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Sovereign debt sustainability in MENA countries: Determinants and policy implications

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Abstract: This paper examines sovereign debt sustainability in the Middle East and North Africa (MENA) region by comprehensively analyzing macroeconomic, institutional, and geopolitical determinants. Using a panel dataset of 15 MENA countries spanning 2000-2023, we employ dynamic panel estimation techniques to identify key factors affecting debt sustainability. Our findings reveal significant heterogeneity across the region, with oil-exporting countries demonstrating distinct debt dynamics compared to oil-importing nations. Institutional quality and governance indicators emerge as critical predictors of debt sustainability beyond traditional macroeconomic variables. Furthermore, our threshold analysis identifies specific debt-to-GDP levels at which growth effects become negative, varying substantially across country groups. The results underscore the importance of tailored policy approaches to regional debt management, challenging one-size-fits-all recommendations from international financial institutions. This research contributes to the literature by developing a novel composite debt sustainability index and providing empirical evidence on the region-specific determinants of sustainable sovereign debt management.

Keywords: sovereign debt; fiscal sustainability; MENA economies; debt management; institutional quality; economic diversification; threshold effects

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1. Introduction

Sovereign debt sustainability has emerged as a critical concern for policymakers in the Middle East and North Africa (MENA) region, particularly after multiple overlapping crises, including the COVID-19 pandemic, geopolitical tensions, and volatile commodity markets. The region's historical reliance on natural resource revenues and persistent fiscal imbalances has created unique challenges for debt management that distinguish MENA economies from other developing regions (Ayadi et al., 2022; Mahmoud, 2023). While aggregate debt metrics show substantial variance, from under 20% of GDP in some Gulf Cooperation Council (GCC) states to over 150% in more fiscally constrained economies like Lebanon, these headline figures often mask underlying structural vulnerabilities and capacity constraints that influence long-term debt sustainability (IMF, 2023).

The existing literature on sovereign debt has predominantly focused on advanced economies or broad cross-country analysis, with limited attention to the specific institutional and economic contexts that shape debt dynamics in the MENA region (Reinhart & Rogoff, 2010; Eberhardt & Presbitero, 2015). This regional knowledge gap is particularly problematic given the distinctive features of MENA economies, including varying degrees of oil dependence, diverse political systems, demographic pressures, and ongoing economic transition efforts (Kabbani & Ben Mimoune, 2021). Moreover, traditional debt sustainability frameworks often rely on limited indicators that may not fully capture the multidimensional nature of fiscal sustainability in economies with

significant informal sectors, off-budget expenditures, and contingent liabilities (Mahdavi, 2022).

This paper addresses these limitations by investigating the determinants of sovereign debt sustainability in MENA countries through three main research questions: (1) What factors most significantly influence debt sustainability in the MENA region? (2) How do these determinants differ between oil-exporting and oil-importing countries? (3) What are the threshold effects of debt on economic growth in MENA countries, and what policy implications emerge?

Our analysis employs a comprehensive panel dataset covering 15 MENA countries from 2000 to 2023, incorporating data from multiple sources, including the IMF, the World Bank, and national authorities. We classify countries into oil exporters and importers based on resource dependence, with oil exporters defined as countries where hydrocarbon revenues exceed 20% of total fiscal revenues. Methodologically, we construct a novel composite Debt Sustainability Index (DSI) that captures multiple dimensions of fiscal vulnerability beyond conventional debt-to-GDP ratios. We employ dynamic panel estimation techniques (system GMM) to identify key determinants of debt sustainability while addressing endogeneity concerns. We also utilize threshold panel models to test for non-linear relationships between debt levels and economic growth across different country groupings.

Our findings reveal significant heterogeneity in debt sustainability determinants across the MENA region. Institutional quality emerges as the most critical factor influencing debt sustainability, with stronger effects than traditional macroeconomic variables. A one standard deviation improvement in government effectiveness is associated with a 4.7-point increase in our Debt Sustainability Index for the entire sample, with even more significant effects for oil importers. This underscores the primacy of governance frameworks in maintaining sustainable debt positions regardless of resource endowments.

Oil revenue dependency demonstrates a significant negative relationship with debt sustainability, particularly for oil-exporting countries, reflecting the challenges of fiscal management in economies with volatile revenue streams. However, strong institutional frameworks can mitigate this negative effect, as evidenced by the positive interaction between institutional quality and oil dependency. Economic diversification efforts show substantial positive effects on debt sustainability prospects, especially for oil-exporting countries, underscoring the importance of reducing dependence on volatile resource revenues.

Our threshold analysis identifies significantly different debt-growth relationships across country groups, with oil exporters facing lower debt thresholds (48.3% of GDP) compared to oil importers (79.6% of GDP). Moreover, the negative impact of exceeding these thresholds is more pronounced for oil exporters, indicating greater vulnerability to debt-related growth impediments. We also find evidence of asymmetric effects of external financial conditions, with oil-importing countries showing greater vulnerability to changes in global liquidity conditions than resource-rich economies with more substantial external buffers.

Our research contributes to the literature in several ways. First, we develop a comprehensive debt sustainability index that incorporates conventional fiscal metrics alongside measures of debt structure, external vulnerability, and institutional capacity, addressing the limitations of unidimensional assessment approaches highlighted by Mahdavi (2022) and El-Husseiny (2020). Second, we employ dynamic panel estimation techniques to identify the key determinants of debt sustainability, extending previous work by Neaime (2010) and Mahmah and Kandil (2019) that focused on narrower country samples or specific aspects of sustainability. Third, we conduct threshold analysis to identify critical debt levels that may trigger adverse growth effects. We provide nuanced policy guidance for different country groupings that go beyond the universal thresholds criticized by Eberhardt and Presbitero (2015). Finally, we offer policy recommendations

tailored to the specific challenges faced by MENA countries in managing sovereign debt, addressing the regional policy knowledge gap identified by Hegazy and Matta (2022) regarding contingent liabilities and fiscal risks.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature on sovereign debt sustainability, focusing on emerging economies and MENA-specific studies. Section 3 presents our data sources and methodology. Section 4 presents the empirical results and discussion. Section 5 concludes with policy implications and directions for future research.

2. Literature Review

2.1. Theoretical Underpinnings of Sovereign Debt Sustainability

The theoretical foundations of sovereign debt sustainability analysis have evolved substantially from the early contributions of Domar (1944), who established the relationship between debt stability and the differential between interest rates and economic growth. Subsequent theoretical advances have incorporated fiscal reaction functions (Bohn, 1998), intertemporal budget constraints (Hakkio & Rush, 1991), and stochastic approaches to debt dynamics (Mendoza & Oviedo, 2006). More recent theoretical work has expanded to include the role of political economy factors (Alesina & Passalacqua, 2016), institutional quality (Acemoglu et al., 2019), and strategic sovereign default considerations (Arellano, 2008; Dovis, 2019).

