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Research Article

Governance Quality, Informality, and Sustainable Tax Capacity in BRICS: A Panel Mediation Analysis

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ABSTRACT

This study investigates whether governance quality enhances sustainable tax revenue by reducing the size of the informal economy, an underexplored transmission channel in emerging economies. Focusing on BRICS countries (Brazil, Russia, India, China, South Africa) over 2000–2023, we integrate the Quality of Government framework, Agency Theory, and the fiscal social contract perspective to propose a mediation model in which stronger institutions lower informality, thereby broadening the tax base. Using an unbalanced panel, we employ counterfactual causal mediation analysis via fixed-effects regressions and bootstrapping, complemented by dynamic system GMM to address sequential ignorability and endogeneity. After controlling for GDP per capita, inflation, unemployment, financial inclusion, and digital payments, governance quality exhibits a significant positive direct effect on tax revenue and a significant negative effect on informality. The indirect effect through informality is 0.317, confirming partial mediation. Furthermore, digital financial inclusion strengthens the governance–formalization link, evidence of moderated mediation. These findings extend the governance–tax literature by demonstrating that formalization is a critical mechanism, especially where informality is pervasive. Policy strategies should therefore sequence institutional reforms with formalization incentives and digital infrastructure development to maximize fiscal capacity.

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1. Introduction

The ability of states to raise tax revenue is a cornerstone of fiscal capacity, macroeconomic stability, and sustainable development. A rich empirical literature has documented the positive influence of governance quality, government effectiveness, regulatory quality, rule of law, control of corruption, political stability, and voice and accountability, on tax revenue performance (Salman et al., 2022; Dramane, 2022; Anjarwi, 2025; Bah, 2024). A particularly comprehensive contribution is the study by Kalsum et al. (2026), which examines the governance–tax revenue nexus in seven ASEAN countries over 1996–2023. The study finds that while several governance dimensions positively affect tax revenue, control of corruption and political stability exhibit short-term negative effects, which are attributable to transitional adjustment costs. However, the analysis treats governance dimensions as direct determinants of tax revenue, without explicitly modelling the structural pathways through which institutional quality translates into higher fiscal capacity.

One of the most critical, and in the existing literature largely omitted, channels linking governance to tax revenue is the informal economy. In emerging and developing countries, informal economic activity often accounts for a substantial share of output and employment, eroding the tax base, undermining compliance, and generating tax leakage (Neog & Gaur, 2021; Lengaram et al., 2025; Mpanza & Mahosi, 2026). The BRICS bloc, Brazil, Russia, India, China, and South Africa, epitomizes this challenge. Despite their global economic weight and varying degrees of institutional development, BRICS nations continue to grapple with large informal sectors, ranging from artisanal mining and unregistered micro-enterprises to undeclared service activities and cross-border petty trade (Mpanza & Mahosi, 2026; Neog & Gaur, 2021). In such environments, the effectiveness of governance reforms in raising tax revenue is likely mediated by the extent to which they succeed in reducing informality and bringing economic actors into the formal fold.

Building upon the baseline governance–tax revenue literature; specifically the work of Kalsum et al. (2026); this study introduces the informal economy as a mediating variable. The central research question we address is: *Does governance quality improve sustainable tax revenue by reducing informality in BRICS economies?* To answer this question, we propose a causal pathway: improved governance; characterized by stricter legal enforcement, reduced corruption, heightened institutional trust, and lower compliance costs; encourages formal sector participation, thereby expanding the tax base and increasing tax revenues. This mechanism is consistent with a broad range of theoretical perspectives, including the Quality of Government (QoG) framework (Kaufmann et al., 2011), Agency Theory (Jensen & Meckling, 1976), and the fiscal social contract literature (Besley & Dray, 2024; Weigel, 2020).

Our contribution is threefold and markedly advances the existing literature. First, we extend the governance–tax revenue framework by explicitly modeling the informal economy as a transmission channel. This approach decisively advances the literature beyond the direct-effects estimations that currently dominate the field. Second, we shift the empirical focus from ASEAN to the BRICS grouping, where informality is larger, tax leakage more severe, and the policy relevance of the formalization mechanism arguably greater. Third, we pioneer a more rigorous methodological framework that combines fixed-effects panel regressions with bootstrapping-based mediation analysis and dynamic system GMM, delivering stronger causal evidence than the baseline OLS-type panel estimates. Furthermore, we uncover a novel boundary condition: digital financial inclusion strengthens the governance–formalization link, providing the first evidence of moderated mediation in the governance–informality–tax revenue nexus.

