019) focus on evaluating the long run sustainability of GCC's public finance by estimating a reaction function of the government's primary balance. Sarangi and El-Ahmadieh (2017) examine three crucial aspects of fiscal sustainability in oil-poor Arab countries: (1) general government gross debt to GDP; (2) the fiscal balances to GDP; and (3) the fiscal policy responses to debt.

To make these definitions operational, Blanchard (1990) defines sustainable fiscal policy as a strategy that ensures that the ratio of debt to GDP converges back toward its initial level. In a similar spirit, Buiter et al. (1985) defines sustainable policy as one maintaining the ratio of public sector net worth to output at its current level.

These definitions, however, are criticized for two main reasons. Firstly, there is no theoretical reason why those ratios should be required to return to their initial levels rather than any other stable level, even if they are lower or higher. Secondly, the government could adopt a policy under which the debt ratio initially rises to an excessive level to promote economic growth, while ensuring that debt comes down and returns to a safe and stable level. To address this issue, a new definition was developed, which states that fiscal policy is sustainable if the present value of future primary surpluses is equal to the current level of debt, which is commonly known as the Inter-temporal Budget Constraint (IBC).

This innovative definition based on the IBC of the government could be used to draw an explicit distinction between solvency and sustainability. If the government can pay off its debt with future primary surpluses over an infinite horizon, it is solvent. In other words, the government is solvent if the IBC is fulfilled. This differs from sustainability, which is the government's capacity, under current policies, to reach a pre-specified debt-to-GDP ratio in a finite time horizon.

Empirical studies dealing with these issues start with the government budget identity. Following Bohn (2007), the budget equation can be written as the following:

$$B_t = (1 + r)B_{t-1} - PB_t \qquad (1)$$

Hence, government debt at the end of period t (B_t) is determined by the primary balance (PB_t), the interest rate (r_t), and the last period public debt (B_{t-1}). Equation (1) shows that public debts are linked to the interest on public debt and the size of the primary balance. When the primary balance is zero, public debt will grow at a rate equivalent to the nominal interest rate. Solving the budget constraint recursively forwards in time gives:

$$B_t = (1 + r)^{-1}B_{t+1} + (1 + r)^{-1}PB_{t+1}$$
$$B_t = (1 + r)^{-2}B_{t+2} + (1 + r)^{-2}PB_{t+2} + (1 + r)^{-1}PB_t$$
$$\ldots\ldots$$
$$B_t = (1 + r)^{-m}B_{t+m} + \sum_{i=1}^{m}(1 + r)^{-i}PB_{t+i} \qquad (2)$$

Where $(1 + r)^{-m}$ is the discount factor.

The IBC implies that a sustainable fiscal policy must rule out any Ponzi scheme; that is, the present value of the expected future stock of debt must converge to zero. In other words, fiscal sustainability requires that the government cannot roll over its debt perpetually. Hence, the transversality condition is expressed as follows:

$$B_t = \lim_{n\to\infty}(1+r)^{-m}B_{t+m} = 0 \qquad (3)$$

If equation (3) is satisfied, the IBC implies that the value of the current stock of debt must equal the discounted present value of all future budget surpluses. The IBC and the transversality condition define the analytical framework.

Empirical studies testing the present value budget constraint focus on the time series proprieties of the fiscal variables of interest. Two empirical frameworks have been used in the literature. The first rests on testing the stationarity of various fiscal variables (Hamilton and Flavin, 1985, Trehan and Walsh, 1991), while the second employs cointegration techniques and explores the existence of a long-run equilibrium relationship between the fiscal variables of interest (Hakkio and Rush, 1991).

The unit root test approach is challenged by Bohn (1998), who uses a completely different strategy to analyze fiscal sustainability. He proposes a new way to test fiscal sustainability by estimating a fiscal reaction function sustainability test. If the primary budget increases after any accumulation in the lagged, the fiscal policy is deemed sustainable. A positive response of the primary balance suggests that the government is counteracting the increase in public debt.

The assessment of the response of primary balance to changes in debt is flexible and can be extended to examine issues such as fiscal fatigue by postulating a non-linear relationship between debt and primary balance. Ghosh et al. (2013) considers a non-linearity assumption, which allows for a threshold where the reaction of primary balance to debt stock wanes as debt levels increase due to adjustment fatigue. This is known as the debt Laffer curve effect, where there is a tipping point beyond which higher debt may not result in increased primary balance.

Specifically, the hypothesis of fiscal fatigue is tested by means of polynomial (quadratic or cubic) functional forms of FRF where, at low levels of debt, there is no relationship between the primary balance and debt. Meanwhile, as debt rises, the primary balance increases but the responsiveness eventually weakens and then decreases at very high levels of debt. This implies that there is a debt level above which the debt dynamics become explosive and the government will necessarily default.

There are at least two channels that make the FRF non-linear. The first rationale for incorporating possible asymmetry in the adjustment of the budget deficit stems in part from fiscal policymakers that respond differently to a deviation of the deficit and/or surplus from its

long-run trend. One would expect, for example, that fiscal policy may respond more when debt is high and/or rising while being less responsive at lower debt levels (Bertola and Drazen, 1991). Second, the available empirical evidence suggests that various business cycle indicators exhibit asymmetric behavior (Enders and Siklos, 2001). Given that the budget deficit is influenced by business cycle movements via automatic fiscal stabilizers and discretionary fiscal measures, it is reasonable to assume that the business cycle asymmetries could possibly translate into a budget deficit (Payne and Mohammadi, 2006).

