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UNLOCKING THE POTENTIAL OF PUBLIC SPENDING ON SUSTAINABLE DEVELOPMENT: THE MODERATING ROLE OF GOVERNANCE QUALITY

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Abstract: This study explores the untapped potential of public spending in promoting sustainable development, with a particular focus on the moderating role of governance quality across 45 developing countries from 2002 to 2023. By employing the System Generalized Method of Moments (S-GMM) and robustness tests using the Method of Moment Quantile Regression (MMQR), the research highlights the significant positive effect of public expenditure on sustainable development outcomes. Furthermore, the study breaks new ground by illustrating how governance quality moderates this relationship, demonstrating that stronger governance frameworks contribute to higher levels of sustainable development. However, the analysis uncovers nuanced effects: in settings at very high levels of governance quality, the marginal returns of additional public spending diminish, suggesting that resource allocation is already optimized in such environments. These findings emphasize the critical role of governance quality in unlocking the full potential of public spending for sustainable development. The study provides original insights into how policymakers can strategically optimize public investment by aligning it with institutional improvements, thereby enhancing the sustainability of development efforts.

Keywords: Public spending; governance quality; sustainable development; GMM; MMQR.

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1. Introduction

The interplay between public spending and sustainable development has garnered increasing attention within the academic community, particularly in the context of global efforts to achieve the Sustainable Development Goals (SDGs) (Kpegba et al., 2023; Oppong et al., 2023). Public spending, encompassing government expenditures in critical areas such as education, healthcare, infrastructure, and social protection, is widely regarded as a central mechanism for fostering economic growth, reducing poverty, and enhancing social equity (Baldacci et al., 2008; Gupta et al., 2002; Guerrero & Castañeda, 2022; Kpegba et al., 2024). However, while the theoretical framework suggests that public spending should play a pivotal role in promoting sustainable development (SD), empirical evidence reveals significant variation in its effectiveness across different national contexts. This inconsistency is especially pronounced in developing countries, where the impact of public spending on SD outcomes is often less predictable and more susceptible to various contextual factors (Afonso et al., 2010; Esfahani & Ramírez, 2003).

In developing countries, where resources are often scarce and governance challenges are more prevalent, the efficiency and effectiveness of public spending are frequently compromised by weak institutional frameworks (Keefer & Knack, 2007; Mauro, 1998). Issues such as corruption, bureaucratic inefficiency, and lack of accountability can lead to the misallocation of public resources, thereby undermining the potential benefits of government expenditures aimed at achieving SD (Rajkumar & Swaroop, 2008). The variation in governance quality across developing countries thus plays a critical role in shaping the outcomes of public spending, making it a key area of concern for policymakers and development practitioners (Nicolòet al., 2024; 2024; Halásková et al., 2023; Poku et al., 2022; Sabir & Qamar, 2019; Sikayena et al., 2022; Wong, 2020).

Given the unique challenges faced by developing countries, the need to investigate the role of governance quality in the relationship between public spending and SD is particularly urgent. Understanding how institutional factors influence the effectiveness of public spending in these contexts is essential for designing policies that can better leverage limited resources to achieve SDGs. Moreover, as developing countries often grapple with multiple, intersecting crises—ranging from economic instability to environmental degradation and social inequities—the role of institutions in moderating the impact of public spending becomes even more critical (López & Mitra, 2000; Rodrik, 2008).

This paper makes a significant contribution by exploring the impact of public expenditure on economic sustainability in developing countries, emphasizing the moderating role of governance quality—an aspect often overlooked in traditional research. While previous studies have broadly acknowledged the importance of governance quality in economic development, this study addresses its role in shaping the relationship between public spending and sustainability. Effective institutions are widely recognized for optimizing national resources, enhancing productivity, and creating a stable economic environment that fosters investor and consumer confidence. These institutions attract more capital and talent and enable upward mobility. In contrast, poor governance and weak institutions can lead to adverse outcomes such as rent-seeking, moral hazard, and mismanagement, all of which elevate public expenditure and hinder economic sustainability (Arvin et al., 2021). This study empirically investigates these dynamics by analyzing data from all 45 developing countries over a period from 2002 to 2023. The unique characteristics and challenges of these economies provide an opportunity to generate novel insights that will deepen our understanding of the interplay between public expenditure, governance quality, and sustainable development. This research is expected to offer substantial contributions to both policy and academic discussions, shedding light on how improved governance structures can enhance the effectiveness of public spending in sustainable development.

We employ the S-GMM to analyze the moderating role of governance quality in the relationship between public expenditure and SD, with a specific emphasis on developing countries. Using S-GMM, the study first estimates the direct effects of public spending on SD outcomes, evaluating how government expenditures contribute to progress towards SDGs amidst resource constraints and governance challenges. The S-GMM offers significant advantages, particularly when evaluating the impact of public expenditure on sustainable development in developing countries. This method is particularly adept at controlling for endogeneity by using internal instruments, which address biases from omitted variables and reverse causality. Additionally, S-GMM effectively accounts for unobserved heterogeneity, making it ideal for panels with many units and few time periods. Combining equations in levels and first differences, improves efficiency, making it a robust choice for dynamic panel data analysis. To ensure robustness, the analysis incorporates the Method of Moments Quantile Regression (MMQR) to examine how the impact of public spending varies across different quantiles of development outcomes. This dual approach provides a comprehensive view of how governance quality—encompassing factors such as voice and accountability (VA), political

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stability and absence of violence/terrorism (PS), government effectiveness (GE), regulatory quality (RQ), rule of law (RL) and control of corruption (CC)—affects the efficiency of public spending. The MMQR has several advantages, particularly in analyzing the heterogeneous effects of variables across different quantiles of the dependent variable's distribution. MMQR is highly effective for capturing the impact of variables on the entire conditional distribution, rather than just the mean, allowing for a more detailed understanding of the relationships. It also handles heteroskedasticity better than traditional methods and provides robust estimates even in the presence of outliers or skewed distributions, making it valuable for studying diverse economic phenomena. The combination of S-GMM and MMQR offers nuanced insights into how variations in governance quality influence the distribution and effectiveness of development impacts, delivering valuable implications for policymakers and practitioners aiming to optimize the developmental impact of public spending in diverse institutional contexts.

2. Literature review

2.1. Public Spending and Sustainable Development

Public spending, encompassing government expenditures on various sectors such as education, healthcare, infrastructure, and social protection, is a critical lever for advancing SD. The concept of SD, as articulated in the Brundtland Report (1987), emphasizes the need for development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This multifaceted goal includes economic growth, social inclusion, and environmental sustainability, each of which is directly influenced by the scale, composition, and effectiveness of public spending (World Bank, 2019).

Extensive research has established that targeted public spending is essential for achieving the SDGs. For example, public investment in education and healthcare is directly linked to improvements in human capital, which is foundational for economic growth and poverty reduction (Baldacci et al., 2008; Gupta et al., 2002; Guerrero & Castañeda, 2022). Baldacci et al. (2008) found that in developing countries, increased public spending on education and healthcare is strongly correlated with higher literacy rates, improved life expectancy, and reduced child mortality, thereby contributing to the achievement of SDGs 3 and 4 (good health and well-being, quality education). Furthermore, infrastructural investments in sectors such as energy, transport, and water management are crucial for fostering economic resilience and reducing inequalities (Esfahani & Ramírez, 2003; Calderón & Servén, 2010). Others also support the notion that government spending is essential for improving productivity. They further assert that increasing government expenditure

enhances the spending capacity of economic agents, such as households and businesses, which, in turn, necessitates economic growth (Nyasha & Odhiambo, 2019; Poku et al., 2022).