The remainder of the paper proceeds in six sections. Section 2 reviews the intersecting literatures on governance, informality, and tax capacity, identifying the empirical and theoretical gaps that motivate our study. Section 3 details the data sources, variable construction, and econometric approach, with special emphasis on the panel mediation model employed to disentangle direct and

indirect pathways. Section 4 presents the full set of empirical results, covering direct, indirect, and total effects, supplemented by a comprehensive battery of robustness checks. Section 5 offers an integrated discussion of our findings against existing theoretical and empirical benchmarks, and draws out their concrete policy ramifications for developing-economy contexts. Section 6 concludes the paper by summarizing the core contributions.

2. Literature Review

2.1 Quality and Tax Revenue Governance

A substantial body of work has demonstrated that governance quality is a fundamental determinant of tax revenue performance. Using the six Worldwide Governance Indicators (WGI) developed by the World Bank, researchers have shown that government effectiveness, regulatory quality, rule of law, and control of corruption are all positively associated with higher tax-to-GDP ratios (Salman et al., 2022; Bah, 2024; Dramane, 2022; Mohammed & Sanusi, 2020). For instance, Salman *et al.* (2022) find that transparent governance and strong legal institutions significantly enhance tax revenue mobilization in West Africa. Similarly, Dramane (2022) provides evidence from WAEMU countries that corruption control and government effectiveness are critical for boosting tax revenue.

The study by Kalsum et al. (2026) offers a comprehensive analysis for seven ASEAN countries over 1996-2023, revealing that government effectiveness, regulatory quality, rule of law, and voice and accountability all exert positive and significant direct effects on tax revenue. Intriguingly, they also report that control of corruption and political stability display negative short-term coefficients, which they interpret as transitional adjustment costs of institutional reform. This finding underscores a crucial insight: the governance–tax revenue relationship is not monotonic and may depend on context-specific structural conditions. Yet, the ASEAN study, like many others, stops short of examining the indirect pathways through which governance operates.

In the BRICS context, evidence on the governance–tax nexus, while sparser, aligns with the broader international findings. Das and Mukhopadhyay (2024) show that governance quality, particularly political stability and control of corruption, is a significant driver of economic growth in BRICS, which in turn expands the tax base. Mazenda and Cheteni (2021) find that governance quality improves economic welfare, while Chigome and Robinson (2021) confirm that institutional quality enhances tax capacity and tax effort in Southern Africa, a region that shares many structural features with South Africa, a key BRICS member. Saba and Monkam (2025) further demonstrate that AI-driven governance improvements significantly boost tax revenue in BRICS-plus nations, but only when accompanied by robust institutional frameworks. These studies collectively indicate that governance matters for fiscal outcomes, but they rarely consider the size of the informal sector as a conditioning or mediating variable.

2.2 The Informal Economy and Tax Capacity

The informal economy, which includes both the shadow economy (legal activities hidden from tax authorities) and subsistence-type informal production, remains a major obstacle to tax revenue mobilisation in developing and emerging economies. In BRICS countries, estimates of the informal sector's share of GDP range from about 15% in China and Russia to well over 30% in Brazil, India, and South Africa (Neog & Gaur, 2021; Medina & Schneider, 2018). Beyond its sheer size, informality is qualitatively distinct across these nations: it manifests as unregistered micro-enterprises in India, large-scale tax evasion in parts of Brazil and Russia, and a pervasive culture of informal employment in South Africa (Mpanza & Mahosi, 2026; Richter, 2019).

Empirically, a larger informal economy depresses tax collection through several channels. First, it narrows the effective tax base, as a significant portion of economic activity goes unreported (Lengaram et al., 2025). Second, it creates unfair competition for formal firms, reducing their profitability and hence corporate tax payments (Williams & Bezeredi, 2020). Third, it fosters a

low-compliance culture that can spill over into the formal sector, weakening tax morale and voluntary compliance (Sebele-Mpofu, 2020; Batrancea et al., 2022). Furthermore, informality does not operate in an institutional vacuum. Neog and Gaur (2021), analyzing panel data for BRICS, demonstrate that the shadow economy and corruption are mutually reinforcing phenomena that compound each other's detrimental effects on tax revenue. Specifically, high levels of public sector corruption lower the risks and costs of operating informally, as state officials and tax inspectors can be bribed to overlook unregistered activities and tax evasion. Because corruption facilitates the shadow economy; and the shadow economy generates the illicit rents that sustain corruption; these two factors act as synergistic, interacting drains on fiscal capacity. This implies that governance deficits and informality are not independent explanatory variables, but rather deeply intertwined structural barriers.

