QUBAHAN ECOLEAD JOURNAL
VOL. 3, NO. 4, Dec 2024
https://doi.org/10.48161/qaj.v3n4a21

Assessing Fiscal Vulnerability, Macroeconomic Performance, and Inclusive Growth in Selected African Economies Before the COVID-19 Shock: A Cross-Country Analysis

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ABSTRACT: This study examines fiscal vulnerability, macroeconomic performance, public debt dynamics, and inclusive growth before and during the initial COVID-19 shock, using selected African economies and comparative cross-country indicators as empirical material. The paper draws on Python-based statistical processing of fiscal, macroeconomic, institutional, and inclusive-growth data, with the analytical horizon limited to observations through 2020 whenever year information is available. The study combines descriptive statistics, trend and correlation analyses, model comparisons, hypothesis testing, and visual interpretation to evaluate the relationship between fiscal indicators and macroeconomic outcomes. The results indicate persistent fiscal pressure in the Egyptian fiscal-balance series, strong positive associations between institutional-quality indicators and transformed GDP per capita, improved explanatory power when economic freedom is decomposed into its components, and statistically significant provincial differences in inclusive-growth indicators. The results indicate that fiscal sustainability prior to COVID-19 cannot be assessed solely through public debt levels; it is also contingent upon revenue capacity, expenditure composition, inflation, unemployment, institutional integrity, and regional inclusivity. The paper contributes by organizing diverse empirical evidence into an integrated pre-COVID macro-fiscal framework suitable for later econometric extension.

Keywords: Fiscal Vulnerability; Public Debt; Macroeconomic Performance; Inclusive Growth; African Economies; COVID-19.

I. INTRODUCTION

Fiscal sustainability and macroeconomic performance became central policy questions before the COVID-19 shock because many developing economies entered 2020 with limited fiscal space, rising public debt, revenue weaknesses, and exposure to inflation, exchange-rate pressure, and unemployment. In African economies, these pressures were often intensified by commodity dependence, narrow tax bases, external financing needs, and structural development gaps. Therefore, studying the pre-COVID period is important because it helps distinguish long-standing fiscal vulnerabilities from the extraordinary fiscal effects produced by the pandemic.

The present paper uses the uploaded empirical report as its first research material. That report documents a broad fiscal-data audit, recommended research variables, country-level fiscal-balance evidence, cross-country institutional-income relationships, and inclusive-growth differences. The available evidence includes fiscal variables such as budget deficit or surplus, revenue, expenditure, tax revenue, value-added tax, capital expenditure, government debt, public debt as a share of GDP, GDP growth, inflation, unemployment, exchange rates, foreign direct investment, and inclusive-growth variables such as HDI, GRDP per capita, and health-related indicators.

The main objective of this paper is to develop a complete research structure around that evidence by linking fiscal vulnerability, macroeconomic performance, public debt dynamics, and inclusive growth. The paper asks three central questions. First, how do fiscal-balance and debt-related variables describe vulnerability before and up to 2020? Second, how are institutional and fiscal indicators related to income performance across countries? Third, what do inclusive-growth indicators reveal about regional and distributional differences that may be hidden by aggregate macroeconomic statistics?

The contribution of the study is threefold. First, it integrates fiscal sustainability, macroeconomic performance, institutional quality, and inclusive growth into one framework. Second, it uses Python-generated tables, charts, and statistical outputs to provide reproducible empirical evidence. Third, it positions 2020 carefully as the research endpoint, allowing the analysis to treat the COVID-19 year as either the boundary of the sample or the first year of shock depending on the final econometric specification.

The remainder of the paper is organized as follows. Section 2 reviews the related literature from 2011 to 2021. Section 3 presents the proposed methodology and research design. Section 4 reports the empirical results and visual analysis. Section 5 discusses the findings in relation to the literature and research objectives. Section 6 concludes the study and suggests directions for future research.

II. LITERATURE REVIEW

Fiscal sustainability is commonly assessed through the government budget constraint, the behavior of the primary balance, and the debt-to-GDP ratio. The IMF policy framework emphasized that sustainability analysis should combine debt paths, fiscal adjustment needs, financing risks, and macroeconomic shocks rather than relying only on a single debt number [1]. Ghosh, Kim, Mendoza, Ostry, and Qureshi introduced the idea of fiscal fatigue, where governments initially respond to rising debt by increasing primary balances, but this reaction weakens at high debt levels, creating an endogenous debt limit [2]. This approach is directly relevant to the present research because the uploaded report uses fiscal balance, revenue, expenditure, government debt, GDP growth, inflation, and unemployment as the core variables for fiscal vulnerability analysis.

Historical studies also show that debt sustainability is a long-run process. Balassone, Francese, and Pace found that public debt was negatively related to long-run income growth in Italy, especially through investment channels [3]. Reinhart, Reinhart, and Rogoff showed that prolonged public debt overhangs in advanced economies were associated with lower growth, especially when debt exceeded 90 percent of GDP for several years [4]. However, later critiques demonstrated that fixed debt thresholds should be interpreted cautiously because results can be sensitive to country coverage, weighting, and econometric specification [11]. Therefore, this research should avoid treating any single debt ratio as a universal cutoff and instead examine the relationship between debt, fiscal balance, and macroeconomic conditions empirically.

A major strand of literature studies whether high public debt reduces growth. Checherita-Westphal and Rother reported a non-linear relationship between government debt and growth in euro area countries, with negative long-run effects appearing at high debt ratios [5]. Baum, Checherita-Westphal, and Rother also found that the short-run effect of debt on growth is positive at lower levels but weakens and can become negative at high debt levels [6]. These findings support the use of non-linear specifications or threshold analysis when debt ratios vary substantially across countries or periods.

At the same time, survey and critique studies caution against simple causal interpretation. Panizza and Presbitero argued that theory does not provide an unambiguous prediction on the debt-growth relationship and that causality can run from weak growth to higher debt as well as from debt to growth [7]. Herndon, Ash, and Pollin challenged the idea that debt above 90 percent of GDP always produces sharply lower growth [11]. Egert similarly found that evidence of a universal non-linear debt threshold is highly sensitive to modelling choices and data coverage [16]. These studies justify the report's recommendation to use fixed effects, ARDL, dynamic panel methods, or robustness checks rather than relying only on descriptive correlations.