However, the efficacy of public spending in promoting SD is not uniformly positive across different contexts. Numerous studies have documented instances where increased government expenditure did not translate into commensurate gains in development outcomes (Sikayena et al., 2022; Poku et al., 2022; Sampson et al., 2021; and Halásková et al., 2023). This discrepancy is often attributed to inefficiencies in public expenditure management, corruption, and misallocation of resources (Afonso et al., 2010; Rajkumar & Swaroop, 2008). For instance, a study by Afonso et al. (2010) highlighted that while public spending on education and healthcare in many OECD countries has increased, the outcomes have varied significantly, indicating that factors beyond the quantum of spending are at play. Similarly, inefficiencies in public investments in infrastructure have been shown to limit their impact on economic growth and poverty reduction, particularly in contexts where governance structures are weak (Keefer & Knack, 2007).

The literature consistently emphasizes that the effectiveness of public spending in achieving SD objectives is mediated by the quality of institutions. Therefore, understanding the role of governance quality in this relationship is essential for designing policies that enhance the developmental impact of public expenditure.

2.2. The Role of Governance Quality in the Relationship between Public Spending and Sustainable Development

Governance quality, which includes factors such as governance effectiveness, regulatory quality, the rule of law, and control of corruption, is increasingly recognized as a critical determinant of the success of public spending in promoting SD. Institutions play a pivotal role in ensuring that public resources are allocated efficiently, policies are implemented effectively, and the benefits of public spending reach the intended populations (North, 1990; Acemoglu et al., 2001).

Empirical research provides robust evidence that governance quality significantly influences the relationship between public spending and SD outcomes. For instance, Rajkumar and Swaroop (2008) found that in countries with high levels of corruption, the impact of public spending on health and education outcomes is significantly diminished. This finding suggests that in contexts where institutions are weak, public spending is more likely to be misallocated or diverted, leading to suboptimal outcomes. Similarly, Mauro (1998) demonstrated that corruption negatively affects public investment, particularly in infrastructure, thereby undermining its contribution to economic growth and SD.

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Moreover, the literature indicates that the nature of institutions can determine whether public spending is directed toward long-term SDGs or short-term political gains. Acemoglu, Johnson, and Robinson (2001) argue that inclusive institutions—those that allow for broad-based participation and accountability—are more likely to implement policies that support SD. In contrast, extractive institutions, where power is concentrated and used to benefit a narrow elite, often lead to public spending that serves the interests of a few rather than the broader population. This divergence in governance quality helps explain why some countries achieve better development outcomes from similar levels of public spending (Rodrik, 2008).

The role of governance quality is also evident in the environmental domain. In countries with strong regulatory frameworks and effective governance, public spending on environmental protection is more likely to result in positive environmental outcomes (López & Mitra, 2000; Fredriksson & Svensson, 2003). For example, López and Mitra (2000) found that in countries with high governance quality, public spending on environmental protection is associated with lower levels of pollution and better conservation outcomes. Conversely, in countries with weak institutions, even significant investments in environmental protection can fail to produce meaningful improvements due to issues such as regulatory capture and enforcement challenges.

Furthermore, the interaction between governance quality and public spending extends to social equity and inclusion, which are core components of SD. Studies have shown that in countries with high governance quality, public spending is more effective in reducing poverty and inequality (Chong & Calderón, 2000; Dollar & Kraay, 2003). For instance, Chong and Calderón (2000) found that governance quality mediates the relationship between public spending and income inequality, with stronger institutions leading to more equitable distributional outcomes. This finding underscores the importance of governance quality in ensuring that the benefits of public spending are broadly shared, contributing to the social pillar of SD. Bazie et al. (2023) present both theoretical and empirical perspectives on the importance of incorporating institutional considerations into human capital development within Sub-Saharan Africa, particularly highlighting the need to combat corruption in developing nations. Their research reveals that corruption undermines the efficacy of education, as well as negatively affects both the average duration of education and citizens' life expectancy by impacting public spending in the education and health sectors. Furthermore, corruption was found to have a direct adverse effect on educational outcomes, underscoring the crucial role of governance quality. Similarly, Anh & Oanh (2023) investigate the impact of fiscal policy on public spending across 63 provinces in Vietnam, emphasizing the influence of

governance quality on government expenditure and economic development. Utilizing the Feasible General Least Squares (FGLS) estimator and the S-GMM models, their study identifies a positive relationship between government expenditure and economic growth. The findings confirm that higher governance quality enhances the beneficial effects of government spending on regional economic development.

In conclusion, while public spending is a necessary instrument for promoting SD, its effectiveness is heavily contingent on the quality of institutions. High-quality institutions enhance the developmental impact of public spending by ensuring efficient resource allocation, reducing corruption, and aligning expenditures with long-term SDGs. Conversely, in contexts characterized by weak institutions, public spending is often less effective, and may even undermine SD efforts. As such, policymakers should prioritize institutional strengthening as a key strategy for leveraging public spending to achieve SD.

3. Data and methodology

3.1. Data and model

This study utilizes a balanced panel dataset from 2002 to 2023 encompassing 45 developing countries (see Appendix 1 for details). These countries were selected based on the availability of data on key variables used in the research. The use of panel data is advantageous as it combines both cross-sectional and time-series information, allowing for a larger number of data points and enhancing the reliability of the analytical models (Hsiao, 2022). Moreover, the relatively large number of countries included in the study facilitates broader inferences within the context of developing nations. Consequently, the findings of this research can be applied to the selected group of developing countries.

Given the objective of examining the role of governance quality in the relationship between public spending and SD in developing countries, the dependent variable of interest is the sustainable development index (SD). The Sustainable Development Goals (SDGs) framework of the United Nations consists of 17 goals (see Appendix 2) and 169 targets aimed at addressing global challenges such as poverty, inequality, climate change, environmental degradation, peace, and justice. Progress toward these goals is tracked using a set of global indicators, which total 232 distinct metrics, proposed by the United Nations Statistical Commission. These indicators cover various domains including economic growth, social inclusion, environmental protection, and institutional development. However, many indicators lack comprehensive, cross-country comparable data, and some indicators even lack

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agreed statistical definitions. Therefore, to support countries in measuring key SDG indicators and assessing future progress, the Bertelsmann Foundation and the Sustainable Development Solutions Network (SDSN) jointly released the first SDG Index and Dashboards in July 2016. The SDG Index and Dashboards provide an annual assessment of SDG progress in all United Nations member states. This assessment is based on a transparent, statistically audited, and peer-reviewed methodology (Lafortune et al., 2018; Papadimitriou et al., 2019; Schmidt-Traub et al., 2017). The SDG Index combines indicators across all 17 goals, providing a multidimensional view of progress toward achieving the SDGs. Data for these indicators are collected from national statistical offices, international organizations, and other reliable sources. The SDG Index score represents the percentage of SDG targets achieved. The difference between 100 and the country scores represents the percentage gap needed to achieve the SDGs. This systematic approach allows for monitoring advancements and identifying gaps in achieving sustainable development, guiding policy decisions and resource allocation to promote a more sustainable future globally. Detailed information on the methodology and index scores can be found at https://dashboards.sdgindex.org/. This composite index captures all aspects of SD, providing a comprehensive view of the impact of public spending and governance quality on SD in developing countries.

Public spending is represented by general government final consumption expenditure (% of GDP), which includes all current government spending on goods and services, including salaries, as well as defense and security expenditures, excluding military spending that contributes to government capital formation (Azam et al., 2023). Data on public spending are obtained from the World Development Indicators (WDI).