The literature on formalization policies highlights that reducing informality is challenging but yields substantial fiscal dividends. For Brazil, Erosa et al. (2023) estimate that lowering informality can increase tax revenue by over 33%. In India, digital technology adoption among informal firms has been shown to increase sales and potentially move them toward formalization (Dutta et al., 2023). In Sub-Saharan Africa, which shares institutional characteristics with South Africa, Bati (2025) demonstrates that a larger shadow economy significantly reduces tax revenue, emphasizing the need for policy interventions that address the root causes of informality.

2.3 The Mediating Role of Informality

The idea that governance quality reduces informality, which in turn enhances tax capacity, is theoretically intuitive but only partially tested. Kaufmann et al. (2011) argue that good governance, including the rule of law, corruption control, and government effectiveness, lowers the costs and risks of formality, making registration and tax compliance more attractive. From the perspective of agency theory (Jensen & Meckling, 1976), institutional fragility exacerbates informational asymmetries between the state and economic

actors, thereby fostering opportunistic behaviors, most notably tax evasion and regulatory noncompliance. Conversely, robust governance mechanisms that mitigate such asymmetries can effectively curtail the scale of the informal economy. Complementing this perspective, the fiscal social contract literature contends that citizens' willingness to formalize and comply with tax obligations is intrinsically linked to their perceptions of public sector transparency and the efficient conversion of tax revenues into tangible public goods and services (Besley & Dray, 2024; Weigel, 2020). Taken together, these theoretical strands imply that governance quality operates as a critical catalytic mechanism, reallocating productive activity from the informal sphere toward formal institutional channels.

Some empirical work provides indirect support for such a mediated relationship. Bekana (2025) finds that governance quality enhances tax revenue in Africa, but notes that this effect is weaker in countries with large informal economies. Similarly, Saba and Monkam (2025) show that the impact of AI-driven tax systems in BRICS-plus nations is contingent on institutional quality; these systems often work by increasing formalization through digital monitoring. However, no study to date has explicitly tested a mediation model in which governance quality raises tax revenue through a reduction in the informal economy using a systematic panel mediation framework.

The baseline study by Kalsum et al. (2026) provides a detailed analysis of governance dimensions and tax revenue in ASEAN, but it does not incorporate the informal economy mechanism. Given that informality is considerably larger and more structurally entrenched in BRICS than in many ASEAN economies, the omission is significant. Our paper fills this gap by introducing the informal economy as a mediator. We also advance the methodological approach from static panel regression to bootstrapped mediation and dynamic panel GMM, thereby addressing endogeneity concerns that have plagued much of the previous literature.

2.4. Hypotheses Development

We synthesise insights from the Quality of Government (QoG) framework, Agency Theory, and the fiscal social contract theory to develop a conceptual model of the governance–informality–tax revenue nexus.

The QoG framework (Kaufmann et al., 2011) posits that high-quality institutions, reflected in government effectiveness, regulatory quality, rule of law, corruption control, political stability, and accountability, create an enabling environment for economic activity by reducing transaction costs, enforcing contracts, and protecting property rights. In such an environment, the net benefits of formality (access to formal credit, legal protection, and public services) outweigh the costs of tax compliance and registration. Consequently, firms and workers are more likely to operate in the formal sector, narrowing the informal economy.

Agency Theory (Jensen & Meckling, 1976) adds that weak governance fosters information asymmetries between the state and economic agents, enabling tax evasion and informal practices. Stronger governance institutions mitigate these asymmetries by increasing transparency, improving tax administration, and raising the probability of detecting non-compliance. This not only directly enhances tax revenue but also indirectly reduces the attractiveness of informality.

The fiscal social contract perspective (Weigel, 2020; Besley & Dray, 2024) emphasizes that trust in government, and perceptions of fairness are crucial for voluntary compliance. When governance quality is high, citizens trust that tax revenues will be used to provide public goods, and they are more willing to formalize and pay taxes. Thus, governance-induced trust reduces the willingness to operate informally.