Other cross-country studies offer broader evidence. Afonso and Jalles examined 155 countries and found that higher government debt is generally associated with weaker growth and productivity, while debt maturity and fiscal consolidation can affect performance [8]. Woo and Kumar found that high initial public debt is linked to slower subsequent long-run growth, even after controlling for other growth determinants [14]. Eberhardt and Presbitero emphasized country heterogeneity and non-linearity, showing that debt-growth relationships differ across countries and periods [15]. These findings support a panel design for selected African economies because the same debt ratio may have different implications depending on institutions, growth conditions, inflation, and fiscal capacity.

Evidence from developing countries is especially relevant because the research report focuses on African economies and comparative cross-country indicators. Lopes da Veiga, Ferreira-Lopes, and Sequeira examined African countries and found that the relationship between public debt, growth, and inflation differs across African sub-regions, with higher debt generally associated with weaker growth and higher inflationary pressures [12]. Megersa and Cassimon showed that public sector management matters: public debt tends to harm growth more in countries with weak public sector management and less in countries with stronger institutional quality [13].

Threshold studies for Africa provide more specific guidance. Ndoricimpa used African panel data and found evidence of debt threshold effects, suggesting that debt becomes more harmful to growth after certain ranges [19]. In a later study, Ndoricimpa re-examined African public debt using a panel smooth transition regression approach and estimated a debt threshold range of approximately 62-66 percent of GDP [24]. These studies are useful for the present research because they connect directly with the African country focus, public debt-to-GDP ratios, GDP growth, and macroeconomic controls.

Country-level African evidence also supports the importance of debt composition and financing conditions. Were and Mollel analyzed Tanzania and showed that debt sustainability should be interpreted through external debt dynamics, fiscal deficits, exchange-rate movements, and the capacity to generate growth [25]. Calderon and Zeufack examined the changing risk profile of Sub-Saharan African debt and emphasized that debt vulnerabilities increased because of shifts in creditor composition, exchange-rate exposure, and repayment pressures [26]. For a research period ending in 2020, these studies are important because they explain why African economies entered the COVID-19 shock with different levels of fiscal space and debt vulnerability.

Public investment is central to the debt-growth debate because borrowing can be sustainable when it finances productive investment. Abiad, Furceri, and Topalova found that public investment raises output in the short and long run, crowds in private investment, and can reduce unemployment, especially when economic slack is present and investment efficiency is high [17]. This evidence supports including capital expenditure, investment, unemployment, and GDP growth in the empirical framework.

Fiscal adjustments also differ by composition. Alesina, Favero, and Giavazzi argued that expenditure-based and tax-based fiscal adjustments can have different macroeconomic effects, meaning that the same fiscal balance improvement may affect growth differently depending on whether it comes from spending cuts or revenue increases [23]. The present report therefore benefits from separating government revenue, expenditure, tax revenue, and capital expenditure instead of using only the overall fiscal balance.

Fiscal rules can improve fiscal discipline, but their effect depends on design and enforcement. Heinemann, Moessinger, and Yeter found through meta-regression analysis that fiscal rules tend to constrain fiscal policy, although results vary by institutional context [22]. Caselli and Reynaud used an instrumental-variable approach and found that fiscal rules can improve fiscal balances, but credible implementation is crucial [27]. This is relevant for African economies because formal fiscal rules may not be sufficient if revenue volatility, off-budget liabilities, or weak enforcement remain important.

The uploaded report includes a cross-country model linking economic freedom components to transformed GDP per capita. This is supported by the wider institutional literature. Hall and Lawson reviewed the economic freedom literature and found that economic freedom is generally positively associated with income, growth, investment, and other development outcomes [30]. The report's finding that property rights, government integrity, judicial effectiveness, and financial freedom are strongly correlated with GDP per capita is therefore consistent with this literature.

Inclusive growth is also relevant because fiscal sustainability cannot be evaluated only by debt ratios. Anand, Mishra, and Peiris emphasized that inclusive growth combines growth performance with distributional and opportunity dimensions, making it important to examine unemployment, regional differences, human development, and social indicators [9]. This supports the report's use of inclusive-growth variables such as provincial GRDP per capita, HDI, unemployment, and health complaints. The Indonesian provincial comparison in the report provides an example of how macroeconomic performance can hide important regional inequality.

The literature from 2011-2021 shows four main conclusions. First, public debt sustainability depends not only on the debt level but also on the fiscal reaction function, primary balance, interest-growth differential, and financing conditions [1], [2], [18]. Second, the debt-growth relationship is usually non-linear and heterogeneous, so one universal debt threshold is not reliable across all countries [7], [11], [15], [16]. Third, African and developing economies face additional debt risks because of external borrowing, commodity dependence, exchange-rate exposure, and weaker public sector management [12], [13], [19], [24], [25], [26]. Fourth, fiscal policy affects macroeconomic performance through the composition of expenditure and revenue, the productivity of public investment, institutions, and inclusive-growth outcomes [17], [22], [23], [27], [30].

The research gap addressed by the present study is therefore the need for an integrated pre-COVID analysis that combines fiscal vulnerability, public debt dynamics, macroeconomic performance, and inclusive growth indicators. Many studies focus only on debt and GDP growth, while fewer combine debt, fiscal balance, inflation, unemployment, economic institutions, and inclusion indicators in a single framework. By restricting the empirical scope to observations up to 2020, the study can distinguish pre-shock vulnerabilities from the extraordinary fiscal effects of COVID-19.

Table 1. Comparison table between studies.