Governance quality (IQ) is represented by six component indices: Control of Corruption (CC), Government Effectiveness (GE), Political Stability and Absence of Violence/Terrorism (PS), Rule of Law (RL), Voice and Accountability (VA), and Regulatory Quality (RQ), sourced from the Worldwide Governance Indicators (WGI). These indices are ranked from -2.5 (weakest governance quality) to +2.5 (strongest governance quality). We use the simple average of six component indicators to measure governance quality.

Finally, control variables are included in the study model, namely Economic Growth (GDP), Population (POP), Foreign Direct Investment (FDI), Education (EDU), and Inflation (INF), with data sourced from the WDI. Descriptive information and measurement of these variables are detailed in Table 1.

Table 1 Variables definitions and sources

Variables	Code	Measures	Sources
Sustainable Development	SD	Integrate 17 indicators from the Sustainable Development report.	SDGIndex
Public Expenditure	PE	General government final consumption expenditure (% of GDP)	WDI
Governance quality	IQ	A simple average of six global governance indicators (Control of Corruption, Government Effectiveness, Political Stability and Absence of Violence/Terrorism, Rule of Law, Voice and Accountability, and Regulatory Quality), which range from -2.5 to +2.5.	The author's calculations are based on data collected from the WDI.
Economic Growth	GDP	GDP per capita (constant 2015 US$)	WDI
Population	POP	Population growth (annual %)	WDI
Foreign Direct Investment	FDI	Foreign direct investment, net inflows (% of GDP)	WDI
Education	EDU	School enrollment, primary (% gross)	WDI
Inflation	INF	Inflation, consumer prices (annual %)	WDI

Source: World Development Indicators (WDI) and Sustainable Development Goals Index (SDGIndex).

Next, based on previous empirical studies, such as Kpegba et al. (2024), a general model is constructed to address the research objectives as follows:

$$SD_{it} = \alpha_0 + \alpha_1 PE_{it} + \alpha_2 IQ_{it} + \alpha_3 PE_{it} \times IQ_{it} + \delta_{it} X_{it} + (\mu_i + \varepsilon_{it}) \quad (1)$$

Which, SD is the dependent variable representing SD, PE and IQ are the independent variables representing public expenditure and governance quality, respectively, and X is the control variable. The term $(PE_{it} \times IQ_{it})$ expresses the interaction between Public Expenditure and Governance quality for countries i across time t. The values i=1, 2, ..., N (representing countries) and t=1, 2, ..., T (representing the study period). Finally, μ is the fixed effect of the model and ε is the estimation error of the model, assumed to be independent, independently and identically distributed with a mean of 0 and a constant variance $\sigma^2(\varepsilon_{it} \sim i.i.d(0, \sigma_\varepsilon))$.

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3.2. Method

3.2.1. Cross-sectional dependence (CD) test

A key feature of panel data is cross-sectional dependence, which arises when a common factor influences the interdependence among cross-sectional units (e.g., countries). Detecting cross-sectional dependence is crucial and should be a primary concern in panel data analysis (Wang et al., 2023). Failure to address cross-sectional dependence can result in biased and inconsistent findings (Chudik & Pesaran, 2022), rendering the results unreliable (Wang et al., 2023). To assess the cross-dependence among variables in the dataset, the Pesaran (2007) test was utilized. The methodology for the Pesaran (2007) test is as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{p=i+1}^{N} \rho_{pi} \qquad (2)$$

In equation (2), T represents time, the size of the panel data is indicated by *N*, and ρ_{pi} is the correlation coefficient. The hypothesis in this test is as follows: H_0: no cross-sectional dependence exists; H_1: cross-sectional dependence exists. To enhance the reliability of our cross-sectional dependence assessment, we also employ Friedman's test in conjunction with the primary test.

3.2.2. Slope heterogeneity test

Given the diverse characteristics of the countries in the research dataset, it is essential to recognize that each cross-sectional unit may not be homogeneous. The homogeneity or heterogeneity of the slopes across the data is a crucial factor in ensuring the accuracy of the estimated results. Therefore, this study employs the slope heterogeneity test proposed by Pesaran and Yamagata (2008), specifically:

$$\widetilde{\Delta_{SH}} = (\mathrm{N})^{\frac{1}{2}}(2K)^{-\frac{1}{2}}\left(\frac{1}{N}\tilde{S} - k\right) \qquad (3)$$

$$\widetilde{\Delta_{ASH}} = (\mathrm{N})^{\frac{1}{2}}\left(\frac{2k(T-k-1)}{T+1}\right)^{-\frac{1}{2}}\left(\frac{1}{N}\tilde{S} - k\right) \qquad (4)$$

Among them, the adjusted delta tilde is $\widetilde{\Delta_{ASH}}$ and the delta tilde is $\widetilde{\Delta_{SH}}$.

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3.2.3. Stationary test

Following the assessment of cross-sectional dependence in the panel data, unit root tests are conducted to determine if a variable is stationary at level I(0) or at first difference I(1). Depending on the outcomes of the cross-sectional dependence test, if cross-sectional dependence is detected among countries, we apply second-generation stationarity tests, specifically the CADF and CIPS tests developed by Pesaran (2007). The CADF test addresses the issue of cross-sectional dependence and helps avoid erroneous regression estimates. The CADF model is specified in Equation (5).

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i \bar{y}_{t-1} + \sum_{j=0}^{k} \delta_{ik} \Delta \bar{y}_{t-j} + \sum_{j=1}^{k} \delta_{ik} \Delta y_{i,t-j} + \varepsilon_{it} \quad (5)$$

Where $\Delta y_{i,t-j}$ và $\bar{y}_{t-1}$ characterize the differences and lags of the variable being tested. After calculating CADF, CIPS is computed by averaging CADF and was introduced by Pesaran (2007) as follows:

$$CIPS = \frac{1}{N} \sum_{i=1}^{N} CADF \quad (6)$$

Conversely, if there is no cross-sectional dependence, we proceed to use first-generation unit root tests, such as Im, Pesaran, and Shin (IPS) (Im et al., 2003), Levin-Lin-Chu (LLC) (Levin et al., 2002), Breitung test (Breitung, 2001), and the ADF-Fisher test introduced by Maddala & Wu (1999).

3.2.4. Two-step System GMM

The study employs the Two-Step System Generalized Method of Moments (S-GMM) for estimation, a dynamic panel data technique introduced by Blundell and Bond (1998) and Arellano and Bover (1995). This two-step GMM method is advantageous for preserving data integrity and preventing unnecessary data loss. It is especially effective for balanced panel datasets, providing more accurate and consistent coefficient estimates (Arellano & Bover, 1995).

Several factors justify the use of the S-GMM approach. First, S-GMM is particularly effective when the number of cross-sectional units NNN exceeds the time periods TTT. In our study, which includes data from 45 countries (N = 45) over the period from 2002 to 2023 (T = 22), this technique is deemed appropriate.

Second, the model accounts for the potential endogeneity of the predictor variables, as lagged values of SD may correlate with past and current errors, leading to endogeneity issues. Third, the method handles country-specific fixed effects and potential collinearity among variables, which could be problematic if included variables are endogenous.

The S-GMM method also offers better explanatory power compared to traditional methods such as Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE). It effectively manages endogeneity and collinearity, particularly when dealing with endogenous factors. The approach also addresses reverse causality and measurement error issues (Hauk & Wacziarg, 2009), which are tested using Hansen's test.

To verify the validity of the instruments used in the regression, p-values from Hansen and Sargan tests are compared to the 5% significance threshold to ensure there are no issues with over-identification. These tests are crucial for ensuring the accuracy of instrumental variable estimates in econometric models (Canh et al., 2019; Sani et al., 2019). Additionally, the p-values for AR(1) and AR(2) are checked against the 5% significance level to test for autocorrelation, with the null hypothesis of no autocorrelation being upheld if the p-value is greater than 0.05.