Empirical research on fiscal responses to debt increases was popularized by the seminal paper by Bohn (1998), who examines the fiscal response to debt for the United States using time series methods. He finds, after controlling for volatility in output and government spending, an increasing fiscal policy response to debt accumulation across different sample periods. However, Bohn's work was focused on the United States, and so the question of how other governments react to debt remained largely unexplored.

Despite their operational importance for policymakers and analysts, few efforts have been devoted to assessing fiscal sustainability in emerging countries in general and in the MENA region in particular. Among the extant studies, Neaime (2010) examines the sustainability of public debt for five MENA countries (Egypt, Jordan, Morocco, Tunisia, and Turkey) using time series econometric tests and the Present Value Constraint model. The empirical results point to the strong sustainability of fiscal policies in Tunisia, weak sustainability in Egypt, mixed results for Morocco, and unsustainable debt and fiscal policies in Jordan and Turkey. El Mahmah and Kandil (2019) focus on evaluating the long-run sustainability of GCC's public finance by estimating a reaction function of the government's primary balance using system generalized methods of moments (System GMM) models. They find a positive relationship between primary balance and the lagged debt-to-GDP ratio. Moreover, empirical findings reveal that various measures of economic performance, as captured by economic growth, openness, and oil price, were also found to be important factors in explaining fiscal performance. Sarangi and El-Ahmadieh (2017) examine the fiscal policy responses to debt in Arab countries. They allow for the possibility of a nonlinear shape by including quadratic and cubic models. The model estimates show that the primary balance ratio was negative and deteriorated with an increase in lagged debt ratio, which is against the required condition that the primary balance ratio should respond positively to increasing lagged debt ratio. Ben Hassine Khalladi (2019) estimates the fiscal limit for some MENA countries (Egypt, Jordan, Morocco, and Tunisia), and results show the existence of fiscal fatigue, namely the loss of control of the debt accumulation using fiscal adjustments when debt increases.

3. Empirical methodology

3.1 Data description

The panel data cover 15 MENA countries[2] using annual data from 1990 to 2019. The public debt data was obtained from the IMF's historical public debt database. The data on other variables were obtained from the IMF's World Economic Outlook, the IMF's International Financial Statistics, and the World Bank's economic database. For the dependent variable, we examine three measures of fiscal response: primary balance, total revenues, and primary spending. This entails breaking down the primary balance and analyzing the response of each component. All outcomes examined are expressed as a share of GDP. The choice of primary balance is reasonable because it better reflects the government's discretionary fiscal behavior and helps to evaluate the impact of automatic stabilizers and discretionary policy. Concerning the explanatory variables, the existing stock of public debt (sum of domestic and external debt), in percent of GDP, is the most used determinant of fiscal performance in the literature. The controls include a measure of the output and expenditure gaps, inflation rate, trade openness, and oil prices.

Table (1) presents the summary statistics for the variables used. There is a significant degree of dispersion across MENA countries in terms of fiscal stance and macroeconomic conditions.

Table 1.Summary statistics

Variable	Mean	Std. Dev	Min	Max
Primary Balance	-0.572	12.667	-186.794	28,569
Debt	59.346	53.063	1.121	495.200
Inflation	8.969	16.144	-4.870	123.578
Trade openness	83.061	36.940	11.087	210.161
Expenditures Gap	-0.456	12.475	-59.625	73.749
Output Gap	-0.019	4.912	-41.764	17.503

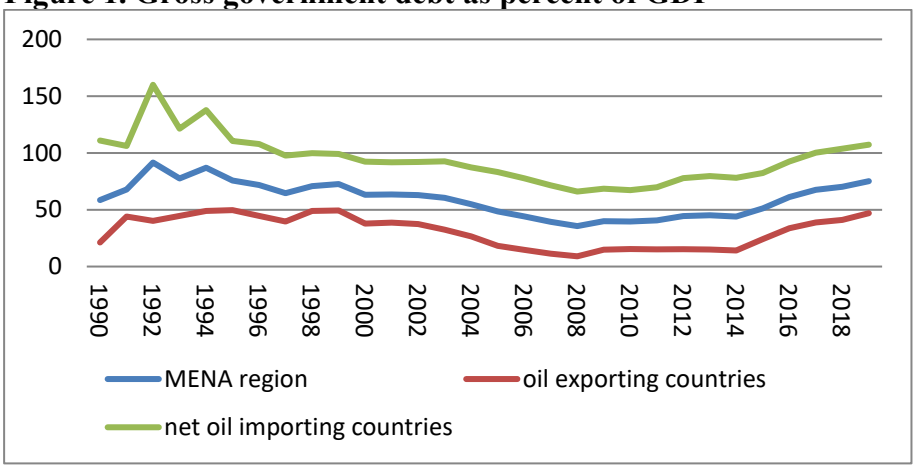
The two most important indicators of fiscal sustainability are the primary balance and the level of public debt. The MENA region is witnessing a rising trend in debt to GDP since the global economic downturn in 2008, which was followed by the 'Arab spring' and the sharp decline in oil prices. For the region as a whole, the average debt to GDP increased from nearly 35 percent in 2008 to 75 percent in 2019. The high GDP of oil-exporting countries and their corresponding low debt to GDP significantly pushes the regional aggregate debt to GDP downward. In reality, oil-importing countries have a much higher debt burden than the average for oil-rich countries.