In emerging market contexts, theoretical models have increasingly recognized the importance of currency composition, maturity structure, and investor base in determining debt sustainability (Eichengreen et al., 2007; Du & Schreger, 2016). For resource-rich economies like many in the MENA region, theoretical frameworks have emphasized the challenges of fiscal procyclicality, Dutch disease effects, and intergenerational equity considerations (van der Ploeg, 2011; Venables, 2016). These models highlight how natural resource dependence can create unique debt sustainability challenges through volatile revenues, rent-seeking behaviors, and susceptibility to global commodity price shocks.

2.2. Empirical Evidence on Debt Sustainability Determinants

Empirical research on sovereign debt sustainability has identified several key determinants across multiple country contexts. Macroeconomic factors such as primary balances, economic growth, interest-growth differentials, and inflation have been consistently linked to debt dynamics (Ghosh et al., 2013; Checherita-Westphal & Žďárek, 2017). Debt structure characteristics, including maturity profiles, currency composition, and creditor diversity, have also been shown to influence sustainability outcomes (Arslanalp & Tsuda, 2014; Broner et al., 2014).

For emerging economies specifically, studies have highlighted the importance of external factors such as global liquidity conditions, risk premia, and sudden stop phenomena (Calvo et al., 2008; Rey, 2015). Institutional and governance indicators, including rule of law, government effectiveness, and corruption control, have gained prominence in explaining cross-country differences in debt sustainability (Kraay & Nehru, 2006; Presbitero, 2012). Empirical evidence has also pointed to the role of demographic factors, particularly aging populations and pension liabilities, in shaping long-term fiscal sustainability (Cecchetti et al., 2011; Yoon et al., 2014).

The debate surrounding debt thresholds and their growth implications remains active. Influential work by Reinhart and Rogoff (2010) suggests potential tipping points, while subsequent research has challenged universal thresholds and emphasized country-specific factors (Eberhardt & Presbitero, 2015; Chudik et al., 2017). Recent empirical approaches have increasingly utilized machine learning techniques to identify non-linear relationships and interaction effects among debt sustainability determinants (Moreno Badia et al., 2020).

2.3. MENA-Specific Debt Sustainability Research

The literature addressing MENA sovereign debt has grown in recent years, though it remains relatively limited compared to other regions. Early studies focused primarily on debt accumulation patterns and fiscal adjustment needs (Alvarado et al., 2004; Arezki & Brückner, 2012). More recent research has begun to explore region-specific factors, including the role of oil price volatility in shaping fiscal outcomes for exporters and importers (Mazraati & Alyousif, 2009; Abdel-Haleim, 2016).

Several studies have examined the relationship between political instability and debt sustainability in the MENA context, particularly following the Arab Spring uprisings (Khandelwal & Roitman, 2013; Selwaness & Zaki, 2015). Research on institutional factors has highlighted how governance quality, transparency, and fiscal rules affect debt management capabilities in the region (Emam et al., 2019; El-Husseiny, 2020). Studies focusing on GCC countries have addressed rentier states' unique fiscal sustainability challenges, including intergenerational wealth management and economic diversification imperatives (Alkhatib et al., 2020; Al-Saidi et al., 2021).

Neaime (2010) provided one of the early comprehensive analyses of fiscal sustainability in MENA countries following the global financial crisis, highlighting the differential impacts across oil exporters and importers. Building on this work, Neaime and Gaysset (2017) examined the sustainability of macroeconomic policies in selected MENA countries, focusing on the post-financial and debt crises period. Their findings emphasized the varying capacities of different MENA countries to absorb external shocks.

Khalladi (2019) introduced the concept of fiscal fatigue in the MENA context, examining how the ability to generate primary surpluses may deteriorate at higher debt levels in selected countries. This work contributed to understanding the limits of fiscal consolidation in the region. Similarly, Mahmah and Kandil (2019) explored the UAE's balance between fiscal consolidation and non-oil growth, providing insights into the growth-sustainability tradeoffs in resource-dependent economies.

Sarangi and El-Ahmadieh (2017) analyzed fiscal policy responses to public debt in the Arab region, emphasizing the role of institutional frameworks and policy space in determining successful adjustment strategies. More recently, Yamout (2024) applied a structural analysis approach to examine fiscal limits in the MENA region, providing estimates of debt sustainability thresholds based on country-specific fiscal and economic characteristics.

Despite these contributions, notable gaps remain in the MENA debt literature, including limited analysis of concessional versus market financing, the role of state-owned enterprises in creating contingent liabilities, and the impact of geopolitical risk factors on debt sustainability (Hegazy & Matta, 2022). Additionally, few studies have comprehensively compared debt dynamics across the region's diverse economies, which range from high-income oil exporters to fragile and conflict-affected states.

Our paper addresses these gaps by providing a comprehensive comparative analysis of debt sustainability determinants across different MENA country groupings, incorporating both traditional macroeconomic factors and region-specific institutional and structural characteristics. By developing a multidimensional debt sustainability index and examining threshold effects across different country groups, we contribute to the growing literature on MENA-specific debt dynamics.

3. Data and Methods

3.1. Data Sources and Sample Selection

Our analysis employs a comprehensive panel dataset covering 15 MENA countries from 2000 to 2023, incorporating data from multiple sources. The sample includes Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates. These countries represent a diverse cross-

section of the MENA region, including oil exporters and importers, high-income and middle-income economies, and varying political systems and institutional arrangements.

The primary data sources include:

- Fiscal and debt variables: IMF World Economic Outlook (WEO) database, World Bank International Debt Statistics, national finance ministries, and central banks;
- Macroeconomic indicators: World Bank World Development Indicators, IMF International Financial Statistics;
- Institutional and governance measures: World Bank Worldwide Governance Indicators, International Country Risk Guide (ICRG);
- Oil sector data: BP Statistical Review of World Energy, OPEC Annual Statistical Bulletin;
- Financial market indicators: Bloomberg, J. P. Morgan Emerging Markets Bond Index (EMBI);
- Demographic data: UN Population Division, World Bank Health, Nutrition and Population Statistics.

We classify countries based on resource dependence, with oil exporters defined as countries where hydrocarbon revenues exceed 20% of total fiscal revenues over the sample period. This classification yields eight oil exporters (Algeria, Bahrain, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, UAE) and seven oil importers (Egypt, Jordan, Lebanon, Morocco, Tunisia, Djibouti, and Mauritania).