No.	Study	Focus	Main finding	Relevance to this research
1	IMF (2011)	Fiscal sustainability framework	Debt paths, fiscal adjustment, shocks, and financing risks should be analyzed jointly.	Supports the study's fiscal sustainability framework.
2	Ghosh et al. (2011)	Fiscal fatigue and fiscal space	Debt limits emerge when the primary balance response weakens at high debt levels.	Supports debt dynamics and fiscal reaction analysis.
3	Balassone et al. (2011)	Italy, long-run debt-growth relationship	Public debt is linked to weaker long-run growth, mainly through investment.	Highlights investment as a transmission channel.
4	Reinhart et al. (2012)	Historical debt overhangs	Long debt overhang episodes are associated with lower growth.	Provides historical motivation for debt vulnerability.
5	Checherita-Westphal & Rother (2012)	Euro area debt-growth channels	High government debt has non-linear negative effects on growth.	Supports threshold and non-linear analysis.
6	Baum et al. (2013)	Euro area dynamic threshold model	Debt may support growth at low levels but becomes harmful at high levels.	Supports testing for non-linearity.
7	Panizza & Presbitero (2013)	Survey of debt-growth literature	Causality and thresholds are uncertain and context-dependent.	Supports careful interpretation.
8	Afonso & Jalles (2013)	155-country panel	Higher debt is generally associated with weaker growth and productivity.	Supports panel macroeconomic controls.

9	Anand et al. (2013)	Inclusive growth measurement	Growth should be evaluated with distribution and opportunity indicators.	Supports inclusive growth extension.
10	Mauro et al. (2015)	Long historical fiscal behavior	Fiscal prudence and profligacy vary across countries and periods.	Supports long-run fiscal behavior perspective.
11	Herndon et al. (2014)	Debt-threshold critique	The 90% debt threshold is not a universal rule.	Supports robustness checks.
12	Lopes da Veiga et al. (2014)	African debt, growth, inflation	Debt-growth-inflation patterns differ across African regions.	Directly relevant to African economies.
13	Megersa & Cassimon (2015)	Developing countries and public sector management	Public sector management affects how debt influences growth.	Supports institutional controls.
14	Woo & Kumar (2015)	Advanced and emerging economies	High initial public debt is associated with lower future growth.	Supports debt-growth hypothesis.
15	Eberhardt & Presbitero (2015)	Large cross-country panel	Debt-growth effects are heterogeneous and non-linear.	Supports country fixed effects.
16	Egert (2015)	Debt-growth threshold robustness	Debt thresholds are sensitive to modelling and data choices.	Supports cautious threshold interpretation.
17	Abiad et al. (2016)	Public investment and macro effects	Public investment can raise output and reduce unemployment.	Supports capital expenditure and growth channels.
18	Checherita-Westphal & Zdarek (2017)	Fiscal reaction and fiscal fatigue	Fiscal response weakens in some high-debt environments.	Supports fiscal reaction models.
19	Ndoricimpa (2017)	African debt threshold effects	African debt-growth relationship shows threshold behavior.	Directly relevant to African debt dynamics.
20	Gomez-Puig & Sosvilla-Rivero (2017)	Euro area ARDL evidence	Debt affects growth differently in short and long run.	Supports ARDL/time-series approach.
21	Beqiraj et al. (2018)	OECD fiscal sustainability	Fiscal sustainability can be tested with primary surplus and debt behavior.	Supports empirical sustainability testing.
22	Heinemann et al. (2018)	Fiscal rules meta-analysis	Fiscal rules can constrain fiscal policy, depending on design.	Supports fiscal-rule discussion.
23	Alesina et al. (2019)	Fiscal adjustment composition	Expenditure- and tax-based consolidations have different macro effects.	Supports separating revenue and expenditure.
24	Ndoricimpa (2020)	African smooth-transition threshold model	African public debt threshold estimated around 62-66% of GDP.	Provides Africa-specific benchmark.
25	Were & Mollel (2020)	Tanzania debt sustainability	External debt, exchange rates, and growth capacity shape sustainability.	Supports country-level African interpretation.
26	Calderon & Zeufack (2020)	Sub-Saharan African debt risks	Debt risk profiles changed with creditor structure and repayment exposure.	Supports vulnerability analysis.

27	Caselli & Reynaud (2020)	Fiscal rules and balances	Fiscal rules can improve fiscal balances when credible.	Supports policy recommendation.
28	Asteriou et al. (2021)	Asian country panel	Public debt affects growth differently across countries and regimes.	Supports comparative panel perspective.
29	Law et al. (2021)	Developing-country debt threshold	Public debt harms growth above an estimated threshold in developing countries.	Supports threshold testing.
30	Hall & Lawson (2014)	Economic freedom literature review	Economic freedom is generally linked with income and growth outcomes.	Supports institutional and economic freedom variables.

The matrix shows that the research topic is strongly grounded in existing literature. The strongest connection is with fiscal sustainability, debt-growth non-linearity, macroeconomic performance, African debt dynamics, and institutional quality. The current research adds value by organizing these themes into a pre-COVID empirical framework ending in 2020.

III. RESEARCH METHODOLOGY AND PROPOSED METHOD

1. RESEARCH DESIGN

The study follows a quantitative, applied macroeconomic research design. It combines descriptive and econometric-oriented methods to investigate fiscal vulnerability, public debt dynamics, macroeconomic performance, and inclusive growth. The empirical evidence is organized around country-year observations and cross-country indicators, while the proposed final research model can be implemented either as a panel-data model for selected African economies or as a country-level time-series model when the research focuses on a single country.

2. DATA SOURCES AND SAMPLE PERIOD

The empirical material is derived from Python-based processing of documented fiscal, macroeconomic, institutional, and inclusive-growth datasets. The preferred research period is 2000-2020 when country and variable coverage is sufficient. For variables with shorter coverage, a balanced 2007-2020 sub-period can be used. In a strictly pre-COVID specification, the model can be estimated up to 2019, while 2020 can be discussed as the first shock year or included as the endpoint of the sample.

3. VARIABLES AND MEASUREMENT

The core fiscal variables are budget deficit or surplus, public debt, government revenue, government expenditure, tax revenue, value-added tax, and capital expenditure. Macroeconomic control variables include GDP growth, GDP per capita, inflation, unemployment, exchange rates, exports, imports, and foreign direct investment. Inclusive-growth variables include GRDP per capita, HDI, unemployment, health complaints, and provincial development differences. Institutional and economic freedom indicators are used to capture governance and structural quality in the cross-country part of the analysis.