The debt-to-GDP ratio is rising sharply for net oil-importing countries in particular; climbing to 107 percent in 2019 from an average of about 66 percent in 2008. This marks a sharp reversal from downward trends in the two decades prior to 2008. On the other hand, the oil-exporting countries used to have low debt on average. But they too reported a significant jump recently,

[2] Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Tunisia, UAE, and Yemen.

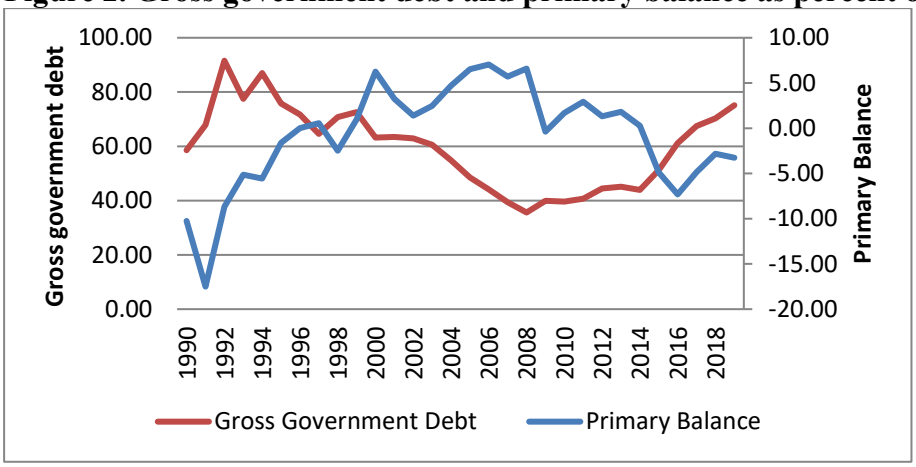
from nearly ten percent of GDP in 2008 to 46 percent in 2019 due to lower oil prices. All oil-exporting countries have reported increasing debt since 2014 and most have started adopting fiscal adjustment measures, mainly by cutting expenditure and introducing value-added taxes.

Figure 1. Gross government debt as percent of GDP



The growing trend of public debt since 2008 reflects, in part, the continuous degradation of primary balance. The primary fiscal balance returned to its lowest level since 1993 in 2019. The primary fiscal balance deteriorated from a surplus of 2.4 percent between 1994 and 2008 to a deficit of 1.4 percent for the period 2009-2019.

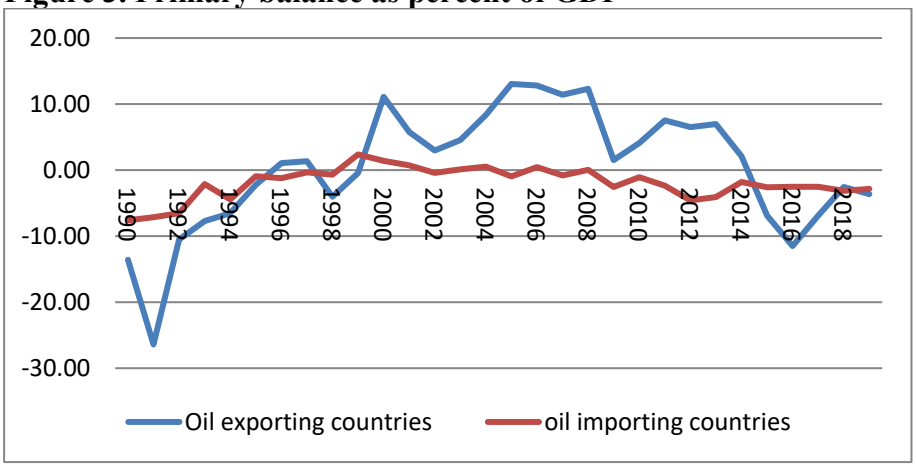
Figure 2. Gross government debt and primary balance as percent of GDP



Among oil-exporting countries, these balances have been mostly in surplus during most years since 1994, except for periods when oil prices dropped significantly. Since 2015, plunging oil prices have turned the balances into deficits. The average primary balance ran at a deficit of 11.5 percent of GDP in 2016. On the other hand, the fiscal balances of oil-importing countries have mostly been in deficit. Average fiscal and primary balances worsened between 2008 and 2013, a period that affected growth and spending negatively due to the global economic recession and the Arab uprisings. Primary balances started improving slowly in 2014, partly because low oil prices benefitted oil-importing countries, and because some countries adopted

fiscal adjustment policies. Average fiscal balances are still negative, however, with an average primary deficit at -2.8 percent of GDP.