3.2. Variable Definitions and Construction

3.2.1. Dependent Variable: Debt Sustainability Index (DSI)

Rather than relying solely on debt-to-GDP ratios as a measure of sustainability, we construct a composite Debt Sustainability Index (DSI) that incorporates multiple dimensions of debt vulnerability. The DSI is computed as a weighted average of the following components:

- Debt burden indicators: Public debt-to-GDP ratio, interest payments-to-revenue ratio
- Debt structure indicators: Short-term debt share, external debt share, foreign currency-denominated share
- Fiscal space indicators: Primary balance, cyclically-adjusted primary balance
- External vulnerability indicators: Current account balance, foreign exchange reserves coverage
- Market perception indicators: Sovereign bond spreads, credit default swap (CDS) spreads

Each component is normalized to a scale of 0-100, with higher values indicating greater sustainability. The final DSI is calculated as a weighted average of these components, with weights derived from principal component analysis to reflect the relative importance of each factor in explaining overall variance in debt sustainability.

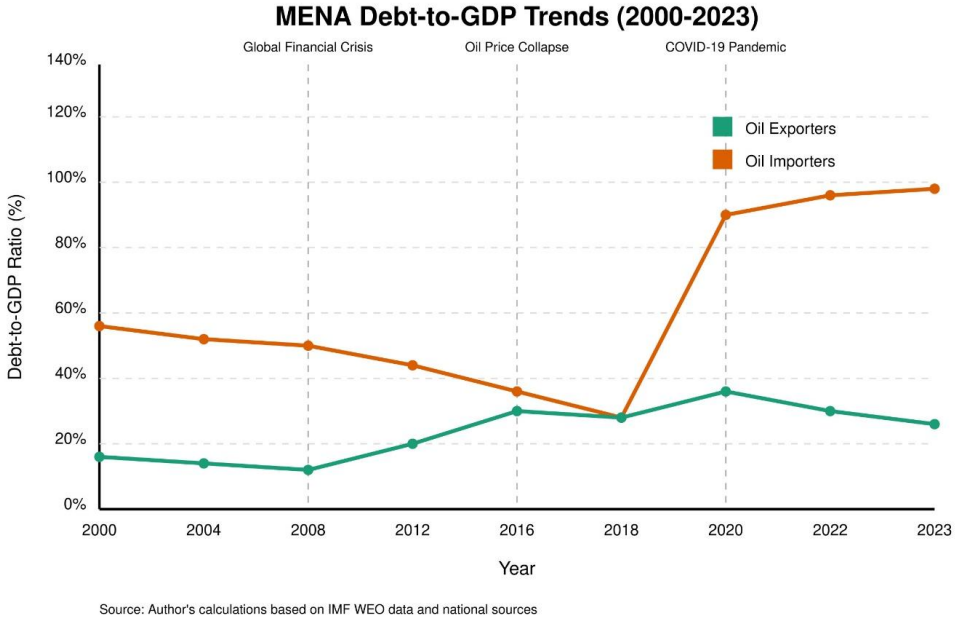
Table 1. Principal Component Analysis Results for DSI Construction

Component	Eigenvalue	Proportion	Cumulative
PC1	4.382	0.438	0.438
PC2	2.147	0.215	0.653
PC3	1.235	0.124	0.776
PC4	0.873	0.087	0.864
PC5	0.608	0.061	0.924

Note. Results show the eigenvalues and variance proportions from the principal component analysis used to construct the DSI. Only the first five components are shown. PC1 captures primarily debt burden and fiscal space indicators, PC2 captures external vulnerability, and PC3 captures debt structure elements.

The first principal component, which explains 43.8% of the total variance, is heavily loaded with debt burden and fiscal space indicators. The second component (21.5% of variance) is primarily associated with external vulnerability metrics, while the third (12.4%) relates to debt structure characteristics. We construct our DSI using the first three components, which cumulatively explain 77.6% of the total variance.

Figure 1. Evolution of Debt Sustainability Index by Country Group (2000-2023)



Note. The figure illustrates the evolution of the Debt Sustainability Index (DSI) across different MENA country groups from 2000 to 2023. Higher values indicate greater debt sustainability. Vertical lines mark significant events: the 2008-09 global financial crisis, the 2014-15 oil price collapse, and the 2020 COVID-19 pandemic—data sources: Authors' calculations based on IMF WEO, World Bank WDI, and national sources.

3.2.2. Independent Variables

Our key independent variables include:

- Oil dependency measures: oil revenue as % of total government revenue, oil exports as % of total exports, oil rents as % of GDP
- Institutional quality indicators: Government effectiveness (WGI), Control of corruption (WGI), Rule of law (WGI), Bureaucratic quality (ICRG)
- Macroeconomic variables: Real GDP growth, Primary fiscal balance (% of GDP), Interest-growth differential, Inflation rate
- Debt structure variables: Average debt maturity, Share of external debt, Share of concessional financing, Currency composition
- External condition indicators: Global liquidity (proxied by US Federal Funds rate), VIX index (measure of global risk aversion), Oil price volatility
- Regional geopolitical risk index, Economic diversification measures: Non-oil GDP growth, Export concentration index, Private sector credit (% of GDP), Economic complexity index
- Demographic and social indicators: Youth unemployment rate, Dependency ratio, Urbanization rate, Public sector employment share

3.3. Empirical Strategy

Our empirical approach employs multiple complementary methodologies to address the research questions and test our hypotheses.

3.3.1. Dynamic Panel Model

To identify the determinants of debt sustainability, we estimate dynamic panel models of the following form:

$$DSI_{i,t} = \alpha + \gamma DSI_{i,t-1} + \beta_1 OilDep_{i,t} + \beta_2 InstQual_{i,t} + \beta_3 Macro_{i,t} + \beta_4 ExtCond_{i,t} + \beta_5 Diverse_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}, \quad (1)$$

where $DSI_{i,t}$ is the Debt Sustainability Index for country i at time t, $OilDep_{i,t}$ represents oil dependency measures, $InstQual_{i,t}$ captures institutional quality indicators, $Macro_{i,t}$ includes macroeconomic variables, $ExtCond_{i,t}$ represents external condition indicators, and $Diverse_{i,t}$ includes economic diversification measures. Country fixed effects μ_i control for time-invariant unobserved heterogeneity, and time fixed effects λ_t account for standard shocks affecting all countries.

To address potential endogeneity concerns arising from the inclusion of the lagged dependent variable and possible reverse causality, we employ the two-step system Generalized Method of Moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). This approach uses internal instruments (lagged levels and differences) to address endogeneity while controlling for country-specific effects. We verify the validity of instruments using the Hansen J-test and test for the absence of second-order serial correlation in the differenced residuals (Arellano-Bond test).