Based on Equation (1), the research model is reformulated using S-GMM as the analytical method, resulting in the following proposed model:

$$SD_{it} = \alpha_0 + \varphi SD_{i,t-1} + \alpha_1 PE_{it} + \alpha_2 IQ_{it} + \alpha_3 (PE_{it} \times IQ)_{it} + \delta_{it} X_{it} + (\mu_i + \varepsilon_{it}) \quad (7)$$

In Equation (7), SD is the dependent variable representing SD, PE denotes public spending, and IQ signifies governance quality. The term $(PE_{it} \times IQ_{it})$ represents the interaction between public spending and governance quality. Additionally, X includes control variables in the model, which are economic growth (GDP), population (POP), foreign direct investment (FDI), education (EDU), and inflation (INF). Finally, $SD_{i,t-1}$ denotes the lagged dependent variable included in the regression model.

3.2.5. Robustness test with Method of Moments Quantile regression

To ensure the robustness of our findings, we utilize the Method of Moments Quantile regression (MMQR) approach as proposed by Machado and Santos Silva (2019). This method is advantageous for its ability to capture heterogeneity in variables across different quantile levels and effectively address issues such as extreme outliers and heteroscedasticity. Recent studies have highlighted that some conventional panel data methods may struggle with heterogeneity and time-varying

cross-sectional variance (Musa et al., 2024). In contrast, MMQR is adept at detecting conditional heteroscedastic effects (Awan et al., 2022).

Moreover, MMQR handles potential endogeneity in independent variables, making it well-suited for scenarios where model effects might obscure the structure of panel data. This approach provides reliable results for nonlinear models and accommodates asymmetry based on quantile positions (Awan et al., 2022; Machado & Santos Silva, 2019). MMQR can produce robust estimates across the entire distribution, addressing nonlinear relationships and heterogeneity effectively. Its robustness has been confirmed by recent research, demonstrating its reliability even in the presence of data irregularities (Berisha et al., 2023; Dada et al., 2023; Musa et al., 2024; Sun et al., 2024). Equation (8) presents a clear formulation for predicting the conditional quantile location scale $Q_y(\tau|R)$ variant:

$$Y_{it} = \alpha_i + X'_{it}\beta + (\delta_i + Z'_{it}\gamma)U_{it} \quad (8)$$

In this context, the probability $P\{\delta_1 + Z'_{it} > 0\} = 1.(\alpha, \beta', \delta, \gamma')'$ needs to be estimated. Here, $(\alpha_i, \delta_i), i = 1, \dots, n$, represent fixed effects for each unit i, while Z denotes a vector of known K factors of X. These factors are distinguishable transformations, and the elements l are as follows:

$$Z_l = Z_l(X), l = 1, \dots, k \quad (9)$$

For each fixed l, X'_{it} is uniformly and independently distributed at every time T. U_{it} is uniformly distributed across individuals iii and time ttt in the same manner and is orthogonal to X_{it}. The remaining variables do not need to be entirely exogenous, and Equation (9) can be expressed as follows:

$$Q_y(\tau|X_{it}) = \big(\alpha_i + \delta_i(\tau)\big) + X'_{it}\beta + Z'_{it}\gamma q(\tau) \quad (10)$$

In which, the vector of explanatory variables is denoted as X_{it}, $Q_y(\tau|X_{it})$ represents the vector of explained variables. The term $X'_{it} - \alpha_i(\tau) = \alpha_i + \delta_i q(\tau)$ signifies a scalar coefficient indicating that the quantile fixed effects τ differ from traditional ordinary least squares fixed effects in that individual effects do not shift the intersection point. These parameters are independent of temporal changes, and their heterogeneous impacts are influenced by variations in quantiles and different conditional distributions. The quantile τ, denoted as $q(\tau)$, is estimated by solving the derived optimization problem.

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$$min_q \sum_i \sum_t \rho\tau(R_{it} - (\delta_i + z'_{it}\gamma)q) \quad (11)$$

Where $\rho_\tau(A) = (\tau - 1)AI\{A \leq 0\} + TAI\{A > 0\}$, shows the check function. Next, based on the proposed model in Equation (1), we reformulate the model using the MMQR method by incorporating the variables from our research model. The details are presented in Equation (12).

$$Q_{SD}(\tau|X_{it}) = \alpha_{it} + \beta_{1\tau}PE_{it} + \beta_{2\tau}IQ_{it} + \beta_{3\tau}(PE_{it} \times IQ_{it}) + \beta_{4\tau}GDP_{it} + \beta_{5\tau}POP_{it} + \beta_{6\tau}FDI_{it} + \beta_{7\tau}EDU_{it} + \beta_{8\tau}INF_{it} + \varepsilon_{it} \quad (12)$$

4. Empirical results

4.1. Descriptive statistics

Table 2 provides the descriptive statistics for the variables in developing countries. Regarding the main variables of interest, Sustainable Development (SD) has a mean of 64.29, with values ranging from 38.18 to 81.80. Public Expenditure (PE), with a mean of 14.50% GDP and a standard deviation of 4.66. It exhibits a statistically significant positive correlation with SD (0.2184, $p < 0.01$). Governance quality (IQ), with a mean of -0.22 and a standard deviation of 0.54, ranges from -1.55 to 1.22, showing a significant positive correlation with SD.

Table 2 Descriptive statistics and correlation analysis

Variable	Obs	Mean	Std.Dev.	Min	Max	Correlation
SD	990	64.29	9.188	38.18	81.80	1.0000
PE	990	14.503	4.661	3.588	36.143	0.2184***
IQ	990	-0.219	0.539	-1.546	1.218	0.5714***
GDP	990	4800.647	3804.668	262.166	17269.99	0.8241***
POP	990	1.351	1.355	-6.187	11.794	-0.7429***
FDI	990	3.894	6.390	-40.086	106.532	0.1261***
EDU	990	99.31467	12.99058	38.684	140.372	0.3637***
INF	990	5.382175	5.11452	-8.975	51.461	-0.0354

Note: *, **, *** represent statistical significance at 10%, 5% and 1%, respectively.
Source: Author's calculation.

4.2. Cross-sectional dependence tests and panel unit root test results

Table 3 summarizes the results of the cross-sectional dependence tests. Sustainable Development (SD), Public Expenditure (PE), Gross Domestic Product (GDP), Population (POP), Foreign Direct Investment (FDI), Education (EDU), and Inflation

(INF) all exhibit significant cross-sectional dependence according to both Pesaran's CD-test and Friedman's CD-test. In contrast, Governance quality (IQ) does not show significant cross-sectional dependence in either test.

Table 3 Result of cross-sectional dependence

Variables	Pesaran's CD-test		Freidman CD-test	
	Statistics	p-value	Statistics	p-value
SD	136.295***	0.0000	874.052***	0.0000
PE	17.848***	0.0000	119.092***	0.0000
IQ	-0.528	0.5977	19.809	0.9994
GDP	105.157***	0.0000	662.594***	0.0000
POP	34.036***	0.0000	205.387***	0.0000
FDI	14.390***	0.0000	94.916***	0.0000
EDU	16.087***	0.0000	116.822***	0.0000
INF	50.111***	0.0000	297.103***	0.0000

Note: *, **, *** represent statistical significance at 10%, 5% and 1%, respectively.
Source: Author's calculation.

Table 4 presents the results of the slope heterogeneity test. The test statistics for both Delta and Adj. are significant, with values of 20.892 ($p < 0.01$) and 27.178 ($p < 0.01$), respectively. These results indicate the presence of slope heterogeneity in the data.

Table 4 Slope heterogeneity test

Slope heterogeneity		
Delta	20.892	0.000
Adj.	27.178	0.000

Source: Author's calculation.