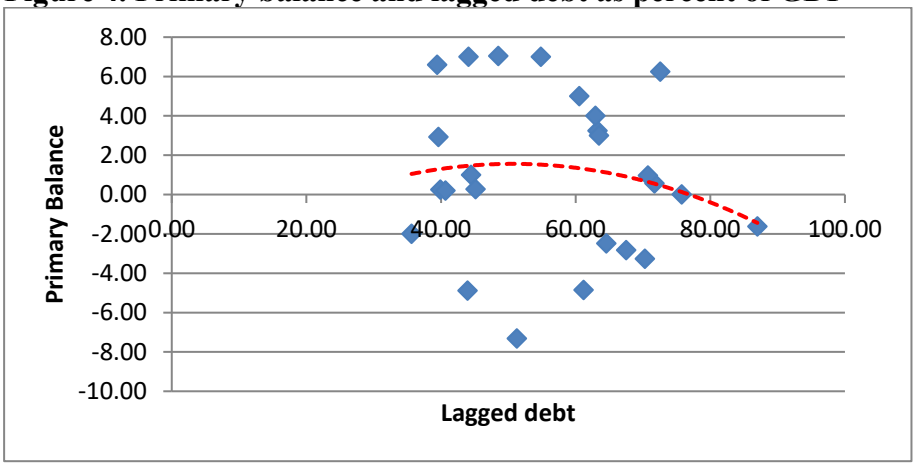
Figure 3. Primary balance as percent of GDP



To get a better understanding of the reaction of primary balance to increases in debt, it is important to plot primary balance against lagged debt. The analysis provides an insight into the behavior of fiscal policy as debt rises. The relationship can be positive, negative, linear, or even non-linear (Ghosh et al., 2011, and Adams et al., 2010).

A scatter plot of primary balance and lagged debt reflects that primary balance has been increasing as debt increases. The relationship shows that there may likely be a threshold where primary balance ceases to react to further increases in debt.

Figure 4. Primary balance and lagged debt as percent of GDP



3.2 Model specification

3.2.1 Baseline specification

Our starting point is the model-based fiscal reaction function proposed by Bohn (1998). This test indicates that a country is fiscally solvent in the long run if the primary balance as a share of GDP is an increasing linear function of the debt-to-GDP ratio. In other words, a government

should react to an increase in the debt-to-GDP ratio by improving the primary balance in order to restrain the debt ratio from rising further. Our baseline fiscal reaction function takes the following dynamic form:

$$PB_{it} = \beta_0 + \beta_1 PB_{it-1} + \beta_2 D_{t-1} + \beta_3 YVAR_{it} + \beta_4 GVAR_{it} + \beta_5 X_{it} + \eta_i + \mu_t + \epsilon_{it} \quad (4)$$

Where PB_{it} is the primary balance of country i in period t, D_{t-1} is the gross debt-to-GDP ratio. PB_{it-1} is the lagged dependent variable to control for the persistence of fiscal policy since the primary balance is the result of a highly institutionalized negotiation process. To account for tax smoothing (Barro 1981, 1986), we control for business cycle ($YVAR_{it}$) and fluctuations of government spending ($GVAR_{it}$). The impact of the business cycle allows us to measure whether fiscal policy is procyclical, a-cyclical, or countercyclical. The expenditure gap and output gap are expected to be negatively related to the primary balance. They are obtained using the Hodrick Prescot (HP) filter after extending the data using IMF medium-term forecasts to take into account the end point bias of the filter. X_{it} represents a vector of control variables, including consumer price inflation and trade openness. Regarding inflation, the literature revealed several opposite effects on the primary balance. A first mechanism resulting in a positive impact is the use of bracket creep effects (Saez 1999). Inflation pushes individuals in a higher tax bracket when these brackets are not (sufficiently) indexed. This mechanism thus increases the tax revenue received by the government but does not affect the expenditures. The combination of higher revenues with constant expenditures results in an increase in the primary balance. Contrary to the bracket creep mechanism, an asymmetric effect of inflation on revenues and expenditures could also cause a decrease in the primary balance.

Trade openness could be favorable to growth through its impact on total factor productivity (TFP) by enhancing revenue performance. However, openness could also increase a country's exposure and vulnerabilities to external shocks, with an adverse impact on revenues and even on expenditures.

The sign and significance of β_2 is central to the fiscal sustainability condition. Essentially, it measures the primary-balance ratio response to changes in the debt ratio, which should be between zero and one to satisfy the fiscal sustainability condition. A larger value of β_2 will imply a stronger response of primary balance to debt ratio. On the contrary, a zero or negative β_2 suggests either no response or a muted response to more debt.

3.2.2 Extended specification

We extend the baseline fiscal reaction in order to take into consideration other important factors. First, we consider that the oil price is a key determinant of fiscal sustainability for MENA countries, following El Mahmah and Kandil (2019). As oil revenue is a critical source of fiscal revenue in oil-exporting countries, an increase in oil price is expected to increase government revenues and therefore boost primary surpluses. In oil-importing countries, an increase in oil price increases government expenditure on imports and subsidies and consequently reduces the primary balance. Moreover, the oil price may also indirectly hurt oil-importing countries through foreign direct investment, remittances, and grants from high-income oil-exporting

countries. Therefore, we extend the fiscal response function to include oil price shocks (changes in oil prices).