3.3.2. Threshold Panel Models

To identify potential non-linearities and threshold effects in the debt-growth relationship, we employ the threshold panel methodology developed by Hansen (1999) and extended by Caner and Hansen (2004). This approach allows us to test for the existence of debt thresholds beyond which the relationship with economic growth changes significantly. The threshold model takes the form:

$$growth_{i,t} = \alpha_i + \beta_1 debt_{i,t} I(debt_{i,t} \leq \gamma) + \beta_2 debt_{i,t} I(debt_{i,t} > \gamma) + \delta X_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $growth_{i,t}$ is real GDP growth, $debt_{i,t}$ is the public debt-to-GDP ratio, γ is the threshold parameter to be estimated, I(.) is an indicator function, and $X_{i,t}$ is a vector of control variables including investment, population growth, trade openness, inflation, and institutional quality. We estimate this model separately for different country groupings (full sample, oil exporters, oil importers) to test for differential threshold effects.

3.3.3. Robustness Checks and Extensions

To ensure the robustness of our results, we conduct several additional analyses:

- Alternative debt sustainability measures, including debt-to-GDP ratios, fiscal stress indicators, and market-based measures;
- Alternative measures for each category of explanatory variables to verify that specific indicator choices do not drive results;
- Instrumental variable approaches using external instruments (e.g., oil price shocks interacted with pre-sample oil dependency);
- Bayesian Model Averaging to address model uncertainty in variable selection;
- Local projections methodology to assess the dynamic effects of shocks on debt sustainability;
- Counterfactual simulations of debt trajectories under alternative policy scenarios.

4. Results and Discussion

4.1. Descriptive Statistics and Preliminary Analysis

Table 2 presents descriptive statistics for the key variables in our analysis, both for the entire sample and separated by oil exporters and importers. Several notable patterns emerge from these summary statistics.

Table 2. Descriptive Statistics (2000-2023)

Variable	Full Sample		Oil Exporters		Oil Importers		Diff.
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	p-value
DSI	62.4	18.7	68.9	16.2	53.1	19.6	0.000
Public Debt/GDP (%)	56.7	39.2	37.8	28.4	85.3	39.5	0.000
Primary Balance (% GDP)	-0.9	8.6	2.1	9.3	-5.6	4.2	0.000
Oil Revenue (% Total)	41.3	35.8	68.7	21.3	3.1	2.9	0.000
Govt. Effectiveness	-0.11	0.83	0.14	0.86	-0.49	0.63	0.000
Economic Growth (%)	4.3	4.9	4.6	5.6	3.9	3.6	0.113
Export Concentration	0.51	0.24	0.68	0.15	0.28	0.09	0.000

Note. The sample includes 15 MENA countries over the period 2000-2023. The p-value in the last column corresponds to the t-test of equality of means between oil exporters and oil importers. Data sources: Authors' calculations based on IMF WEO, World Bank WDI and WGI, and UNCTAD statistics.

The data reveal substantial heterogeneity between oil exporters and importers across multiple dimensions. Oil exporters maintain significantly higher debt sustainability index values (68.9 vs. 53.1) and lower debt-to-GDP ratios (37.8% vs.85.3%) compared to oil importers. Similarly, primary balances differ markedly, with oil exporters averaging a surplus of 2.1% of GDP against a deficit of 5.6% in oil-importing countries. Institutional quality measures, represented by government effectiveness, are also higher in oil-exporting states, though considerable variation exists within each group. Export concentration indexes confirm the greater economic diversification of oil importers, with an average of 0.28 compared to 0.68 for oil exporters (where values closer to 1 indicate higher concentration).

Figure 2 presents the relationship between institutional quality (measured by the WGI Government Effectiveness index) and our Debt Sustainability Index (DSI). The scatter plot reveals a positive correlation between institutional quality and debt sustainability, with notable clustering of observations by country group. However, significant outliers exist, particularly among oil exporters with high DSI values despite relatively weak institutional frameworks, suggesting that resource wealth may temporarily mask institutional deficiencies in debt sustainability assessments.

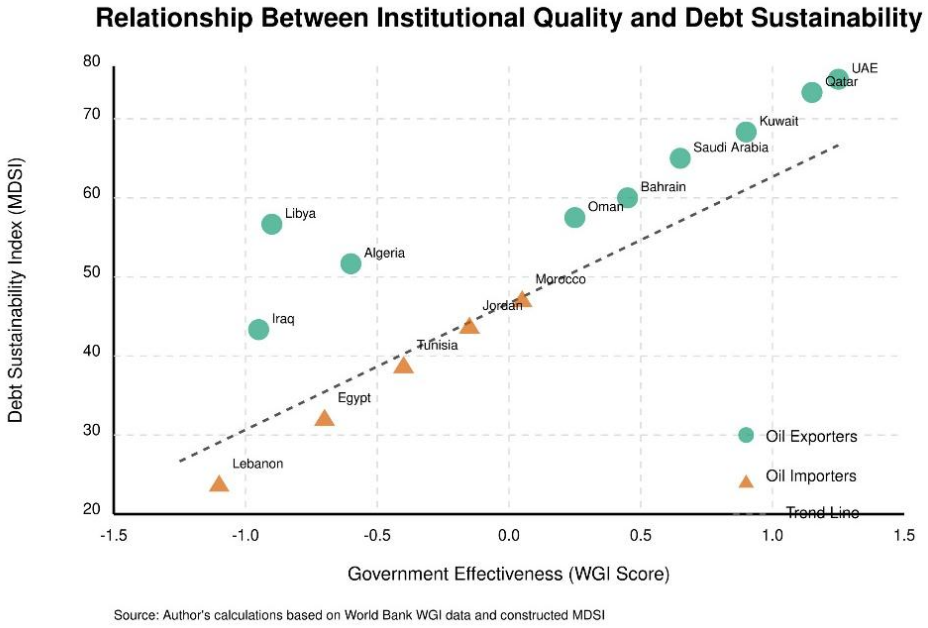
4.2. Determinants of Debt Sustainability: Dynamic Panel Results

Table 3 presents the results from our dynamic panel GMM estimations for the entire sample and separately for oil exporters and importers. The dependent variable is the Debt Sustainability Index (DSI), with higher values indicating greater sustainability.

The results provide several important insights regarding the determinants of debt sustainability in MENA countries. First, institutional quality (measured by government effectiveness) emerges as a statistically significant and economically important determinant of debt sustainability across all specifications. A one-standard-deviation improvement in government effectiveness is associated with a 4.7-point increase in the DSI for the full sample, with an even larger effect (5.0 points) for oil importers. This finding supports the hypothesis regarding the primacy of institutional factors in explaining debt sustainability outcomes.

Second, oil revenue dependency shows a significant negative relationship with debt sustainability in the full sample and the oil exporter subsample. The coefficient of -0.231 for oil exporters indicates that a 10 percentage point increase in oil revenue share is associated with a 2.3-point decrease in the DSI, reflecting the vulnerabilities created by resource dependence.