Table 5 presents the results of the unit root test using the CIPS method to determine the order of integration for each variable. The test indicates that Sustainable Development (SD), Foreign Direct Investment (FDI), Education (EDU), and Inflation (INF) are stationary at the level, exhibiting an integration order of I(0). Conversely, Public Expenditure (PE), Gross Domestic Product (GDP), and Population (POP) display non-stationarity at the level but become stationary after first differencing, indicating they are integrated of order I(1). Specifically, PE has a test statistic of -1.964 at the level and -4.309 at the first difference; GDP shows -1.855 at the level and -3.441 at the first difference; and POP records -1.612 at the level and -3.026 at the first difference. These results are crucial for subsequent

econometric analyses, as they inform the appropriate modeling techniques based on the integration order of the variables.

Table 5 Results of the unit root test with CIPS

Variables	Level	First difference	Decision
SD	-2.648***	-	I(0)
PE	-1.964	-4.309***	I(1)
GDP	-1.855	-3.441***	I(1)
POP	-1.612	-3.026***	I(1)
FDI	-2.696***	-	I(0)
EDU	-2.467***	-	I(0)
INF	-3.177***	-	I(0)

Note: *, **, *** represent statistical significance at 10%, 5% and 1%, respectively.
Source: Author's calculation.

Table 6 presents the results of unit root tests conducted on the Governance quality (IQ) variable. At this level, the IQ variable is found to be non-stationary across most tests. However, when tested at the first difference, the IQ variable becomes stationary in all tests. The IPS test reveals a statistic of -14.308 with a p-value of 0.0000, the LLC test shows -11.9423 with a p-value of 0.0000, the ADF-Fisher test reports 486.5146 with a p-value of 0.0000, and the Breitung test indicates -8.0691 with a p-value of 0.0000. These findings suggest that the IQ variable is integrated with the order I(1), becoming stationary after first differencing.

Table 6 Results of the unit root test for IQ variable

Methods	Level		First difference	
	Statistics	p-value	Statistics	p-value
Im, Pesaran and Shin (IPS) test	-0.2339	0.4075	-14.308***	0.0000
Levin-Lin-Chu (LLC) test	-4.1027***	0.0000	-11.9423***	0.0000
ADF-Fisher test	88.0709	0.5379	486.515***	0.0000
Breitung test	1.2000	0.8849	-8.0691***	0.0000

Note: *, **, *** represent statistical significance at 10%, 5% and 1%, respectively.
Source: Author's calculation.

4.3. Results of S-GMM

Table 7 summarizes the results from the S-GMM estimation, where SD is the dependent variable and IQ represents governance quality. In addition, we also analyze the impact of each institutional component including: Voice and

Accountability (VA), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), Political Stability (PS), and Control of Corruption (CC).

For the dependent variable SD, the lagged variable SD (t-1) is consistently significant across all models, with coefficients ranging from 0.985 to 0.992. This suggests that SD exhibits strong persistence over time, indicating that past values of SD have a substantial influence on current values. This finding is consistent with studies such as those by Arellano and Bover (1995), which emphasize the importance of incorporating lagged dependent variables in dynamic panel data models to capture the persistence of the dependent variable.

The impact of public expenditure (PE) on SD is significant in all models, with coefficients ranging from 0.281 to 0.385. This implies that increased public spending positively influences SD outcomes. This aligns with the findings of recent studies, such as those by Gupta and Verhoeven (2022), who found that public investment in infrastructure and social services can enhance SD. This can be attributed to several factors, first, increased public expenditure often leads to investment in infrastructure projects, such as transportation, healthcare, and education, which are crucial for SD. Improved infrastructure supports economic growth, enhances quality of life, and promotes environmental sustainability. Second, public spending on social services, including healthcare and education, can improve human capital and social well-being. This contributes to SD by ensuring better health outcomes, higher educational attainment, and increased productivity.

The governance quality variable (IQ) shows a positive and significant effect on SD, with a coefficient of 0.712. Similar results were found for all six components of governance quality. This indicates that higher governance quality is associated with better SD outcomes. These results are consistent with research by Acemoglu and Robinson (2012), who argue that strong institutions contribute significantly to the economy and SD by fostering effective governance and policy implementation.

However, when we consider the interaction effects between governance quality and its components and public spending, we find strong statistical evidence of the negative effects of these interaction variables on SD. This finding supports the results of Kaufmann et al. (2009), who highlight that while accountability can improve policy effectiveness, its influence can vary based on the quality of governance; World Bank (2017), suggests that the quality of government effectiveness can impact the efficiency of public spending; Mauro (1995), who found that corruption and weak regulatory environments can undermine the effectiveness of public investment.

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The results suggest that higher governance quality can moderate the impact of public expenditure on SD, leading to a more nuanced understanding of this relationship. This can be explained based on several mechanisms as follows.

First, efficient allocation and use of resources: In countries with high governance quality, institutions are generally effective at ensuring that public expenditure is used efficiently. Such institutions provide a transparent framework for the allocation and utilization of funds. Consequently, additional public expenditure might yield diminishing returns in terms of SD, as the existing high-quality institutions already optimize resource allocation effectively. The marginal benefit of additional spending may be less pronounced in these contexts compared to countries with weaker institutions, where spending inefficiencies are more common.

Second, focus on high-impact interventions: High governance quality often leads to more targeted and strategic investments. Public spending in these countries may be directed towards areas with robust institutional support, such as advanced infrastructure or established social programs. While these investments contribute positively to SD, their relative impact might be less dramatic. High-quality institutions may already achieve substantial development outcomes with less expenditure, making the incremental benefits of additional spending less noticeable.

Third, strategic prioritization and policy integration: Effective institutions are adept at integrating public expenditure with broader development strategies and policies. This integrated approach can result in a more balanced allocation of resources based on strategic priorities. High-quality institutions may also prioritize sustainability goals that are already being met through existing programs and policies. Consequently, additional public expenditure might show less visible impact if it is incorporated into a framework where sustainability outcomes are already well-supported.

These results are supported by previous studies. Besley and Persson (2010) support the idea that high-quality institutions enhance the efficiency of public spending, potentially leading to smaller incremental improvements in development outcomes. Their work emphasizes that institutions with strong governance structures may already optimize resource allocation, affecting the marginal impact of additional spending. Additionally, the concept of diminishing marginal returns on spending, as discussed by Barro (1991), suggests that as governance quality improves, the relative benefits of additional public expenditure may decrease due to already efficient systems achieving substantial outcomes.

In summary, while higher governance quality generally enhances the effectiveness of public expenditure, it can also lead to a situation where the additional impact of such spending on SD is less pronounced. Efficient institutions may achieve

substantial development outcomes with less expenditure, resulting in smaller incremental improvements from additional spending.