Second, we extend the literature and examine the reaction of separate components of primary balance in MENA countries. We extend the analysis to consider the composition of fiscal adjustment. We estimate separate fiscal reaction functions for government revenue and spending. The estimated elasticities (with respect to the debt-to-GDP ratio) can be used to inform appropriate fiscal policy adjustments for the countries examined.

3.2.3 Nonlinear fiscal reaction function

This section investigates nonlinearity, in the form of kink points, in the relationship between primary balance and debt ratios. Our focus is to test the fiscal fatigue hypothesis in line with Ghosh et al (2013). In this case, the model extends the baseline specification by adding lagged polynomial terms of public debt.

Specifically, the nonlinear FRF is approximated by cubic approximation as follow:

$$PB_{it} = \beta_0 + \beta_1 PB_{it-1} + \beta_2 D_{t-1} + \beta_3 D_{t-1}^2 + \beta_4 D_{t-1}^3 + \beta_5 YVAR_{it} + \beta_6 GVAR_{it} + \beta_7 X_{it} + \eta_i + \mu_t + \epsilon_{it} \quad (5)$$

The fiscal fatigue proposition of the positive but eventually slowing response of the primary balance to rising debt shows up as $\beta_3 < 0$ in (a cubic specification) or $\beta_2 < 0, \beta_3 = 0$ (in a quadratic specification). The estimated coefficient can be used to endogenously define a debt threshold for which the response of the primary balance to lagged debt is at its maximum; above which the response starts to decline (fiscal fatigue).

3.2.4 Fiscal reaction functions for oil-importing and oil-exporting countries

The overall average fiscal reaction in the MENA region may mask heterogeneity in sources of revenue mobilization and development challenges across countries. Thus, the region can be classified into two clusters of countries: (1) oil-exporting countries and (2) net oil-importing countries.

The major source of revenue in oil-exporting countries (Algeria, Bahrain, Iran, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) is oil and gas, so they are susceptible to oil-price fluctuations. Oil-importing countries (Egypt, Jordan, Lebanon, Morocco, Sudan, Tunisia, and Yemen) rely on a mixture of sources of revenue, mainly taxation. With low tax-to-GDP ratios, they face severe constraints in meeting the financing needs to address development needs. To examine differential responses of fiscal policies across country groupings, we split the sample of countries into oil-exporting and oil-importing countries.

3.2.5 Econometric issues

The main problem that has been highlighted in the literature with respect to modeling fiscal reaction functions is the issue of endogeneity, which is likely to stem from the interactions between the variables entering the equation. In a dynamic panel-data model, the

lagged dependent variable is correlated with the error term. Moreover, lagged debt-to-GDP may be correlated with the idiosyncratic error term. A country's debt is an accumulation of previous deficits, so unobserved factors that cause large primary surpluses (relatively low levels of debt) bias downward the estimated debt-ratio coefficient (Celasun et al., 2006). Another potential source of endogeneity is the persistence of policy shocks. A persistent fiscal policy shock in the previous period (implying that ε_{it-1} and ε_{it} are serially correlated) will render the estimates inconsistent because D_{t-1} is correlated with that initial shock. To deal with the issues of endogeneity, we apply the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998).

Another issue is related to the fact that countries differ in their ability to generate primary surpluses apart from the differences that could be explained through the different explanatory variables. Identical debt coefficients thus imply an identical outcome in the fiscal sustainability analysis. However, the very different evolutions in the debt ratio in the period 1990-2019 prove that our data set is made up of a variety of countries with different fiscal policies. Some underwent major debt increases and others succeeded in stabilizing their debt ratio rather well. Thus, the conduct of fiscal policy can be different among countries and the assumption of a homogeneous slope coefficient is a strong assumption and more likely to be violated.

As a result, moving away from homogeneous debt coefficients gives us another perspective regarding fiscal sustainability analysis. A country that has always had a very lax fiscal policy (which results in low debt coefficients), is expected to be heavily indebted. Countries with a low debt-GDP ratio, on the other hand, are expected to have followed a very prudent fiscal policy (which results in high debt coefficients). It is thus possible that the low reaction, found at high debt levels, is driven by heavily indebted countries that have always reacted less and is not a general phenomenon. If this is all indeed true, ignoring heterogeneity is a case of misspecification.

Recent literature has proposed a model to account for slope heterogeneity and cross-sectional dependence: the Common Correlated Effects Mean Group (CCEMG) model designed by Pesaran (2006). This estimator helps control cross-country correlation and heterogeneity. The following panel set can be considered:

$$y_{it} = x'_{it}\beta_i + u_{it} \quad (6)$$

$$u_{it} = \alpha_{1i} + \lambda_i f_t + \varepsilon_{it} \quad (7)$$

$$x_{it} = \alpha_{2i} + \lambda_i f_t + \gamma_i g_t + v_{it} \quad (8)$$

y_{it} are the observable variables. β_i refers to panel-specific slope coefficients. α_{ij} refers to standard individual fixed effect capturing time-invariant heterogeneity. f_t and g_t are unobserved common factors with heterogeneous factor loadings λ_i and γ_i, accounting for time-variant heterogeneity and cross-section dependence.

Pesaran's (2006) CCEMG estimator controls cross-sectional dependence, time-variant unobserved factors with heterogeneous effects across units and identification problem. To

solve these problems, the CCEMG estimator augments the group-specific regression equations with cross-sectional averages of the dependent and observable independent variables.