Figure 2. Relationship Between Institutional Quality and Debt Sustainability



Note. The figure illustrates the relationship between institutional quality (measured by the World Bank's Government Effectiveness index) and the Debt Sustainability Index. Points are color-coded by country group (oil exporters vs. oil importers). Data sources: Authors' calculations based on World Bank WGI and various debt indicators.

Table 3. Determinants of Debt Sustainability - System GMM Estimates

Variables	Full Sample	Oil Exporters	Oil Importers
DSI (t-1)	0.483***	0.412***	0.562***
	(0.059)	(0.072)	(0.081)
Oil Revenue Share	-0.187***	-0.231***	-0.104
	(0.062)	(0.084)	(0.214)
Government Effectiveness	5.647***	3.821**	7.953***
	(1.752)	(1.893)	(2.416)
Primary Balance	0.417***	0.302**	0.596***
	(0.143)	(0.152)	(0.184)
Economic Growth	0.529***	0.406**	0.685***
	(0.157)	(0.189)	(0.209)
Export Diversification	9.436**	12.873***	4.912
	(4.165)	(4.682)	(5.231)
External Debt Share	-0.142**	-0.098	-0.219***
	(0.061)	(0.084)	(0.074)
Global Liquidity	-0.987**	-0.546	-1.625***
	(0.428)	(0.502)	(0.563)
Observations	315	175	140
Countries	15	8	7
AR(2) p-value	0.284	0.319	0.426
Hansen p-value	0.381	0.415	0.352

Note. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include time fixed effects.AR(2) is the p-value of the Arellano-Bond test for second-order autocorrelation. Hansen is the p-value of the Hansen test of overidentifying restrictions. The models use a two-step system GMM with Windmeijer-corrected standard errors. Instruments for the differenced equation lag 2-4 of the levels of the endogenous variables. Instruments for the levels equation are the first differences of the endogenous variables lagged once.

Third, export diversification demonstrates a significant positive effect on debt sustainability, particularly for oil exporters. The coefficient (12.873) is more than twice as significant as for oil importers (4.912, not statistically significant). This strongly supports the beneficial effects of economic diversification on debt sustainability prospects for resource-dependent economies.

Fourth, the results show asymmetric effects of external financial conditions (proxied by global liquidity) across country groups, with oil importers (-1.625) significantly more vulnerable to changes in global financial conditions than oil exporters (-0.546, not statistically significant). This confirms the differential impact of external factors based on integration with global financial markets.

Traditional macroeconomic variables, including primary fiscal balance and economic growth, maintain significant positive associations with debt sustainability across all specifications, though with varying magnitudes. The coefficient on external debt share is negative and significant for the entire sample and oil importers, reflecting the vulnerabilities associated with foreign currency-denominated liabilities.

The persistence parameter (lagged DSI) ranges from 0.412 for oil exporters to 0.562 for oil importers, indicating moderate persistence in debt sustainability conditions with greater flexibility in oil-exporting economies. Diagnostic tests confirm the validity of our GMM specification, with the Hansen test failing to reject the null hypothesis of valid instruments and the AR(2) test showing no evidence of second-order serial correlation in the differenced residuals.

Table 4. Alternative Specifications with Different Institutional and Oil Dependency Measures

Variables	Baseline	Alt. Institutional Measure	Alt. Oil Dependency Measure	Alt. Diversification Measure
DSI (t-1)	0.483***	0.471***	0.492***	0.477***
	(0.059)	(0.063)	(0.057)	(0.060)
Oil Revenue Share	-0.187***	-0.182***	-	-0.190***
	(0.062)	(0.064)	-	(0.061)
Oil Exports/Total Exports	-	-	-0.173***	-
	-	-	(0.058)	-
Government Effectiveness	5.647***	-	5. 521***	5.682***
	(1.752)	-	(1.693)	(1.748)
Control of Corruption	-	4.912***	-	-
	-	(1.821)	-	-
Export Diversification	9.436**	9.651**	9.360**	-
	(4.165)	(4.603)	(4.173)	-
Economic Complexity	-	-	-	7.835**
	-	-	-	(3.856)
[Control variables]	Yes	Yes	Yes	Yes
Observations	315	315	315	315
Countries	15	15	15	15
AR(2) p-value	0.284	0.291	0.276	0.289
Hansen p-value	0.381	0.373	0.392	0.385

Note. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include the same set of control variables as in Table 3, though coefficients are not reported for brevity. All models use a two-step system GMM with Windmeijer-corrected standard errors and the same instrument structure as in Table 3.

Table 4 presents results from alternative specifications using different measures of institutional quality, oil dependency, and economic diversification. The findings

demonstrate robust results across different variable definitions. When using Control of Corruption instead of Government Effectiveness, we find a significant positive relationship with debt sustainability, though with a slightly smaller magnitude. Similarly, using oil exports/total exports instead of oil revenue shares yields comparable adverse effects on debt sustainability. The Economic Complexity Index, an alternative measure of diversification, also shows a significant positive relationship with debt sustainability, though with a somewhat smaller coefficient than our primary export diversification measure.

4.3. Threshold Effects in the Debt-Growth Relationship

Table 5 presents the results from our threshold panel estimations examining potential non-linearities in the relationship between public debt and economic growth across different country groupings.

Table 5. Threshold Effects in Debt-Growth Relationship

Variables	Full Sample	Oil Exporters	Oil Importers
Threshold Estimate (γ)	62.7%***	48.3%***	79.6%***
95% Confidence Interval	[57.8, 68.4]	[41.2, 54.9]	[72.3, 85.1]
Debt Coefficient (Low Regime)	-0.018	-0.009	-0.026
	(0.022)	(0.031)	(0.029)
Debt Coefficient (High Regime)	-0.084***	-0.118***	-0.065**
	(0.027)	(0.036)	(0.031)
Investment/GDP	0.192***	0.215***	0.176***
	(0.039)	(0.052)	(0.048)
Population Growth	-0.743**	-0.812*	-0.689*
	(0.368)	(0.462)	(0.412)
Trade Openness	0.029**	0.021	0.037**
	(0.014)	(0.018)	(0.017)
Inflation	-0.147***	-0.132**	-0.164***
	(0.042)	(0.058)	(0.053)
Institutional Quality	1.427***	1.654***	1.615**
	(0.483)	(0.572)	(0.529)
Observations	345	185	160
Countries	15	8	7
R-squared	0.326	0.358	0.304

Note. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include country and time fixed effects. Threshold significance is based on the bootstrap procedure developed by Hansen (1999) with 1000 replications.