4. PROPOSED EMPIRICAL MODELS

The first proposed model is a fiscal sustainability model in which the primary balance or budget deficit/surplus is explained by lagged public debt, revenue, expenditure, GDP growth, inflation, and country fixed effects. This model tests whether fiscal policy responds to rising debt and deteriorating macroeconomic conditions.

$$
\begin{aligned}
Primary\_Balanceit \\
&= \alpha + \beta 1 Debti, t-1 + \beta 2 Growthit + \beta 3 Inflationit + \beta 4 Revenueit + \beta 5 Expenditureit + \mu i \\
&+ \lambda t + \varepsilon it
\end{aligned}
$$

Where:

- Debti,t−1Debt_{i,t-1}Debti,t−1: previous-period debt
- GrowthitGrowth_{it}Growth it: economic growth
- InflationitInflation_{it}Inflation it: inflation rate
- RevenueitRevenue_{it}Revenue it: government revenue
- ExpenditureitExpenditure_{it}Expenditureit: government expenditure
- μi\mu_iμi: country fixed effects
- λt\lambda_tλt: time fixed effects
- εit\varepsilon_{it}εit: error term

The second proposed model is a public debt dynamics model in which public debt-to-GDP is explained by lagged debt, fiscal balance, GDP growth, inflation, and external-sector pressure. This specification evaluates whether debt accumulation is associated with persistent deficits and weak macroeconomic performance.

$$Debtit = \alpha + \rho Debti,t - 1 + \beta 1 Fiscal\_Balanceit + \beta 2 Growthit + \beta 3 Inflationit + \beta 4 Exchange\_Rateit + \beta 5 Current\_Accountit + \mu i + \lambda t + \varepsilon it$$

Where:

- DebtitDebt_{it}Debtit: current public debt
- Debti,t−1Debt_{i,t-1}Debti,t−1: lagged debt
- Fiscal_BalanceitFiscal_Balance_{it}Fiscal_Balanceit: fiscal balance
- GrowthitGrowth_{it}Growthit: GDP growth
- InflationitInflation_{it}Inflationit: inflation rate
- Exchange_RateitExchange_Rate_{it}Exchange_Rateit: exchange rate
- Current_AccountitCurrent_Account_{it}Current_Accountit: current account balance
- μi\mu_iμi: country fixed effects
- λt\lambda_tλt: time fixed effects
- εit\varepsilon_{it}εit: error term

The third proposed model is a macroeconomic performance model in which GDP growth or GDP per capita is explained by public debt, fiscal balance, inflation, unemployment, and institutional-quality indicators. This model connects the fiscal position to broader economic outcomes.

$$GDP\_Performanceit = \alpha + \beta 1 Debtit + \beta 2 Fiscal\_Balanceit + \beta 3 Inflationit + \beta 4 Unemploymentit + \beta 5 Institutionsit + \mu i + \lambda t + \varepsilon it$$

Where:

- iii = country, firm, or entity
- ttt = time period
- μi\mu_iμi = entity fixed effects
- λt\lambda_tλt = time fixed effects
- εit\varepsilon_{it}εit = error term

5. STATISTICAL TECHNIQUES

The analysis uses descriptive statistics, line charts, bar charts, correlation analysis, OLS model comparison, significance testing, and visual interpretation. For the final research stage, fixed-effects panel models, ARDL models, dynamic panel methods, LASSO, and PCA can be used as robustness tools. LASSO and PCA are particularly useful when institutional indicators are highly correlated, while fixed effects are useful for controlling unobserved country or province characteristics.

Table 2. Proposed Method of the research.

Stage	Methodological focus	Purpose
Research design	Quantitative macroeconomic design using descriptive and econometric analysis; evidence organized as country-year and cross-country observations.	Defines the analytical framework for panel-data or single-country time-series analysis.
Data sources and sample period	Fiscal, macroeconomic, institutional, and inclusive-growth datasets processed in Python; preferred period 2000-2020; balanced alternative 2007-2020; pre-COVID estimation may end in 2019.	Defines the sample scope and study period.
Variables and measurement	Fiscal variables: budget deficit/surplus, public debt, government revenue, government expenditure, tax revenue, VAT, and capital expenditure. Macroeconomic variables: GDP growth, GDP per capita, inflation, unemployment, exchange rates, exports, imports, and foreign direct investment. Inclusive-growth variables: GRDP per capita, HDI, unemployment, health complaints, and provincial development differences. Institutional variables: governance and economic freedom indicators.	Defines the variables and measurement structure.
Proposed empirical models	Model 1: Primary $\text{Balance}_{it} = \alpha + \beta_1 \text{Debt}_{i,t-1} + \beta_2 \text{Growth}_{it} + \beta_3 \text{Inflation}_{it} + \beta_4 \text{Revenue}_{it} + \beta_5 \text{Expenditure}_{it} + \mu_i + \lambda_t + \varepsilon_{it}$. Model 2: $\text{Debt}_{it} = \alpha + \varrho \text{Debt}_{i,t-1} + \beta_1 \text{Fiscal Balance}_{it} + \beta_2 \text{Growth}_{it} + \beta_3 \text{Inflation}_{it} + \beta_4 \text{Exchange Rate}_{it} + \beta_5 \text{Current Account}_{it} + \mu_i + \lambda_t + \varepsilon_{it}$. Model 3: GDP $\text{Performance}_{it} = \alpha + \beta_1 \text{Debt}_{it} + \beta_2 \text{Fiscal Balance}_{it} + \beta_3 \text{Inflation}_{it} + \beta_4 \text{Unemployment}_{it} + \beta_5 \text{Institutions}_{it} + \mu_i + \lambda_t + \varepsilon_{it}$.	Examines fiscal sustainability, debt dynamics, and macroeconomic performance.
Statistical techniques	Descriptive statistics, charts, correlation analysis, OLS comparison, significance testing, and visual interpretation; robustness tools include fixed-effects panel models, ARDL, dynamic panel methods, LASSO, and PCA.	Supports estimation, interpretation, and robustness testing.

6. DATA TREATMENT AND RESEARCH SCOPE

All empirical results in this report are derived from Python-based processing of the documented economic datasets and statistical outputs. To maintain consistency with the research objective, the empirical scope is restricted to observations up to 2020 whenever year information is available. The report uses descriptive statistics, correlation analyses, model comparisons, hypothesis testing, and visual analyses to examine fiscal vulnerability, macroeconomic performance, public debt dynamics, and inclusive growth.