4. Results and analysis

This section presents the main results from the panel-regression estimates of the fiscal response functions discussed in section III. Most estimations are based on the application of a System General Method of Moments (System GMM) approach, although an alternative Common Correlated Effects Mean Group (CCEMG) method was also tried.

Table 2 presents the baseline results of fiscal response to debt while taking into account different estimation techniques and control variables. Model (1) only has the lagged primary balance and debt as regressors. There is a five percent significance for all coefficients. Our results are, to some extent, in line with other literature. An important aspect of fiscal policy for debt sustainability is that the primary balance ratio should respond positively to increasing lagged debt ratio, as discussed above. In our sample, the coefficient of lagged debt ratio is positively and significantly correlated to primary balance, which is an indication of fiscal behavior that takes into account the government's intertemporal budget constraint and, therefore, long-term fiscal solvency concerns.

This finding implies that, on average, governments take into account corrective measures when the public debt begins accumulating, which could lead to sustainable debt policy (Bohn, 1998). The magnitude of the coefficient, however, is not economically large. The average response of primary balance to lagged debt ratios lies between 0.013 and 0.042. Although the result is compatible with those yielded by some previous studies in fiscal responses to debt in developing countries (e.g. Adams et al., 2010, Small et al., 2020, El Mahmah and Kandil, 2019) it contradicts the findings of Sarangi and El-Ahmadieh (2017).

The coefficient of the lagged primary fiscal balance is positive and significant, suggesting a high degree of persistence of the basic primary fiscal balance. This coefficient means that the current fiscal performance is strongly determined by that of the previous year (El Mahmah and Kandil, 2019).

Model (2) includes the output gap and expenditure gap. Almost all coefficients are significant at the one percent level, except for lagged debt, which is significant at five percent. The estimated coefficient for the output gap is positive and statistically significant. This provides suggestive evidence of countercyclical fiscal policy in the sampled countries over the period 1990-2018, which is contrary to previous studies that tend to show procyclical fiscal behavior among developing countries, especially MENA countries (Abdih et al., 2010, Ben Slimane and Ben Tahar, 2010). A positive coefficient means that the fiscal stance is tightened or loosened during economic upturns and downturns, respectively.

Moreover, a temporary increase in government expenditures, captured by the expenditure gap, has a significant negative effect on the primary balance. This is expected and the result is

broadly in line with the theoretical prediction of Barro's model. It implies that primary surplus decreases when public spending is above its trend.

Model (3) includes all the controls. The coefficient of trade openness was significantly positive, as expected. Thus, economies that are more open in terms of international trade activity demonstrate better fiscal performance. Consumer price inflation, on the other hand, has a negative coefficient, which is statistically significant at conventional levels.

We rely on the Hansen test for the overall validity of our instruments, as well as the Arellano and Bond test (1991) for the presence of second-order autocorrelation in the differenced residuals. These results reveal that for all the adopted models, the Hansen test cannot reject, at the one percent level, the null hypothesis of the overall validity of the used instruments. Furthermore, the Arellano and Bond test cannot reject, at the one percent level, the null hypothesis of the absence of autocorrelation of the second order in the residuals.

Table 1. Fiscal reaction function: Baseline estimations

	System GMM		
	Model 1	**Model 2**	**Model 3**
Lagged primary balance	0.383*** [0.000]	0.351*** [0.000]	0.285*** [0.000]
Lagged debt	0.042*** [0.000]	0.013*** [0.000]	0.014*** [0.015]
Output gap		0.288*** [0.001]	0.546*** [0.014]
Expenditure gap		-0.213*** [0.000]	-0.467*** [0.000]
Inflation			-0.003 [0.904]
Trade openness			0.206*** [0.000]
Constant	-2.301*** [0.003]	-0.713 [0. 206]	-1.932 [0.000]
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
AR1 p –value	0.008	0.016	0.054
AR2 p –value	0.310	0.291	0.579
Hansen J-test p-value	0.033	0.006	0.008

In the nonlinear equation approach, we allow for the possibility that the response of the primary balance to debt takes the form of a cubic function rather than a linear response function. The cubic function allows us to capture the two inflection points in the curvature of the response. We test the fiscal fatigue hypothesis in line with Ghosh et al. (2013). The results presented in Table 2 indicate that the coefficients of the cubic functional form, which capture the increasing but slowing response of the primary balance to lagged debt, are statistically significant. Overall, the results suggest some evidence of differential effects whereby the primary balance function has an n-shape. The coefficients of the lagged debt ratio in the quadratic and cubic functional specification were positive and negative, respectively. They indicate that the parameter of

adjustment first increases after a certain threshold and then it declines (the coefficient turned negative) at a very high level of lagged debt ratio. This could be a sign of fiscal fatigue; that is, the necessary fiscal effort to achieve sustainability becomes untenable at high levels of indebtedness.

The finding of an n-shaped fiscal response differs from those of Bohn (1998) and Adams et al. (2010), who found u-shaped effects (fiscal effort increases with the debt level). However, it supports the results of Ghosh et al. (2013), Mendoza and Ostry (2008), and Sarangi and El-Ahmadieh (2017), who found that sustainability is less assured when public debt is high than when it is moderate. Our results are potentially quite significant in economic terms. At very low debt ratios, there is little (or even a slightly negative) relationship between lagged debt and primary balance. As debt increases, the primary balance rises but the responsiveness eventually begins to weaken, and then it decreases at very high levels of debt.