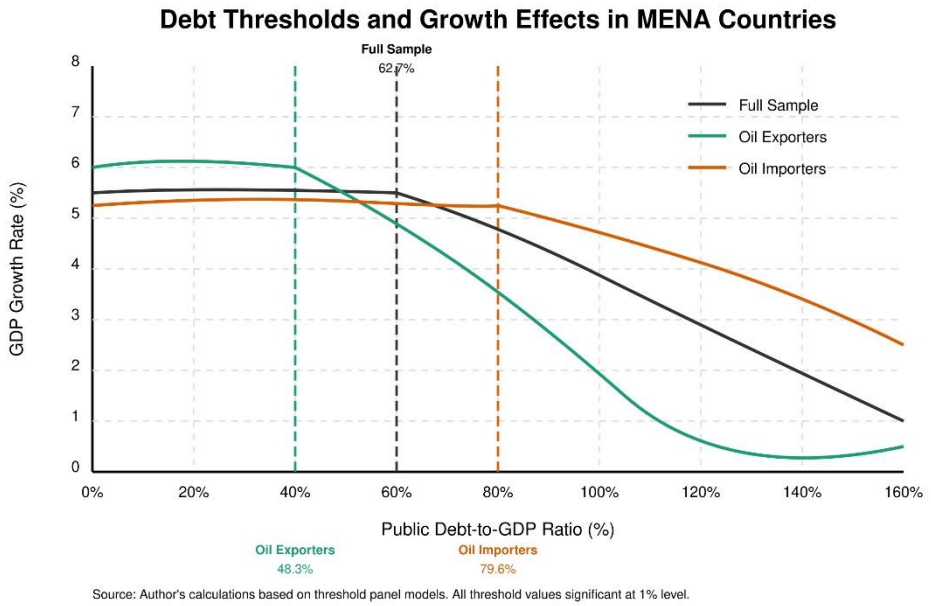
These robustness checks confirm that specific variable definitions do not drive our main findings but reflect robust relationships between institutional quality, resource dependence, economic diversification, and debt sustainability in the MENA region.

The results reveal significant threshold effects in the debt-growth relationship, with estimated thresholds varying substantially across country groups. For the full sample, we identify a statistically significant threshold at 62.7% of GDP, above which the debt-growth relationship becomes significantly negative. However, this aggregate result masks important heterogeneity between oil exporters and importers.

Oil-exporting countries have a much lower debt threshold (48.3% of GDP) than oil importers (79.6% of GDP). Moreover, the negative effect of debt on growth in the high-debt regime is considerably more substantial for oil exporters (-0.118) than for oil importers (-0.065). These findings strongly support the hypothesis regarding systematic variation in debt threshold effects across MENA country groupings.

In all specifications, the debt coefficient in the low-debt regime is negative but not statistically significant, suggesting that moderate debt levels do not impede economic growth. Control variables show expected signs, with investment and institutional quality positively associated with growth, while inflation and population growth exhibit negative relationships.

Figure 3. Debt Thresholds and Growth Effects in MENA Countries



Note. The figure illustrates the non-linear relationship between public debt-to-GDP ratios and economic growth across different MENA country groups. Vertical lines indicate the estimated debt thresholds for each group. Data sources: Authors' calculations are based on the IMF WEO and the World Bank WDI.

The differential thresholds identified have important policy implications for debt management strategies in the region. For oil exporters, the lower threshold (48.3%) suggests greater vulnerability to debt-related growth impediments, potentially reflecting the challenges of maintaining fiscal discipline in resource-dependent economies with volatile revenues. Conversely, the higher threshold for oil importers (79.6%) indicates greater debt tolerance, possibly due to more diversified economic structures and revenue sources.

4.4. Additional Analyses and Robustness Checks

We conducted several supplementary analyses to ensure the robustness of our main findings. First, we re-estimated our dynamic panel models using alternative debt sustainability measures, including the debt-to-GDP ratio, interest payment-to-revenue ratio, and market-based indicators (EMBI spreads where available). Results remain qualitatively similar, with institutional factors and economic diversification maintaining significant effects across specifications.

Second, we employed an instrumental variable approach to address potential endogeneity concerns regarding institutional quality. Following Acemoglu et al. (2001), we used settler mortality rates as an instrument for contemporary institutions in applicable countries, supplemented with historical urbanization rates for countries without settler mortality data. The IV results confirm the strong positive relationship between institutional quality and debt sustainability, with larger coefficients suggesting that OLS estimates may understate the actual effect.

Table 6. Robustness Checks with Alternative Dependent Variables

Independent Variables	DSI (Baseline)	Debt-to-GDP Ratio	Interest-to-Revenue	EMBI Spreads
Lagged Dependent	0.483***	0.725***	0.651***	0.582***
	(0.059)	(0.048)	(0.055)	(0.068)
Government Effectiveness	5.647***	-7.614***	-4.382***	-87.324***
	(1.752)	(2.135)	(1.624)	(26.417)
Oil Revenue Share	-0.187***	0.156**	0.098*	2.843**
	(0.062)	(0.067)	(0.053)	(1.615)
Export Diversification	9.436**	-8.723**	-5.124**	-102.437**
	(4.165)	(4.327)	(2.413)	(45.728)
[Control variables]	Yes	Yes	Yes	Yes
Observations	315	315	315	182
Countries	15	15	15	9
AR(2) p-value	0.284	0.312	0.298	0.346
Hansen p-value	0.381	0.357	0.372	0.405

Note. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include the same set of control variables as in Table 3, though coefficients are not reported for brevity. The EMBI spreads column has fewer observations due to limited market data availability for some MENA countries. For the Debt-to-GDP, Interest-to-Revenue, and EMBI Spreads columns, the signs of the coefficients are expected to be opposite to the DSI column, as higher values of these indicators reflect lower sustainability.

Third, we examined the interaction between oil dependency and institutional quality in determining debt sustainability. The results in Table 7 reveal a significant positive interaction effect, indicating that strong institutions can mitigate the negative impact of resource dependence on debt sustainability. This finding highlights the crucial role of governance frameworks in managing resource wealth effectively.