These mechanisms lead to the following testable hypotheses:

- **H1:** Governance quality has a positive total effect on tax revenue.
- **H2:** Governance quality reduces the size of the informal economy.
- **H3:** The informal economy has a negative effect on tax revenue.

- **H4:** The informal economy mediates the relationship between governance quality and tax revenue; i.e., there is a positive indirect effect of governance on tax revenue through a reduction in informality.
- **H5:** Digital financial inclusion strengthens the negative effect of governance on informality (moderated mediation), as digital payment systems facilitate formalization and broaden the tax base.

The conceptual diagram below captures these relationships:

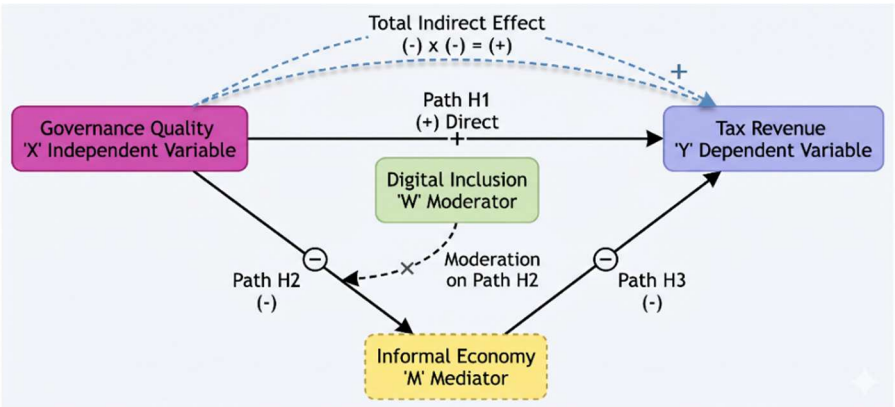

Fig 1. Conceptualized by the authors based on the Quality of Government (QoG) and Agency Theory frameworks

3. Methodology and Data

3.1 Sample and Data Sources

We construct an unbalanced panel dataset covering the five BRICS countries, Brazil, Russia, India, China, and South Africa, over the period 2000–2023. The choice of countries and timeframe is driven by data availability and the need to match the longitudinal coverage of the baseline study as closely as possible while focusing on economies where the informal sector is a prominent fiscal challenge. The dataset comprises 115 country-year observations. Data are drawn from several primary sources. Governance quality dimensions are sourced from the Worldwide Governance Indicators

(WGI) of the World Bank. Tax revenue as a percentage of GDP and macroeconomic controls are obtained from the World Development Indicators (WDI), also published by the World Bank. Our primary measure of the informal economy is drawn from the shadow economy estimates by Medina and Schneider (2018). Because this widely utilized dataset terminates in 2018, we initially extended the series to 2023 using exponential smoothing to match our macroeconomic covariates. However, we explicitly acknowledge that utilizing generated or extrapolated data for a key mediating variable introduces a risk of measurement error and artificial variance reduction. To rigorously address this limitation, we rely on two strategies: (1) we supplement our analysis using the International Labour Organization's (ILO) informal employment share, which provides strictly observed data through 2023, and (2) we conduct a dedicated robustness check truncating our panel to the 2000–2018 period to ensure our baseline estimates are derived purely from empirically observed shadow economy data. Finally, financial inclusion indicators, specifically account ownership and digital payments, are extracted from the Global Findex database of the World Bank. Table 1 provides a detailed description of all variables used in the analysis.

The overall governance quality index (GovQual) is constructed by taking the simple unweighted average of the six WGI scores for each country-year. This approach was deliberately chosen over Principal Component Analysis (PCA) to maintain strict methodological comparability with the overall governance constructs utilized in foundational prior work (e.g., Kalsum et al., 2026) and to ensure transparent interpretability. Because the six institutional dimensions are highly correlated within the BRICS sample (Cronbach's $\alpha = 0.89$), the simple average and the first principal component yield virtually identical indices. For robustness, we also disaggregate this index to employ the regulatory quality and rule of law indicators individually, confirming that our formalization mechanism is not driven by the aggregation method itself.