Table 2. Fiscal reaction function: Nonlinear estimations

	System GMM		
	Model 1	**Model 2**	**Model 3**
Lagged primary balance	0.391*** [0.000]	0.358*** [0.000]	0.353*** [0.000]
Lagged debt	-0.082*** [0.000]	-0.077*** [0.000]	-0.103* [0.051]
Lagged debt^2	0.0045*** [0.000]	0.0025 [0.057]	0.0047 [0.348]
Lagged debt^3	-0.0006*** [0.000]	-0.0002 [0.000]	-0.0005 [0.329]
Output gap		0.202 [0.000]	0. 1603 [0.251]
Expenditure gap		-0.219 [0.002]	-0.362* [0.096]
Inflation			-0.018* [0.089]
Trade openness			0.067 [0.140]
Constant	2.994** [0.019]	3.283*** [0.000]	-3.66 [0.206]
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
AR1 p –value	0.009	0.017	0.048
AR2 p –value	0.432	0.345	0.419
Hansen J-test p-value	0.046	0.089	0.959

The response of the primary balance, however, does not provide the margins along which fiscal adjustments are made, whether countries tend to rely more heavily on revenue increases, spending cuts, or both. To do so, we extend the analysis to consider the composition of fiscal adjustment. Following Claeys (2008) and Favero and Marcellino (2005), the primary balance was in turn replaced with primary expenditure and total revenue, respectively. The estimated elasticities with respect to the debt-to-GDP ratio can be used to inform appropriate fiscal policy

adjustments for the countries examined. Table 3 decomposes the fiscal response into the revenue and spending components for the period 1990-2019. The results indicate that, while expenditures respond negatively to an increase in the debt-to-GDP ratio, revenues have an insignificant (negative) response. These findings suggest that MENA countries adjust along the expenditure margin. In other words, fiscal adjustment to counteract debt accumulation tends to be expenditure-based in our sample of countries. This result is in line with the IMF (2017), which considers that fiscal policies in the MENA region are largely determined by expenditure policy. This occurs because tax systems are characterized by very low rates and narrow bases and generate persistently low revenues. We also find that government spending has a statistically significant procyclical bias, while revenues appear to be countercyclical. This result is not surprising, since procyclical public spending in developing countries plays a crucial role in shaping the fiscal policy (Perotti and Gavin, 1997).

Table 3. Fiscal reaction function: Composition of fiscal adjustment

	System GMM					
	Primary Spending			Total Revenue		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Lagged dependent variable	0.330*** [0.000]	0.329*** [0.000]	0.380*** [0.000]	0.651*** [0.000]	0.537*** [0.000]	0.389*** [0.004]
Lagged debt	-0.00015 [0.112]	-0.0002*** [0.001]	-0.00026** [0.015]	-0.00005 [0.152]	-0.00003 [0.538]	-0.00005 [0.303]
Output gap		0.072*** [0.002]	0.046 [0.383]		0.160*** [0.002]	0.298** [0.029]
Expenditure gap					0.016 [0.136]	-0.058 [0.276]
Inflation			-0.00034** [0.041]			0.00026** [0.019]
Trade openness			-0.0008** [0.048]			0.0009** [0. 024]
Constant	0.213*** [0.000]	0.217*** [0.000]	0.283*** [0.000]	0.100*** [0.000]	0.133*** [0.000]	0.091*** [0.009]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
AR1 p –value	0.045	0.042	0.061	0.029	0.035	0.033
AR2 p -value	0.492	0.480	0.448	0.400	0.442	0.522
Hansen J-test p-value	0.016	0.045	0.089	0.052	0.087	0.031

This paper also evaluates the fiscal sustainability for a panel of oil-exporting and oil-importing countries. This grouping allows us to estimate more reliable results and examine heterogeneous responses. Moreover, we extend the baseline fiscal reaction in order to consider other important factors such as oil price shocks (oil price changes). Concerning oil-exporting countries, since oil revenue is a critical source of fiscal revenue, an increase in oil price is expected to increase government revenues and therefore boost primary surpluses. In oil-importing countries, an increase in oil price increases government expenditure on imports and subsidies and

consequently reduces the primary balance. Oil price may also indirectly hurt oil-importing countries through foreign direct investment, remittances, and grants from high-income oil-exporting countries.

Table 4 shows that the lagged primary balance is positively correlated with the primary balance. We find that both groups of countries have been fiscally responsible, with a generally positive FRF. However, the magnitudes of the coefficients are not comparable. Empirical results show greater responsiveness in oil-exporting countries (0.031) than oil-importing countries (0.01). These findings might suggest a greater ability on the part of the former to increases revenues and cut spending in response to growing debt and perhaps an inability on the part of the latter to do the same.

The obtained results confirm the crucial role played by oil price in the long-run behavior of the primary balance. For the oil-exporting countries, an increase in oil price is expected to increase government revenues and therefore boost primary surpluses. This is reflected by the statistically significant positive coefficient. In net oil-importing countries, an increase in oil price increases government expenditure on imports and subsidies and consequently reduces the primary fiscal balance. This is confirmed by the statistically significant negative coefficient.