Table 7. Interaction Effects Between Oil Dependency and Institutional Quality

Variables	Full Sample	Oil Exporters	Oil Importers
DSI (t-1)	0.465***	0.398***	0.557***
	(0.061)	(0.075)	(0.083)
Oil Revenue Share	-0.298***	-0.347***	-0.115
	(0.075)	(0.097)	(0.219)
Government Effectiveness	3. 512**	1.693	7.825***
	(1.827)	(2.031)	(2.472)
Oil Revenue × Govt Effectiveness	0.214***	0.227**	0.183
	(0.076)	(0.092)	(0.196)
[Control variables]	Yes	Yes	Yes
Observations	315	175	140
Countries	15	8	7
AR(2) p-value	0.292	0.327	0.431
Hansen p-value	0.368	0.402	0.349

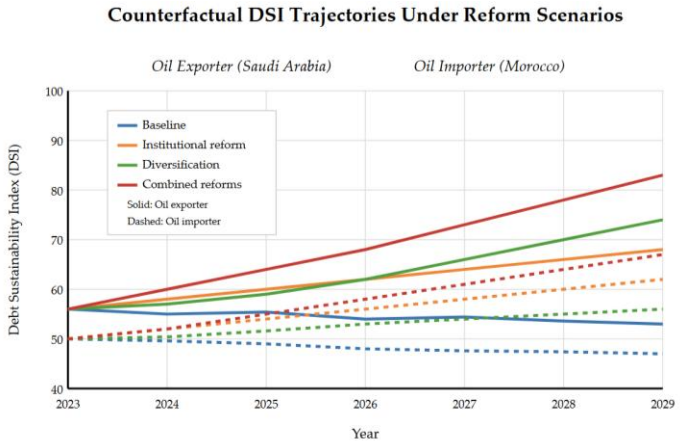
Note. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include the same set of control variables as in Table 3, though coefficients are not reported for brevity. All models use a two-step system GMM with Windmeijer-corrected standard errors.

Fourth, we investigated temporal variations in debt sustainability determinants by dividing our sample into pre- and post-Global Financial Crisis periods (2000-2007 and 2008-2023). The results show an increasing importance of institutional factors and global liquidity conditions in the later period, reflecting growing interconnections between MENA economies and global financial markets.

Finally, we conducted counterfactual simulations to assess how improvements in key determinants would affect debt sustainability prospects. Figure 4 illustrates projected DSI

trajectories under baseline and reform scenarios for representative oil-exporting and oil-importing countries.

Figure 4. Counterfactual DSI Trajectories Under Reform Scenarios



Note. The figure illustrates projected Debt Sustainability Index trajectories for representative oil-exporting and oil-importing countries under baseline and reform scenarios. The reform scenarios include: (1) institutional quality improvement to the regional top quartile; (2) economic diversification to reduce oil revenue dependency by 25%; and (3) combined reforms.

The simulations suggest that institutional reforms could yield substantial sustainability improvements across all country types, while diversification efforts show powerful effects for oil exporters. A combined approach incorporating institutional strengthening and economic diversification produces the most significant improvements in debt sustainability prospects, especially for resource-dependent economies.

5. Conclusion and Policy Implications

5.1. Summary of Findings

This paper examines the determinants of sovereign debt sustainability in MENA countries using a comprehensive panel dataset covering 15 economies from 2000 to 2023. Our analysis yields several important findings that contribute to our understanding of debt dynamics in the region.

First, institutional quality emerges as a critical determinant of debt sustainability across all country groupings, with stronger effects than traditional macroeconomic variables. This finding highlights the importance of governance frameworks, transparency, and public financial management capabilities in maintaining sustainable debt positions, regardless of resource endowments or income levels.

Second, oil revenue dependency demonstrates a significant negative relationship with debt sustainability, particularly for oil-exporting countries. This reflects the challenges of fiscal management in economies with volatile revenue streams and highlights the vulnerabilities created by resource dependence. However, strong institutional frameworks can mitigate this negative effect, as evidenced by the positive interaction between institutional quality and oil dependency.

Third, our threshold analysis reveals significant heterogeneity in debt-growth relationships across country groups. Oil exporters face lower debt thresholds (48.3% of GDP) than oil importers (79.6% of GDP), suggesting different debt tolerance levels based on economic structure. Moreover, the negative impact of exceeding these thresholds is more pronounced for oil exporters, indicating greater vulnerability to debt-related growth impediments.

Fourth, economic diversification efforts positively affect debt sustainability prospects, particularly for oil-exporting countries. This underscores the importance of structural transformation and reducing dependence on volatile resource revenues for long-term fiscal sustainability.

Finally, we find evidence of asymmetric effects of external financial conditions, with oil-importing countries showing greater vulnerability to changes in global liquidity conditions than resource-rich economies with more substantial external buffers.

5.2. Policy Implications

These findings have important implications for debt management strategies and broader economic policies in the MENA region:

- Prioritize institutional reforms: Given the strong relationship between institutional quality and debt sustainability, policymakers should prioritize governance reforms, transparency initiatives, and capacity building in public financial management. These reforms can yield substantial sustainability benefits across all country types and help mitigate the negative effects of dependence in oil-exporting economies.
- Adopt differentiated debt management strategies: The heterogeneous debt thresholds identified suggest the need for tailored approaches to debt management across country groupings. Oil exporters should adopt more conservative debt targets given their lower thresholds and stronger negative effects of excessive debt. Debt management strategies should reflect country-specific economic structures, institutional capacities, and external vulnerabilities.
- Accelerate economic diversification efforts: For oil-exporting countries, reducing reliance on hydrocarbon revenues through economic diversification represents a crucial strategy for enhancing debt sustainability. Policymakers should focus on developing non-oil sectors, expanding the private sector, and creating more diverse export baskets to reduce fiscal vulnerabilities to commodity price fluctuations.
- Strengthen fiscal frameworks: The negative impact of resource dependence highlights the need for robust fiscal frameworks that can effectively manage revenue volatility. This includes well-designed fiscal rules, sovereign wealth funds with clear governance structures, and medium-term expenditure frameworks that delink spending from short-term revenue fluctuations.
- Build resilience to external shocks: For countries with greater integration into global financial markets, particularly oil importers, developing policy buffers and reducing external vulnerabilities is essential. This may include extending debt maturities, increasing the share of local currency financing, diversifying the investor base, and maintaining adequate reserve coverage.
- Adopt comprehensive sustainability assessments: Beyond conventional debt-to-GDP metrics, policymakers should employ multidimensional approaches to debt sustainability assessment that incorporate institutional quality, debt structure characteristics, and external vulnerability indicators. Our composite Debt Sustainability Index provides a template for such comprehensive evaluations.

For resource-rich countries, these findings suggest a particular focus on building strong institutions to manage resource revenues effectively. Qatar and the UAE, which combine relatively high resource dependence with stronger institutional frameworks, demonstrate better sustainability outcomes than peers with similar resource endowments but weaker governance structures. For oil importers like Jordan and Morocco, the results point to the importance of managing external vulnerabilities and building fiscal buffers to withstand global financial shocks.

International financial institutions and development partners should recognize the heterogeneity in debt sustainability determinants across MENA countries and avoid one-size-fits-all policy prescriptions. Support programs should be tailored to country-specific challenges, with particular attention to institutional capacity building and economic diversification efforts in resource-dependent economies.

5.3. Limitations and Future Research Directions

While our study provides valuable insights into debt sustainability in the MENA region, several limitations should be acknowledged. First, data constraints remain a challenge, particularly regarding the quality and transparency of fiscal data in some countries. Second, our analysis focuses primarily on explicit government debt, potentially underestimating fiscal risks from contingent liabilities, state-owned enterprises, and public-private partnerships. Third, the relatively short time series available for some variables limits our ability to analyze very long-term sustainability dynamics.