Table 7 Results of S-GMM

Dep.Var: SD	(IQ)	(VA)	(GE)	(RQ)	(RL)	(PS)	(CC)
SD (t-1)	0.990***	0.992***	0.992***	0.986***	0.991***	0.992***	0.985***
	[0.00393]	[0.00402]	[0.00361]	[0.00424]	[0.00463]	[0.00375]	[0.00509]
PE	0.360***	0.348***	0.331***	0.281***	0.351***	0.336***	0.385***
	[0.0823]	[0.0818]	[0.0788]	[0.0722]	[0.0811]	[0.0803]	[0.0857]
IQ	0.712***						
	[0.234]						
PE*IQ	-0.045***						
	[0.0155]						
VA		0.645***					
		[0.241]					
PE*VA		-0.0405**					
		[0.0170]					
GE			0.487***				
			[0.169]				
PE*GE			-0.034***				
			[0.0124]				
RQ				0.582**			
				[0.288]			
PE*RQ				-0.0339*			
				[0.0192]			
RL					0.640***		
					[0.189]		
PE*RL					-0.042***		
					[0.0128]		
PS						0.410**	
						[0.187]	
PE*PS						-0.0274**	
						[0.0116]	
CC							0.766***
							[0.209]
PE*CC							-0.046***
							[0.0142]
GDP	9.125***	8.726***	8.553***	7.484***	9.191***	8.125***	10.02***
	[1.638]	[1.570]	[1.636]	[1.451]	[1.677]	[1.549]	[1.768]
POP	0.0845***	0.0772***	0.0831**	0.0620*	0.0861**	0.0741**	0.0778*
	[0.0323]	[0.0293]	[0.0332]	[0.0327]	[0.0362]	[0.0291]	[0.0398]
FDI	-0.007***	-0.006***	-0.007***	-0.006***	-0.007***	-0.006***	-0.007***
	[0.00112]	[0.00101]	[0.00123]	[0.00113]	[0.00118]	[0.00106]	[0.00129]
EDU	-0.227***	-0.205***	-0.224***	-0.203***	-0.230***	-0.206***	-0.252***
	[0.0297]	[0.0265]	[0.0320]	[0.0260]	[0.0310]	[0.0288]	[0.0326]
INF	-0.009***	-0.009***	-0.010***	-0.009***	-0.010***	-0.009***	-0.009***
	[0.00311]	[0.00310]	[0.00304]	[0.00332]	[0.00305]	[0.00305]	[0.00315]

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Const	0.711**	0.608*	0.551*	1.024***	0.612	0.593*	1.009**
	[0.337]	[0.335]	[0.323]	[0.347]	[0.391]	[0.318]	[0.430]
N	900	900	900	900	900	900	900
No. of IVs	39	39	39	39	39	39	39
Countries	45	45	45	45	45	45	45
AR(2) test	(0.772)	(0.756)	(0.722)	(0.635)	(0.739)	(0.766)	(0.775)
Sargan test	(0.060)	(0.038)	(0.034)	(0.038)	(0.063)	(0.022)	(0.122)
Hansen test	(0.226)	(0.221)	(0.239)	(0.195)	(0.227)	(0.179)	(0.272)

Note: standard error in []; p-value in (); *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.
Source: Author's calculation.

In addition, control variables such as GDP, POP, FDI, EDU, and INF show consistently significant effects on SD. For instance, GDP consistently has a positive and significant impact, with coefficients ranging from 7.484 to 10.02. Similarly, POP has a positive effect, with coefficients ranging from 0.0620 to 0.0861. FDI and EDU exhibit negative effects on SD. The consistently positive impact of GDP on SD underscores the role of economic growth in supporting SD, echoing the findings of Dollar and Kraay (2002), who found that economic growth is a key driver of development outcomes. The positive effect of population on SD suggests that a higher population might correlate with better development outcomes, consistent with studies like those by Bloom and Canning (2004), which discuss the role of demographic changes in development. The negative impact of FDI on SD may reflect potential issues with the quality of FDI or its management, a result that aligns with the findings of Loungani and Mauro (2002), who found mixed effects of FDI on development outcomes. The consistently negative impact of inflation on SD highlights the detrimental effect of inflation on development, a finding consistent with the research by Bruno and Easterly (1998), who found that high inflation undermines economic stability and development.

The results of the diagnostic tests indicate that the models are robust, with satisfactory AR(2) test results and Sargan and Hansen test p-values confirming the validity of the instruments used in the estimations.

4.4. Robustness test

The results of the robustness test with the MMQR, as shown in Table 8, confirm our previous findings. The impact of public expenditure varies across quantiles. At lower quantiles (Q10, Q20), the coefficients are negative and significant, indicating that increased public spending is associated with a decrease in SD in these contexts. However, at higher quantiles (Q70, Q80, Q90), the impact becomes positive and significant, suggesting that in contexts with better SD outcomes, additional public expenditure is associated with further improvements in SD. These findings align

with the diminishing marginal returns hypothesis, where the impact of public spending becomes less pronounced as governance quality improves or reaches certain thresholds.

The coefficients for IQ are consistently positive and significant across all quantiles, indicating that higher governance quality strongly enhances SD. The impact remains robust at various points in the distribution of SD, reinforcing the notion that good governance quality is crucial for achieving better development outcomes.

The interaction between public expenditure and governance quality significantly negatively affects most quantiles. This suggests that while governance quality generally enhances the effectiveness of public spending, its positive impact might be moderated at higher quantiles, where the returns to additional public spending are diminished. This finding is consistent with the idea that high-quality institutions may already achieve substantial outcomes with less spending, thus the incremental impact of additional expenditure is less significant.

The findings on the control variables are similar to the S-GMM estimates.

Overall, the robustness test with MMQR confirms the nuanced effects of public expenditure and governance quality on SD, highlighting the importance of considering institutional contexts and distributional effects when assessing the impact of public policies.

5. Conclusions and policy recommendations

Sustainable development has become a central focus of global policy discussions, driven by the need to balance economic growth, environmental protection, and social equity. As nations strive to enhance their development outcomes, the role of public expenditure and governance quality has gained prominence. Public expenditure is often viewed as a critical tool for promoting development, but its effectiveness can be significantly influenced by the quality of institutions governing its use. This study employs the System Generalized Method of Moments (S-GMM) to analyze the interplay between public expenditure, governance quality, and SD. By examining the direct impact of public expenditure, and the moderating role of governance quality, this analysis provides a comprehensive understanding of how these factors interact to shape development outcomes. The focus on governance quality offers insights into how the effectiveness of public spending can be influenced by the strength of governance and institutional frameworks. Our results are also robust with the MMQR estimate.

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Table 8 Robustness test with MMQR

Variables	Location	Scale	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
PE	-0.00267	0.141***	-0.240***	-0.147**	-0.0840	-0.0417	0.00562	0.0485	0.0944	0.152**	0.219***
	[0.0591]	[0.0386]	[0.0903]	[0.0722]	[0.0640]	[0.0604]	[0.0591]	[0.0601]	[0.0639]	[0.0713]	[0.0827]
IQ	9.865***	0.594	8.864***	9.255***	9.522***	9.701***	9.900***	10.08***	10.27***	10.52***	10.80***
	[1.214]	[0.794]	[1.839]	[1.486]	[1.313]	[1.241]	[1.213]	[1.237]	[1.313]	[1.469]	[1.708]
PE*IQ	-0.338***	-0.0188	-0.306**	-0.318***	-0.327***	-0.333***	-0.339***	-0.345***	-0.351***	-0.359***	-0.367***
	[0.0796]	[0.0520]	[0.120]	[0.0974]	[0.0860]	[0.0814]	[0.0795]	[0.0811]	[0.0861]	[0.0963]	[0.112]
GDP	18.53***	1.080	20.35***	19.64***	19.16***	18.83***	18.47***	18.14***	17.79***	17.35***	16.84**
	[5.159]	[3.373]	[7.811]	[6.316]	[5.579]	[5.276]	[5.155]	[5.258]	[5.580]	[6.244]	[7.262]
POP	4.166***	1.079***	5.983***	5.274***	4.788***	4.464***	4.102***	3.774***	3.423***	2.979***	2.469***
	[0.266]	[0.174]	[0.414]	[0.325]	[0.289]	[0.272]	[0.267]	[0.270]	[0.288]	[0.321]	[0.370]
FDI	-0.066***	-0.0200	-0.099***	-0.086***	-0.077***	-0.071***	-0.065***	-0.058**	-0.052*	-0.0437	-0.0343
	[0.0247]	[0.0162]	[0.0374]	[0.0303]	[0.0267]	[0.0253]	[0.0247]	[0.0252]	[0.0267]	[0.0299]	[0.0348]
EDU	-0.239***	0.00699	-0.250**	-0.246***	-0.243***	-0.240***	-0.238***	-0.236***	-0.234***	-0.231**	-0.228**
	[0.0749]	[0.0490]	[0.113]	[0.0917]	[0.0810]	[0.0766]	[0.0749]	[0.0764]	[0.0810]	[0.0907]	[0.105]
INF	-0.0176	0.00439	-0.0250	-0.0221	-0.0202	-0.0189	-0.0174	-0.0160	-0.0146	-0.0128	-0.0107
	[0.0386]	[0.0252]	[0.0584]	[0.0472]	[0.0417]	[0.0394]	[0.0385]	[0.0393]	[0.0417]	[0.0467]	[0.0543]
Const	71.81***	0.602	70.80***	71.19***	71.46***	71.64***	71.85***	72.03***	72.23***	72.47***	72.76***
	[1.036]	[0.677]	[1.567]	[1.269]	[1.120]	[1.060]	[1.036]	[1.057]	[1.121]	[1.255]	[1.460]
N	945	945	945	945	945	945	945	945	945	945	945