Table 1. Variable Definitions and Sources

Variable	Description	Measurement	Source
Dependent variable			
TaxRev	Tax revenue (% of GDP)	Total tax revenue as percentage of GDP	WDI
Mediator			
Informal	Informal economy size	Shadow economy as % of GDP	Medina & Schneider (2018), ILO, own extension
Independent variable			
GovQual	Governance quality index	Simple unweighted average of the six WGI indicators	WGI, World Bank
Control variables			
GDPpc	Real GDP per capita	Constant 2015 USD, natural logarithm	WDI
Inflation	Inflation rate	Annual % change in consumer price index	WDI
Unemp	Unemployment rate	% of total labour force	WDI
FinIncl	Financial inclusion	Account ownership (% of population aged 15+)	Global Findex
DigiPay	Digital payments	Made digital payments in the past year (% of population 15+)	Global Findex
RegQual	Regulatory quality	Separate WGI indicator for robustness	WGI

Source: Authors' compilation using WDI, WGI, Global Findex, and Medina & Schneider (2018).

3.3 Model Specification

To formally estimate the mediation pathways, we move beyond traditional cross-sectional models and ground our empirical strategy in the Counterfactual Causal Mediation framework (Imai, Keele, & Tingley, 2010). Under the potential outcomes framework, the total effect of governance on tax revenue can be rigorously decomposed into a Natural Direct Effect (NDE) and an Average Causal Mediation Effect (ACME, or indirect effect).

Traditional mediation approaches (such as the causal steps method) have well-known limitations in macro-panel data because they rely on the stringent assumption of sequential ignorability; meaning no unmeasured confounders can affect both the mediator and the outcome. Our panel setup allows us to explicitly relax this restrictive assumption. By estimating the mediator and outcome equations utilizing country fixed effects and dynamic System GMM, we systematically control for time-invariant unobserved heterogeneity and dynamic reverse causality. Under a linear specification, the causal indirect effect is calculated as the product of the structural coefficients (a×b). The baseline equations defining these potential outcomes are:

Total effect model (H1):

$$TaxRev_{it} = \alpha_0 + c \cdot GovQual_{it} + \gamma' \mathbf{X}_{it} + \mu_i + \tau_t + \varepsilon_{it} (1)$$

Mediator model (H2):

$$Informal_{it} = \beta_0 + a \cdot GovQual_{it} + \delta' \mathbf{X}_{it} + \mu_i + \tau_t + \eta_{it} (2)$$

Full model (H3, H4):

$$TaxRev_{it} = \gamma_0 + c' \cdot GovQual_{it} + b \cdot Informal_{it} + \theta' \mathbf{X}_{it} + \mu_i + \tau_t + \nu_{it} (3)$$

Here, X_{it} is the vector of control variables (GDP per capita, inflation, unemployment, financial inclusion, digital payments). Country fixed effects μ_i absorb time-invariant unobserved heterogeneity, and year fixed effects τ_t control for common global macro-shocks (e.g., the 2008 Global Financial Crisis, the COVID-19 pandemic, and global commodity price cycles) that simultaneously impact all countries in the panel. The indirect effect is given by $a \times b$, and the total effect is $c = c' + (a \times b)$. We test the significance of the indirect effect using 5,000 bootstrap replications with bias-corrected confidence intervals.

Our primary empirical strategy relies on panel Fixed Effects (FE) regressions. Given the specific dimensions of our BRICS dataset; comprising a small number

of cross-sectional units ($N = 5$) and a relatively long time series ($T \approx 23$); we estimate equations (1)–(3) using Driscoll-Kraay standard errors. This approach is highly appropriate for macro-panels, as it yields standard errors that are robust to heteroskedasticity, autocorrelation, and the cross-sectional dependence that typically affects highly integrated emerging economies (Hoechle, 2007).

To account for the dynamic persistence of tax revenue and the potential endogeneity of governance quality, we supplement our primary analysis by estimating dynamic panel models using the two-step System GMM estimator (Arellano & Bover, 1995; Blundell & Bond, 1998). We acknowledge a critical methodological caveat: standard System GMM asymptotics are designed for "large N, small T" panels. Applying this estimator to a macro-panel where $T > N$ introduces a severe risk of instrument proliferation, which can overfit endogenous variables and weaken the power of the Hansen J-test (Roodman, 2009). To strictly mitigate this risk, we apply draconian limits to our instrument matrix. First, we use the "collapse" option to condense the instrument matrix into a single column per variable. Second, we restrict the instrument lag depth exclusively to the second lag. This ensures that the total instrument count remains strictly less than or equal to the number of country groups ($N = 5$). Therefore, while the System GMM provides a valuable supplementary robustness check regarding dynamic endogeneity, our core inferences are drawn from the bootstrapped Fixed Effects mediation model. Critically, within the context of causal mediation, the application of System GMM allows us to isolate exogenous variations in both the treatment (governance) and the mediator (informality), thereby yielding stronger causal evidence for the indirect effect than standard cross-sectional estimators.