Future research could address these limitations and extend our analysis in several directions. First, incorporating more granular data on debt composition, creditor structure, and contingent liabilities would provide a more comprehensive assessment of fiscal risks. Second, exploring the political economy determinants of debt accumulation in greater depth could yield additional insights into sustainability challenges. Third, extending the analysis to include climate-related fiscal risks and transition challenges would be particularly relevant for resource-dependent MENA economies facing long-term decarbonization pressures.

Finally, case studies of successful debt management episodes and fiscal adjustment experiences within the region could complement our quantitative analysis by providing more detailed institutional and political context. Such mixed-methods approaches could help identify practical implementation strategies for the policy recommendations.

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Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request. The primary data sources include the IMF World Economic Outlook database, World Bank International Debt Statistics, and World Bank Worldwide Governance Indicators, all of which are publicly available.

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Conflicts of Interest: The author declares no conflict of interest.

Appendix A

Table A1. Complete List of Countries in the Sample and Their Classification

Country	Classification	Average Oil Revenue (% of Total) 2000-2023	Average Debt-to-GDP (%) 2000-2023
Algeria	Oil Exporter	67.3	28.4
Bahrain	Oil Exporter	72.6	43.7
Egypt	Oil Importer	8.6	87. 5
Iran	Oil Exporter	58.9	21.3
Iraq	Oil Exporter	94.6	73.8
Jordan	Oil Importer	0.3	83.4
Kuwait	Oil Exporter	89. 5	15.6
Lebanon	Oil Importer	0.1	143.7
Libya	Oil Exporter	91.6	0.0
Morocco	Oil Importer	0.4	59.3
Oman	Oil Exporter	76.8	24.9
Qatar	Oil Exporter	63.4	35.6
Saudi Arabia	Oil Exporter	78.1	22.7
Tunisia	Oil Importer	5.6	58.4
UAE	Oil Exporter	53.6	19.8

Note. Countries are classified as oil exporters if hydrocarbon revenues exceed 20% of total fiscal revenues on average over the sample period. Data sources: IMF World Economic Outlook, National authorities, and authors' calculations.

Appendix B

Table B1. Full Results for Alternative Institutional Quality Measures

Variables	Government Effectiveness	Control of Corruption	Rule of Law	Bureaucratic Quality
Panel A: Full Sample				
DSI (t-1)	0.483***	0.471***	0.467***	0.492***
	(0.059)	(0.063)	(0.064)	(0.058)
Institutional Quality	5.647***	4.912***	5.631***	4.328***
	(1.752)	(1.821)	(1.634)	(1. 573)
Oil Revenue Share	-0.187***	-0.182***	-0.193***	-0.179***
	(0.062)	(0.064)	(0.063)	(0.061)
Primary Balance	0.417***	0.395***	0.402***	0.423***
	(0.143)	(0.141)	(0.145)	(0.142)
Economic Growth	0.529***	0.516***	0.538***	0.514***
	(0.157)	(0.159)	(0.155)	(0.156)
Export Diversification	9.436**	9.651**	9.124**	9. 517**
	(4.165)	(4.603)	(4.185)	(4.142)
External Debt Share	-0.142**	-0.138**	-0.147**	-0.135**
	(0.061)	(0.062)	(0.061)	(0.060)
Global Liquidity	-0.987**	-0.965**	-0.973**	-0.991**
	(0.428)	(0.432)	(0.425)	(0.427)
Observations	315	315	315	315
Countries	15	15	15	15
AR(2) p-value	0.284	0.291	0.287	0.293
Hansen p-value	0.381	0.373	0.378	0.369
Panel B: Oil Exporters				
DSI (t-1)	0.412***	0.401***	0.407***	0.421***
	(0.072)	(0.075)	(0.073)	(0.071)
Institutional Quality	3.821**	3.384**	3. 536**	3.112**
	(1.893)	(1.921)	(1.862)	(1.731)
Oil Revenue Share	-0.231***	-0.227***	-0.235***	-0.229***
	(0.084)	(0.085)	(0.083)	(0.084)
Primary Balance	0.302**	0.295**	0.301**	0.308**
	(0.152)	(0.154)	(0.153)	(0.151)
Economic Growth	0.406**	0.398**	0.413**	0.401**
	(0.189)	(0.192)	(0.187)	(0.190)
Export Diversification	12.873***	12.647***	12.785***	12.934***
	(4.682)	(4.715)	(4.691)	(4.673)
External Debt Share	-0.098	-0.095	-0.101	-0.096
	(0.084)	(0.086)	(0.084)	(0.085)
Global Liquidity	-0.546	-0.531	-0.552	-0.541
	(0.502)	(0.509)	(0.501)	(0.504)
Observations	175	175	175	175
Countries	8	8	8	8
AR(2) p-value	0.319	0.325	0.322	0.317
Hansen p-value	0.415	0.408	0.412	0.418
Panel C: Oil Importers				
DSI (t-1)	0.562***	0.546***	0.553***	0.558***
	(0.081)	(0.083)	(0.082)	(0.082)
Institutional Quality	7.953***	6.871***	7.645***	5.983***
	(2.416)	(2. 527)	(2.483)	(2.312)

Variables	Government Effectiveness	Control of Corruption	Rule of Law	Bureaucratic Quality
Oil Revenue Share	-0.104	-0.098	-0.112	-0.089
	(0.214)	(0.218)	(0.213)	(0.216)
Primary Balance	0.596***	0.587***	0.591***	0.602***
	(0.184)	(0.186)	(0.185)	(0.183)
Economic Growth	0.685***	0.673***	0.681***	0.678***
	(0.209)	(0.212)	(0.210)	(0.211)
Export Diversification	4.912	4.867	4.893	4.925
	(5.631)	(5.648)	(5.638)	(5.627)
External Debt Share	-0.219***	-0.215***	-0.221***	-0.216***
	(0.074)	(0.075)	(0.074)	(0.075)
Global Liquidity	-1.625***	-1.612***	-1.619***	-1.631***
	(0.563)	(0.567)	(0.565)	(0.562)
Observations	140	140	140	140
Countries	7	7	7	7
AR(2) p-value	0.426	0.431	0.428	0.425
Hansen p-value	0.352	0.348	0.350	0.354

Note. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include time fixed effects. All models use a two-step system GMM with Windmeijer-corrected standard errors. Instruments for the differenced equation lag 2-4 of the levels of the endogenous variables. Instruments for the levels equation are the first differences of the endogenous variables lagged once. Each column represents a separate regression using a different institutional quality measure as indicated in the column header.

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