Note: Standard errors in [ ]; *, **, *** represent statistical significance at 10%, 5% and 1%, respectively.
Source: Author's calculation.

The results show that SD exhibits significant persistence over time, as indicated by the strong coefficients for the lagged dependent variable (SD(t-1)). This persistence underscores the influence of historical development trends on current outcomes, highlighting the importance of considering long-term patterns in SD.

Public expenditure has a consistently positive impact on SD, with coefficients ranging from 0.281 to 0.385. This suggests that increased public spending contributes positively to development outcomes. However, the extent of this impact varies, reflecting the complex interaction between expenditure and development goals. Additionally, higher governance quality, as measured by the IQ variable, significantly enhances SD. This result emphasizes that effective institutions are crucial for achieving better development outcomes by facilitating better governance, resource allocation, and policy implementation.

The interaction terms between public expenditure and components of governance quality reveal nuanced effects. For instance, the negative impact of the interaction term PEIQ suggests that while high-quality institutions enhance the effectiveness of public expenditure, the incremental benefits of additional spending may diminish in contexts with already strong institutions. Similar patterns are observed with other interaction terms, such as PE*VA, PE*GE, PE*RQ, PE*RL, PE*PS, and PE*CC, indicating that the effectiveness of public expenditure is influenced by various aspects of governance quality.

Based on these findings, several policy recommendations emerge. First, policymakers should prioritize strengthening institutional frameworks to improve the overall effectiveness of public expenditure. High-quality institutions that ensure transparency, accountability, and efficient resource allocation are crucial for maximizing the benefits of public spending. Second, while public expenditure positively impacts SD, its effectiveness may be moderated by governance quality. Therefore, it is important to strategically target public spending in areas where it can have the most significant impact, particularly in contexts with varying levels of institutional effectiveness. Continuous monitoring and evaluation of public expenditure and governance quality are necessary to make informed policy adjustments. Addressing inefficiencies in public spending and supporting comprehensive development strategies can further enhance SD outcomes. In summary, while public expenditure is a key driver of SD, its impact is significantly influenced by governance quality. Strengthening institutions and strategically directing public spending are essential for achieving meaningful and SD outcomes.

The findings from this study contribute to the ongoing discourse on development policy by highlighting the importance of both effective institutions and strategic

public expenditure. As policymakers grapple with the challenges of achieving SD, understanding these dynamics can guide the formulation of policies that maximize the benefits of public spending while fostering robust institutional environments. The results emphasize the need for a nuanced approach to public expenditure that considers the varying impacts across different institutional contexts and underscores the critical role of governance quality in shaping development outcomes.

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Author Contributions
- Thi Lam Ho: Project administration, Conceptualization, Formal analysis, Writing – original draft, Writing – review and editing.
- Le Hong Ngoc: Resources, Data curation, Methodology, Software.

Disclosure Statement
The authors report there are no competing interests to declare.

References
1. Acemoglu, D., & Robinson, J. A. (2012). *Why Nations Fail: The Origins of Power, Prosperity, and Poverty.* Crown Publishing Group.
2. Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review, 91*(5), 1369-1401.
3. Akai, N. (2024). Evidence-based policymaking in Japan's public expenditure: Compatibility of fiscal health and investing for the future. *Asia Pacific Business Review*, 1-14, 514–527. https://doi.org/10.1080/13602381.2024.2320543
4. Awan, A., Abbasi, K. R., Rej, S., Bandyopadhyay, A., & Lv, K. (2022). The impact of renewable energy, internet use and foreign direct investment on carbon dioxide emissions: A method of moments quantile analysis. *Renewable Energy, 189*, 454–466. https://doi.org/10.1016/j.renene.2022.03.017
5. Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics, 68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

6. Arvin, M. B., Pradhan, R. P., & Nair, M. S. (2021). Are there links between governance quality, government expenditure, tax revenue and economic growth? Evidence from low-income and lower-middle-income countries. *Economic Analysis and Policy*, 70, 468–489. https://doi.org/10.1016/j.eap.2021.03.011
7. Azam, W., Khan, I., & Ali, S. A. (2023). Alternative energy and natural resources in determining environmental sustainability: A look at the role of government final consumption expenditures in France. *Environmental Science and Pollution Research, 30*(1), 1949–1965. https://doi.org/10.1007/s11356-022-22334-z
8. Barro, R. J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics, 106*(2), 407-443. https://doi.org/10.2307/2937943
9. Bazie, P., Thiombiano, N., & Maiga, E. W. H. (2023). Fighting corruption in developing countries to meet the challenge of human capital development: Evidence from Sub-Saharan African countries. *Journal of the Knowledge Economy*. https://doi.org/10.1007/s13132-023-01330-9
10. Besley, T., & Persson, T. (2010). State Capacity, Conflict, and Development. *Econometrica, 78*(1), 1-34. https://doi.org/10.3982/ECTA8025
11. Bloom, D. E., & Canning, D. (2004). Global demographic change: Dimensions and economic significance. *Population and Development Review, 30*(1), 26-51. https://doi.org/10.1111/j.1728-4457.2004.00002.x
12. Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8
13. Brundtland, G. H. (1987). *Our Common Future: Report of the World Commission on Environment and Development.* Oxford University Press.
14. Breitung, J. (2001). The local power of some unit root tests for panel data. In B. H. Baltagi, T. B. Fomby, & R. Carter Hill (Eds.), *Nonstationary Panels, Panel Cointegration, and Dynamic Panels* (Vol. 15, pp. 161–177). Emerald Group Publishing Limited. https://doi.org/10.1016/S0731-9053(00)15006-6
15. Canh, N. P., Schinckus, C., & Thanh, S. D. (2019). Do economic openness and governance quality influence patents? Evidence from GMM systems estimates. *International Economics, 157*, 134–169. https://doi.org/10.1016/j.inteco.2018.10.002
16. Calderón, C., & Servén, L. (2010). Infrastructure and economic development in Sub-Saharan Africa. *Journal of African Economies, 19*(1), i13-i87.
17. Chudik, A., & Pesaran, M. H. (2022). An augmented Anderson–Hsiao estimator for dynamic short-T panels. *Econometric Reviews, 41*(4), 416–447. https://doi.org/10.1080/07474938.2021.1971388
18. Dollar, D., & Kraay, A. (2002). Growth is Good for the Poor. *Journal of Economic Growth, 7*(3), 195-225. https://doi.org/10.1023/A:1015759422837
19. Dollar, D., & Kraay, A. (2003). Institutions, trade, and growth. *Journal of Monetary Economics, 50*(1), 133-162.