Table 4. Differential responses of oil-exporting and oil-importing countries

	Oil-Exporting Countries		**Net Oil-Importing Countries**	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Lagged primary balance	0.593*** [0.000]	0.601*** [0.000]	0.684*** [0.000]	0.627*** [0.000]
Lagged debt	0.031* [0.086]	0.026*** [0.009]	0.002*** [0.003]	0.001*** [0.001]
Oil price	0.149*** [0.007]	0.146** [0.016]	-0.008 [0.100]	-0.0017 [0.090]
Output gap	0.304*** [0.002]	0.284*** [0.003]	0.241*** [0.000]	0.216*** [0.000]
Expenditure gap	-0.363*** [0.002]	-0.395*** [0.000]	-0.0605*** [0.001]	-0.078*** [0.000]
Inflation		-0.269** [0.018]		-0.0826*** [0.000]
Trade openness		0.032 [0.332]		0.0064 [0.600]
Constant	0.633 [0.398]	1.063 [0.729]	-2.674*** [0.000]	-3.393*** [0.004]
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
AR1 p –value	0.003	0.004	0.008	0.002
AR2 p -value	0.237	0.196	0.307	0.218
Hansen J-test p-value	0.008	0.058	0.034	0.046

Table 5 reports the estimation of equation (4) using Pesaran's (2006) CCEMG estimator. By estimating a different FRF for each country, we lose a lot of degrees of freedom.

In order to maintain enough degrees of freedom, we had to remove some variables. This also meant that time-fixed effects could not be included. The estimated coefficients of lagged public debt are positive and significant, which suggests that the primary balance does not react to any accumulations in public debt. According to Bohn (1998), this finding implies that, on average, governments take into account corrective measures when the public debt begins accumulating, which could lead to sustainable debt policy. These findings, corroborated with the results mentioned above, mean that the results are robust to various specifications.

Table 5. Fiscal reaction function: CCEMG estimations

	CCEMG		
	Model 1	**Model 2**	**Model 3**
Lagged primary balance	0.072*** [0.000]	0.137*** [0.000]	0.218*** [0.000]
Lagged debt	0.024*** [0.000]	0.017*** [0.000]	0.055* [0.056]
Output gap		0.339*** [0.001]	0.436*** [0.014]
Expenditure gap		-0.734*** [0.000]	-0.716*** [0.000]
Inflation			-0.296 [0.904]
Trade openness			0.336*** [0.000]
Test χ^2	76.585***	70.457***	86.865***
ρ	0.000	0.000	0.000

5. Conclusion

Fiscal sustainability remains a paramount challenge for MENA countries with higher debt and a vulnerability to external shocks. This paper evaluates long-run fiscal sustainability in MENA countries. We estimate fiscal-reaction functions to determine if the authorities have followed sustainable fiscal policies during the period 1990-2019. We address some potential econometric problems by employing econometric specifications that take into account the issue of endogeneity, cross-section dependence, and heterogeneity.

Our findings are robust to various specifications and show that MENA countries are fiscally responsible, as evidenced by the positive and significant response in the primary balance to changes in the lagged debt-to-GDP ratio. Fiscal policy in the MENA region takes corrective actions to counteract rising debt-to-GDP ratios. Moreover, we find robust evidence of a nonlinear fiscal-policy response to debt accumulation. However, the negative estimated cubic-debt parameter suggests that countries do not adjust adequately to ensure sustainability at higher levels of indebtedness. This finding could be a sign of fiscal fatigue; that is, the necessary fiscal effort to achieve sustainability becomes untenable at high levels of indebtedness.

Furthermore, we show that fiscal adjustment to debt accumulation is, on average, expenditure-based, and that public spending tends to be countercyclical with rising debt. However, the

results show procyclical fiscal behavior, which does not augur well with debt sustainability. Accordingly, government spending is procyclical in general but countercyclical with rising debt. These results confirm that policymakers should maintain a fiscal policy stance that takes into account long-run solvency concerns to build buffers and ensure debt sustainability.

These findings suggest that MENA countries adjust along the expenditure margin. In other words, fiscal adjustment to counteract debt accumulation tends to be expenditure-based in our sample of countries. This result is in line with the IMF (2017), which considers that fiscal policies in the MENA region are largely determined by expenditure policy. This occurs because tax systems are characterized by very low rates and narrow bases and generate persistently low revenues. We also find that government spending has a statistically significant procyclical bias, while revenues appear to be countercyclical. This result is not surprising, since procyclical public spending in developing countries plays a crucial role in shaping fiscal policy (Perotti and Gavin, 1997).

Fiscal authorities in oil-exporting countries respond more robustly to an increase in debt levels compared to their counterparts in net oil-importing countries. This difference is consistent with the greater fiscal space in oil-exporting countries, allowing more scope to move forward with public finance reforms to satisfy the intertemporal budget constraint.

Overall, by diversifying sources of funding for their budgets, sustaining the growth momentum, and moving forward with necessary reforms to increase the primary fiscal balance, MENA countries can reduce the risks of entering a vicious cycle of low growth and unsustainable debt.

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