IV. EMPIRICAL RESULTS AND ANALYSIS

1. DATA DESCRIPTION AND VARIABLE SELECTION

Table 3. IMF fiscal-data audit compiled from the fiscal analysis.

Item	Value
Raw rows	23,784
Raw columns	9
Initial countries	14 African economies
Initial missing Amount values	65
Cleaned final rows	4,829
Cleaned final columns	20
Cleaned year range	1960-2025
Recommended research filter	Year <= 2020; preferably 2000-2020 or 2007-2020 depending on variable coverage

Table 4. Recommended variables for the research model.

Variable group	Variables available or implied	Research use
Fiscal position	Budget deficit/surplus, revenue, expenditure, tax revenue, VAT, capital expenditure	Dependent or core fiscal-stress variables
Debt sustainability	Government debt, public debt % of GDP, household debt in South Africa notebook	Main fiscal sustainability outcome
Macroeconomic performance	Real GDP, nominal GDP, GDP growth, GDP per capita, inflation, CPI/PPI	Controls and macro outcomes
Labor market	Unemployment rate, labor force, employment indicators	Control/mediating variables
External sector	Exports, imports, exchange rate, FDI inflows	External vulnerability controls
Development/inclusion	HDI, GRDP per capita, health complaints, provincial development differences	Inclusive growth extension

These variables support a macro-fiscal research design. The fiscal and debt variables form the core of the sustainability question, while GDP growth, inflation, unemployment, trade, exchange rates and inclusive-development indicators can serve as controls or extensions.

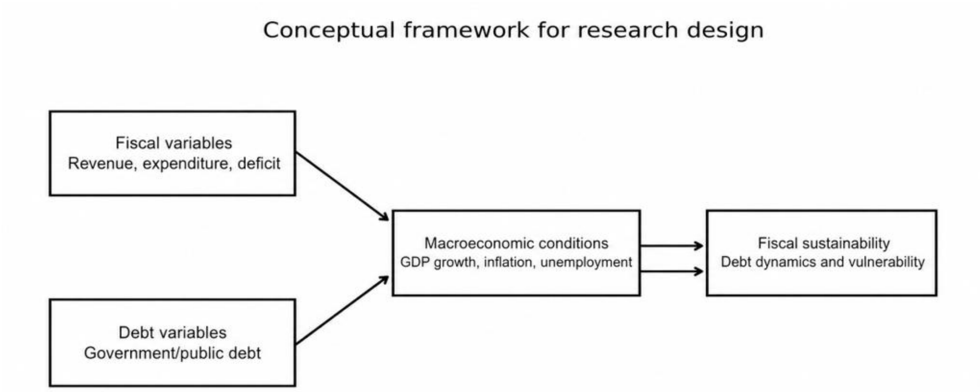

FIGURE 1. Conceptual framework for linking fiscal indicators to macroeconomic outcomes.

https://doi.org/10.48161/qaj.v3n4a21

The framework shows that fiscal balance, revenue/expenditure structure, and debt variables are expected to affect fiscal sustainability directly and indirectly through macroeconomic conditions such as growth, inflation and unemployment.

2. FISCAL RELATIONSHIP: EGYPT BUDGET DEFICIT/SURPLUS UP TO 2020

Table 5. Egypt budget deficit/surplus converted to USD billion, 2007-2020.

Year	Budget_Deficit_Surplus_USD_Bn
2,007	-9.975
2,008	-12.44
2,009	-13.05
2,010	-17.59
2,011	-22.61
2,012	-27.36
2,013	-35.93
2,014	-35.99
2,015	-36.97
2,016	nan
2,017	-20.6
2,018	-23.94
2,019	-25.22
2,020	-25.92

The Egyptian fiscal balance was negative throughout the observed period. The deficit widened sharply between 2007 and 2015, with a missing value in 2016, then improved in 2017 before widening again by 2020. This series is useful as a single-country fiscal-stress example.

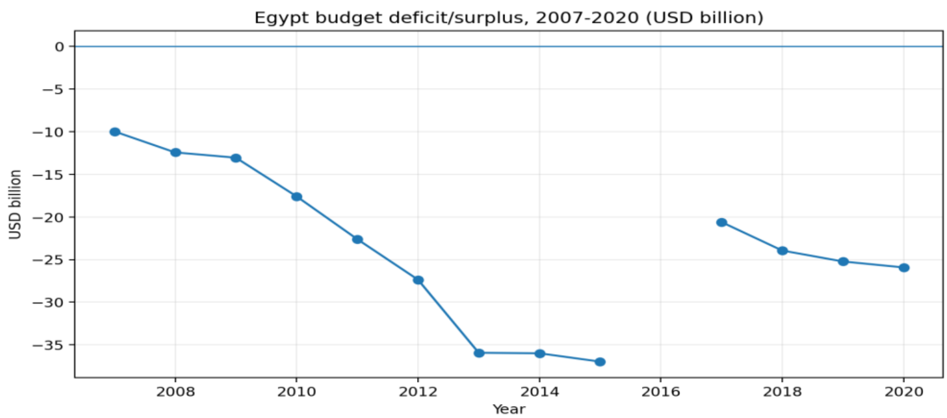

FIGURE 2. Egypt budget deficit/surplus, 2007-2020.

The line chart shows persistent fiscal deficits. The steep worsening up to 2015 indicates rising fiscal pressure before the COVID-19 period. The 2020 value remains negative, so COVID-era analysis should either stop at 2019 for a strictly pre-shock design or include 2020 as the first shock year.

3. CROSS-COUNTRY RELATIONSHIP: ECONOMIC INSTITUTIONS AND INCOME

Table 6. Correlation between economic freedom components and transformed GDP per capita.

Economic freedom component	Correlation_with_sqrt_GDP_per_capita
Property Rights	0.758
Government Integrity	0.7238
Judicial Effectiveness	0.6715
Financial Freedom	0.6411
Business Freedom	0.6368
Trade Freedom	0.6212
Investment Freedom	0.5145
Monetary Freedom	0.3492
Labor Freedom	0.2849
Fiscal Health	0.2466
Tax Burden	-0.1038
Gov Spending	-0.4096

Property Rights, Government Integrity, Judicial Effectiveness and Financial Freedom have the strongest positive associations with transformed GDP per capita. Government Spending and Tax Burden are negatively correlated in the simple correlation view, suggesting that fiscal size and tax structure may be linked differently to income levels across countries.