20. Dada, J. T., Ajide, F. M., & Arnaut, M. (2023). Income inequality, shadow economy and environmental degradation in Africa: Quantile regression via moment's approach. *International Journal of Development Issues, 22*(2), 214–240. https://doi.org/10.1108/IJDI-11-2022-0248
21. Esfahani, H. S., & Ramírez, M. T. (2003). Institutions, infrastructure, and economic growth. *Journal of Development Economics, 70*(2), 443-477.
22. Fredriksson, P. G., & Svensson, J. (2003). Political instability, corruption and policy formation: The case of environmental policy. *Journal of Public Economics, 87*(7-8), 1383-1405.
23. Guerrero, O.A., Castañeda, G. (2022). How does government expenditure impact sustainable development? Studying the multidimensional link between budgets and development gaps. *Sustainability Science* 17, 987–1007. https://doi.org/10.1007/s11625-022-01095-1
24. Gupta, S., & Verhoeven, M. (2022). Public investment and sustainable development: Evidence from a cross-country analysis. *World Development, 144*, 105469. https://doi.org/10.1016/j.worlddev.2021.105469
25. Gupta, S., Verhoeven, M., & Tiongson, E. R. (2002). The effectiveness of government spending on education and health care in developing and transition economies. *European Journal of Political Economy, 18*(4), 717-737.
26. Hauk, W. R., & Wacziarg, R. (2009). A Monte Carlo study of growth regressions. *Journal of Economic Growth, 14*(2), 103–147. https://doi.org/10.1007/s10887-009-9040-3
27. Halásková, R., Halásková, M., & Pomp, M. (2023). The effect of government expenditures on the economic and institutional dimension of governance in European countries. Scientific Papers of the University of Pardubice. *Series D, Faculty of Economics and Administration*, 31(1), 1690–1705. https://doi.org/10.46585/sp31011690
28. Hsiao, C. (2022). *Analysis of panel data* (Issue 64). Cambridge University Press.
29. Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), 53–74. https://doi.org/10.1016/S0304-4076(03)00092-7
30. Kaufmann, D., Kraay, A., & Mastrorillo, M. (2009). Governance and the quality of growth. *World Bank Policy Research Working Paper, 4280*. https://doi.org/10.1596/1813-9450-4280
31. Kpegba, S. A., Oppong, C., & Atchulo, A. S. (2023). Urban entrepreneurship, public management and sustainability nexus: Evidence from developing countries. *Sustainable Development*, 32(1), 520–528.
32. Kpegba, S. A., Atisu, L. K. K., Nketiah Sarfo, K., Oppong, C., & Akwaa-Sekyi, E. K. (2024). Public expenditure and economic sustainability: Does governance quality matter? *Sustainable Development*. https://doi.org/10.1002/sd.3024
33. Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics, 108*(1), 1–24. https://doi.org/10.1016/S0304-4076(01)00098-7

34. Loungani, P., & Mauro, P. (2002). Capital flight: A subtractive model of FDI and economic growth. *IMF Working Paper WP/02/41*. https://doi.org/10.5089/9781451843820.001
35. Machado, J. A. F., & Santos Silva, J. M. C. (2019). Quantiles via moments. *Journal of Econometrics, 213*(1), 145–173. https://doi.org/10.1016/j.jeconom.2019.04.009
36. Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics, 61*(S1), 631–652. https://doi.org/10.1111/1468-0084.0610s1631
37. Mauro, P. (1995). Corruption and growth. *Quarterly Journal of Economics, 110*(3), 681-712. https://doi.org/10.2307/2946696
38. Mauro, P. (1998). Corruption and the composition of government expenditure. *Journal of Public Economics, 69*(2), 263-279.
39. Musa, S. A., & Mavrotas, G. (2024). The impact of public spending on economic growth: A panel data analysis of African countries. *Journal of African Economies, 33*(1), 34–56. https://doi.org/10.1093/jae/ejad007
40. Ndung'u, N., & Wambugu, A. (2019). The effect of public investment on economic growth in Africa. *African Development Review, 31*(1), 15–30. https://doi.org/10.1111/1467-8268.12329
41. Nicolò, G., L'Abate, V., Raimo, N., & Vitolla, F. (2024). Exploring the antecedents of local governments' sustainability disclosure: The role of the mayor. *Journal of Public Affairs*, 24(1), e2908. https://doi.org/10.1002/pa.2908
42. Nugent, J. B. (2000). Institutions and economic development: A critical review. *Journal of Development Studies, 36*(3), 1-19. https://doi.org/10.1080/00220380412331322161
43. Olsson, O. D., & Svensson, J. (2001). Why countries develop differently: Institutions and growth in the context of global development. *World Development, 29*(2), 161-186.
44. Oppong, C., Salifu Atchulo, A., & Fatia Oman, S. (2023). Public debt and economic growth nexus in Sub-Saharan Africa: Does governance quality matter? *International Review of Applied Economics*, 37(3), 311–323. https://doi.org/10.1080/02692171.2023.2205107
45. Osei, R. D., & Boakye, S. (2024). Public spending and its impact on economic development: An empirical analysis of governance quality. *Journal of African Business, 25*(2), 246–269. https://doi.org/10.1080/15228916.2024.2087390
46. Pritchett, L., & Summers, L. H. (1996). Wealthier is healthier. *Journal of Human Resources, 31*(4), 847-868. https://doi.org/10.2307/146016
47. Rodrik, D. (1999). Where did all the growth go? External shocks, social conflicts, and growth collapse. *Journal of Economic Growth, 4*(4), 385-412. https://doi.org/10.1023/A:1009879600518
48. Sachs, J. D., & Warner, A. M. (1997). Sources of long-term growth: The role of geography and institutions. *Harvard University Working Paper*.
49. Svensson, J. (2005). Eight questions about corruption. *Journal of Economic Perspectives, 19*(3), 19-42. https://doi.org/10.1257/089533005774357850

50. Tella, R. D., & MacCulloch, R. J. (2001). Policymaking and human happiness. *Journal of Economic Perspectives, 15*(1), 125-142. https://doi.org/10.1257/jep.15.1.125
51. Viet Hong Anh, N., & Thi Kim Oanh, T. (2023). Role of institution quality in the impact of government expenditure on economic development: A case study in Vietnamese provinces. *Macroeconomics and Finance in Emerging Market Economies*, 16(3), 409–427.
52. Wang, M., & Yang, L. (2023). Governance quality, fiscal decentralization, and economic growth: Evidence from West Africa. *African Development Review, 35*(1), 123–145. https://doi.org/10.1111/1467-8268.12543
53. World Bank. (2021). *World Development Indicators.* World Bank.
54. Zhou, Y., & Li, X. (2023). The role of governance quality in shaping the effect of government spending on economic performance. *Economic Modelling, 112*, 105716. https://doi.org/10.1016/j.econmod.2022.105716.

Appendix

Appendix 1: List of research countries (45 developing countries)

Albania	Croatia	Kyrgyz Republic	Poland
Armenia	Dominican Republic	Malaysia	Romania
Botswana	Ecuador	Mali	Senegal
Brazil	Egypt, Arab Rep.	Mauritius	South Africa
Bulgaria	Ghana	Mexico	Tanzania
Burkina Faso	Honduras	Moldova	Thailand
Burundi	Hungary	Mongolia	Togo
Chad	India	Niger	Tunisia
Chile	Indonesia	Pakistan	Viet Nam
China	Jamaica	Paraguay	
Colombia	Jordan	Peru	
Costa Rica	Kenya	Philippines	

Appendix 2: 17 Sustainable Development Goals

1. No Poverty
2. No Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

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