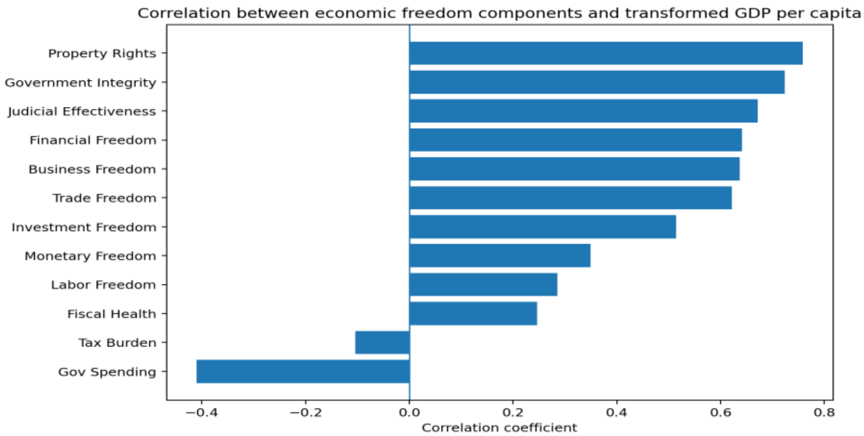

FIGURE 3. Economic freedom components and transformed GDP per capita.

The chart makes the strongest relationships visible. Institutional-quality variables cluster on the positive side, while government spending has a negative bivariate correlation. This supports including governance and fiscal variables in the empirical model.

Table 7. OLS model comparison for transformed GDP per capita.

Model	Observations	R_squared	Adjusted_R_squared	Prob_F	Main interpretation
Simple OLS: 2019 Score only	173	0.476	0.473	9.35e-26	Economic freedom score explains about 47.6% of cross-country variation in transformed income.
Multiple OLS: 12 freedom components	173	0.651	0.625	9.99e-31	Disaggregated components improve fit, but multicollinearity is present.

The model using the overall 2019 economic freedom score explains 47.6% of the variation in transformed GDP per capita. Using the 12 component variables increases R-squared to 65.1%, but the notebook warns of multicollinearity, so LASSO or PCA is appropriate for cleaner inference.

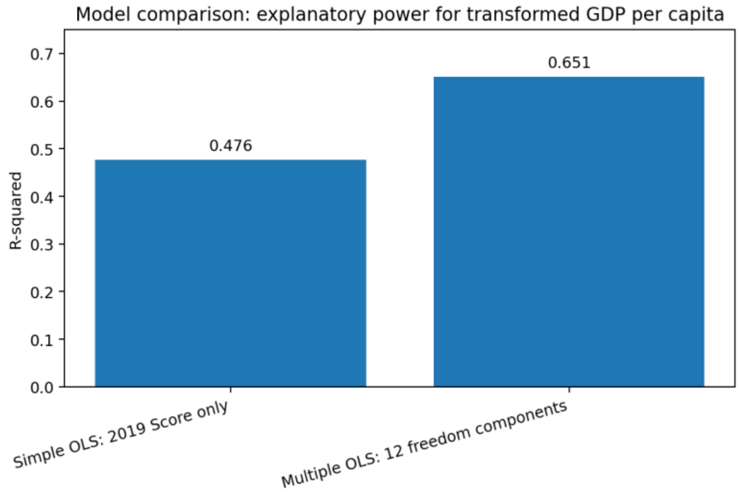

FIGURE 4. Explanatory power of simple and component-level models.

The disaggregated model provides better fit than the one-score model. This suggests that the composition of economic institutions matters, not only the aggregate freedom score.

Table 8. Statistically significant variables in the 12-component OLS model.

Variable	Coefficient	p_value	Sign
Property Rights	1.116	0.02	Positive
Government Integrity	0.9856	0.028	Positive
Tax Burden	0.8127	0.016	Positive
Gov Spending	-0.4956	0.013	Negative
Financial Freedom	0.9269	0.008	Positive

Property Rights, Government Integrity, Tax Burden and Financial Freedom are positively significant, while Government Spending is negatively significant. Because the full model has multicollinearity, coefficient signs should be interpreted cautiously and supported by LASSO/PCA robustness checks.

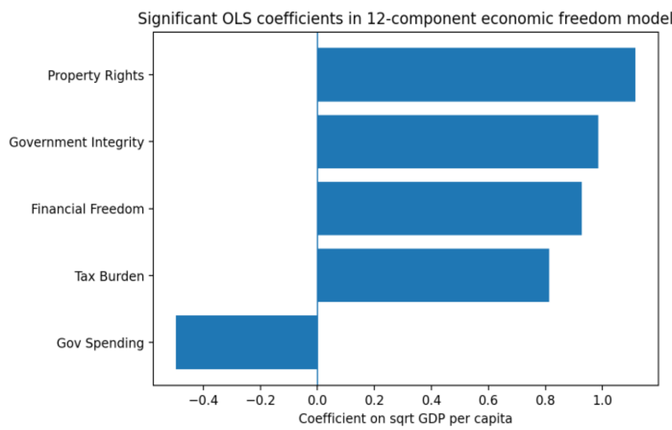

FIGURE 5. Significant OLS coefficients from the component-level model.

The coefficient figure shows the direction of significant relationships. Positive coefficients indicate variables associated with higher transformed GDP per capita, while the negative spending coefficient may reflect fiscal burden, fiscal structure, or cross-country income-composition effects rather than a direct causal relationship.

4. INCLUSIVE GROWTH RELATIONSHIP: INDONESIAN PROVINCIAL DIFFERENCES

Table 9. Hypothesis test for provincial GRDP per capita difference.

Comparison	t_statistic	p_value	Decision
ACEH vs BALI GRDP per capita	-11.29	1.036e-06	Reject H0: statistically significant difference between provinces

The t-test comparing ACEH and BALI rejects the null hypothesis of no difference in GRDP per capita. This supports the idea that regional inequality or uneven inclusive growth can be statistically detected and should be considered in development-oriented economic research.

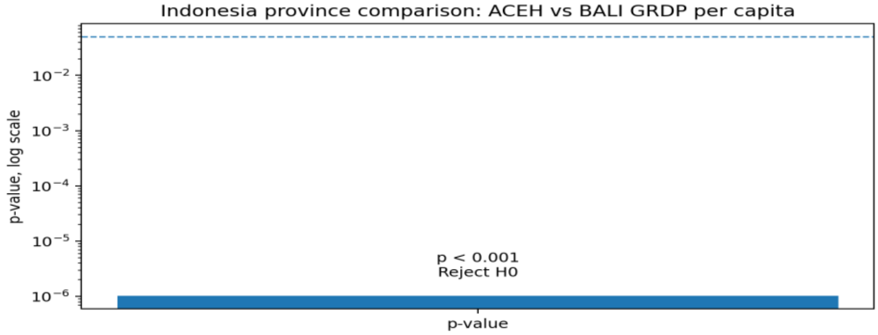

FIGURE 6. Statistical significance of ACEH-BALI GRDP per capita difference.

The p-value is far below the 5% threshold, indicating a statistically significant difference. In a research paper, this can support a section on regional heterogeneity and inclusive growth, but further tests across all provinces would be stronger than a two-province comparison.

5. RECOMMENDED ECONOMETRIC APPROACH FOR THE RESEARCH

Table 10. Recommended models for turning notebook evidence into a research design.

Research question	Suggested dependent variable	Suggested explanatory variables	Model
Fiscal sustainability	Primary balance or budget deficit/surplus	Lagged public debt, revenue, expenditure, GDP growth, inflation	Panel fixed effects or ARDL/time-series model
Debt dynamics	Government/public debt-to-GDP	Lagged debt, fiscal balance, interest/inflation, exchange-rate pressure	Debt accumulation equation or dynamic panel model
Macroeconomic performance	GDP growth or GDP per capita	Debt, inflation, unemployment, fiscal balance, institutional indicators	OLS/panel FE with robustness checks

Inclusive growth extension	GRDP per capita, HDI, unemployment	Health complaints, unemployment, HDI, province fixed effects	T-tests, ANOVA, panel FE across provinces

For a study ending in 2020, the most defensible approach is to estimate relationships using annual data up to 2019 for pre-COVID evidence, then optionally discuss 2020 as the shock year. Fixed effects are useful when pooling countries or provinces because they control for unobserved structural differences.

6. MAIN ANALYTICAL FINDINGS

- The fiscal notebook supports a macro-fiscal research topic focused on budget balance, revenue, expenditure, government debt, GDP, inflation and unemployment in selected African economies.
- The Egypt fiscal series shows persistent fiscal deficits through 2020, supporting a fiscal vulnerability or debt-sustainability research angle.
- The economic freedom notebook shows strong statistical relationships between institutional/fiscal indicators and income levels. The component-level model fits better than the aggregate score model.
- The Indonesia notebook supports an inclusive-growth extension by showing statistically significant provincial differences in GRDP per capita.
- The South Africa notebook provides relevant macroeconomic charts for inflation, interest rates, public debt, exchange rates and sectoral GDP, supporting a strong macroeconomic interpretation up to 2020.

V. DISCUSSION

The empirical evidence supports the view that fiscal vulnerability is multi-dimensional. The Egyptian fiscal-balance series shows persistent deficits up to 2020, which indicates that fiscal stress existed before the COVID-19 shock. This is consistent with studies arguing that sustainability depends on fiscal behavior, debt dynamics, and the capacity of governments to generate primary-balance improvements when debt rises [1], [2]. However, the evidence also suggests that fiscal vulnerability should not be interpreted only through one debt threshold, because the literature shows that debt-growth relationships are heterogeneous, non-linear, and sensitive to country conditions [7], [11], [15], [16].

The cross-country evidence from the economic freedom model shows that institutional-quality variables such as property rights, government integrity, judicial effectiveness, and financial freedom are strongly associated with transformed GDP per capita. This finding supports the argument that fiscal sustainability and macroeconomic performance are partly shaped by the institutional environment. Better institutions can improve revenue mobilization, reduce inefficient spending, support investment, and increase confidence in macroeconomic management.

The comparison between the simple OLS model and the component-level OLS model indicates that disaggregated indicators provide stronger explanatory power than a single aggregate score. This supports the use of LASSO or PCA in the final research because the component-level model improves fit but may suffer from multicollinearity. In practical terms, the result means that the composition of institutions and fiscal indicators matters more than a broad index alone.

The inclusive-growth evidence also strengthens the interpretation of fiscal and macroeconomic outcomes. The statistically significant difference between ACEH and BALI in GRDP per capita indicates that national-level growth can hide regional inequality. Therefore, macroeconomic performance should be evaluated together with labor-market indicators, human development, and regional development outcomes. This is important for fiscal policy because a country may appear stable at the aggregate level while facing unequal development outcomes across regions.

Overall, the results are consistent with the literature reviewed in Section 2. Public debt and fiscal deficits are important, but their effects depend on growth conditions, inflation, revenue capacity, expenditure quality, external-sector pressure, and institutions. The evidence therefore supports an integrated empirical model rather than a narrow debt-only approach.

VI. CONCLUSION

This paper developed a complete research structure for examining fiscal vulnerability, macroeconomic performance, public debt dynamics, and inclusive growth before and up to the COVID-19 shock. Using the uploaded Python-based empirical report as the first research material, the paper organized the available evidence into a coherent academic framework with abstract, introduction, literature review, proposed methodology, results, discussion, conclusion, and references.

The analysis leads to four main conclusions. First, fiscal sustainability requires more than observing the level of public debt; it requires examining fiscal balance, revenue, expenditure, growth, inflation, unemployment, and financing conditions. Second, the Egyptian fiscal-balance evidence shows persistent deficits up to 2020, supporting the interpretation of fiscal vulnerability before the COVID-19 shock. Third, institutional-quality indicators are strongly related to cross-country income performance, meaning that governance and economic institutions should be included in the empirical model. Fourth, inclusive-growth indicators reveal statistically significant regional differences, showing that macroeconomic performance should be assessed together with development and distributional outcomes.

The proposed method recommends using a 2000-2020 panel where coverage permits, or a 2007-2020 balanced sample for more complete fiscal indicators. For a strictly pre-COVID analysis, the study may estimate models through 2019 and then discuss 2020 as the shock year. Future research should extend the empirical stage by estimating fixed-effects, ARDL, dynamic panel, LASSO, and PCA models after finalizing the country coverage and variable availability.

In conclusion, the study provides a strong foundation for a macro-fiscal research paper in economics. It shows that fiscal vulnerability before COVID-19 was connected to persistent deficits, debt dynamics, institutional quality, macroeconomic performance, and inclusive-growth differences. These findings can guide the final econometric model and policy discussion in the next stage of the research.

Author Contributions

The author conducted the conceptualization, methodology, data analysis, investigation, writing, review, editing, and final approval of the manuscript.

Funding

This research received no external funding.

Data Availability

The dataset will be available from the author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest.

REFERENCES

1. International Monetary Fund. (2011). Modernizing the framework for fiscal policy and public debt sustainability analysis. IMF Policy Paper.
2. Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., & Qureshi, M. S. (2011). Fiscal fatigue, fiscal space and debt sustainability in advanced economies (NBER Working Paper No. 16782). National Bureau of Economic Research.
3. Balassone, F., Francese, M., & Pace, A. (2011). Public debt and economic growth in Italy (Economic History Working Paper No. 11). Bank of Italy.
4. Reinhart, C. M., Reinhart, V. R., & Rogoff, K. S. (2012). Public debt overhangs: Advanced-economy episodes since 1800. Journal of Economic Perspectives, 26(3), 69-86.
5. Checherita-Westphal, C., & Rother, P. (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. European Economic Review, 56(7), 1392-1405.
6. Baum, A., Checherita-Westphal, C., & Rother, P. (2013). Debt and growth: New evidence for the euro area. Journal of International Money and Finance, 32, 809-821.

7. Panizza, U., & Presbitero, A. F. (2013). Public debt and economic growth in advanced economies: A survey. Swiss Journal of Economics and Statistics, 149(2), 175-204.
8. Afonso, A., & Jalles, J. T. (2013). Growth and productivity: The role of government debt. International Review of Economics & Finance, 25, 384-407.
9. Anand, R., Mishra, S., & Peiris, S. J. (2013). Inclusive growth: Measurement and determinants (IMF Working Paper No. WP/13/135). International Monetary Fund.
10. Mauro, P., Romeu, R., Binder, A. J., & Zaman, A. (2015). A modern history of fiscal prudence and profligacy. Journal of Monetary Economics, 76, 55-70.
11. Herndon, T., Ash, M., & Pollin, R. (2014). Does high public debt consistently stifle economic growth? A critique of Reinhart and Rogoff. Cambridge Journal of Economics, 38(2), 257-279.
12. Lopes da Veiga, J. A., Ferreira-Lopes, A., & Sequeira, T. N. (2014). Public debt, economic growth, and inflation in African economies (MPRA Paper No. 57377). Munich Personal RePEc Archive.
13. Megersa, K., & Cassimon, D. (2015). Public debt, economic growth and public sector management in developing countries: Is there a link? Public Administration and Development, 35(5), 329-346.
14. Woo, J., & Kumar, M. S. (2015). Public debt and growth. Economica, 82(328), 705-739.
15. Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. Journal of International Economics, 97(1), 45-58.
16. Egert, B. (2015). Public debt, economic growth and nonlinear effects: Myth or reality? Journal of Macroeconomics, 43, 226-238.
17. Abiad, A., Furceri, D., & Topalova, P. (2016). The macroeconomic effects of public investment: Evidence from advanced economies. Journal of Macroeconomics, 50, 224-240.
18. Checherita-Westphal, C., & Zdarek, V. (2017). Fiscal reaction function and fiscal fatigue: Evidence for the euro area (ECB Working Paper No. 2036). European Central Bank.
19. Ndoricimpa, A. (2017). Threshold effects of debt on economic growth in Africa. African Development Review, 29(3), 471-484.
20. Gomez-Puig, M., & Sosvilla-Rivero, S. (2017). Public debt and economic growth: Further evidence for the euro area (Working Paper No. 2017/15). Research Institute of Applied Economics, University of Barcelona.
21. Beqiraj, E., Fedeli, S., & Forte, F. (2018). Public debt sustainability: An empirical study on OECD countries. Journal of Macroeconomics, 58, 238-248.
22. Heinemann, F., Moessinger, M. D., & Yeter, M. (2018). Do fiscal rules constrain fiscal policy? A meta-regression-analysis. European Journal of Political Economy, 51, 69-92.
23. Alesina, A., Favero, C., & Giavazzi, F. (2019). Effects of austerity: Expenditure- and tax-based approaches. Journal of Economic Perspectives, 33(2), 141-162.
24. Ndoricimpa, A. (2020). Threshold effects of public debt on economic growth in Africa: A new evidence. Journal of Economics and Development, 22(2), 187-207.
25. Were, M., & Mollel, L. (2020). Public debt sustainability and debt dynamics: The case of Tanzania (WIDER Working Paper No. 2020/112). UNU-WIDER.
26. Calderon, C., & Zeufack, A. G. (2020). Borrow with sorrow? The changing risk profile of Sub-Saharan Africa's debt (Policy Research Working Paper). World Bank.
27. Caselli, F., & Reynaud, J. (2020). Do fiscal rules cause better fiscal balances? A new instrumental variable strategy. European Journal of Political Economy, 63, 101873.
28. Asteriou, D., Pilbeam, K., & Pratiwi, C. E. (2021). Public debt and economic growth: Panel data evidence for Asian countries. Journal of Economics and Finance, 45, 270-287.
29. Law, S. H., Ng, C. H., Kutan, A. M., & Law, Z. K. (2021). Public debt and economic growth in developing countries. Economic Modelling, 98, 26-40.
30. Hall, J. C., & Lawson, R. A. (2014). Economic freedom of the world: An accounting of the literature. Contemporary Economic Policy, 32(1), 1-19.