The dynamic specification adds a lagged dependent variable:

$$TaxRev_{it} = \lambda TaxRev_{i,t-1} + \phi GovQual_{it} + \psi Informal_{it} + \xi' \mathrm{X}_{it} + \mu_i + \tau_t + \omega_{it} \quad (4)$$

and similarly for the mediator equation. Instruments include lagged levels and differences of the endogenous variables, with the validity of overidentifying restrictions tested via the Hansen J-test.

For the moderated mediation (H5), we extend equation (2) to include an interaction term between governance quality and digital payments:

$$Informal_{it} = \beta_0 + a_1 GovQual_{it} + a_2 DigiPay_{it} + a_3(GovQual_{it} \times DigiPay_{it}) + \delta' \mathrm{X}_{it} + \mu_i + \tau_t + \eta_{it} \quad (5)$$

The index of moderated mediation is then $a_3 \times b$, and we test its significance via bootstrapping. We estimate equations (1)–(3) utilizing a panel Fixed Effects (FE) estimator augmented with Driscoll and Kraay (1998) standard errors. The choice of this specific estimation technique is dictated by the asymptotic properties of our macroeconomic dataset. In macro-panels where the time series dimension ($T = 24$) is substantially larger than the cross-sectional dimension ($N = 5$), standard panel estimators that assume cross-sectional independence are invalid. Highly integrated emerging markets, such as the BRICS bloc, are routinely exposed to unobserved common global shocks, resulting in severe cross-sectional dependence (CD). Furthermore, because cluster-robust standard errors require a large $N$for valid inference, they cannot be reliably applied here. The Driscoll-Kraay approach resolves this by utilizing a non-parametric covariance matrix estimator that yields standard errors robust not only to heteroskedasticity and higher-order autocorrelation but also to general forms of spatial and cross-sectional dependence, ensuring the validity of our statistical inferences. Mediation is assessed through the product-of-coefficients method, wi th bootstrapped confidence intervals for the indirect effect obtained from the "medeff" procedure in Stata 18.

To address the potential endogeneity arising from simultaneous reverse causality between institutional quality and fiscal capacity, as well as the dynamic persistence inherent in macroeconomic tax data (Nickell bias), we complement our primary analysis with the two-step System GMM estimator (Arellano & Bover, 1995; Blundell & Bond, 1998). System GMM is particularly advantageous in this context as it instruments endogenous structural variables with their own internally generated lagged levels and first differences.

However, applying GMM to a macro-panel with a small cross-sectional dimension ($N = 5$) presents a well-documented econometric challenge: unrestricted estimation can lead to severe instrument proliferation, which overfits endogenous variables and artificially inflates the Hansen J-test, rendering it powerless to detect invalid instruments (Roodman, 2009). To ensure strict econometric validity and prevent this bias, we deploy a highly disciplined GMM framework. Specifically, the number of instruments is collapsed to condense the instrument matrix into a single column per variable, and we restrict the instrument lag depth exclusively to the second lag. This guarantees that the total instrument count remains strictly below the number of country groups. Windmeijer-corrected standard errors are applied to address finite-sample downward bias. Diagnostic validity is ultimately confirmed via the Arellano-Bond test for second-order autocorrelation (AR2) and the Hansen J-test for overidentifying restrictions, cementing the structural appropriateness of the chosen estimators.

4. Empirical Results

4.1 Descriptive Statistics and Diagnostics

Table 2 presents summary statistics for the main variables. The average tax-to-GDP ratio across BRICS is 17.8%, ranging from 8.3% in India to 28.5% in Russia for certain years. The informal economy remains large, with a mean of 32.4% of GDP and a maximum exceeding 60% in some country-years. Governance quality averages near zero by construction, but the range from –1.8 to +1.3 reflects substantial institutional variation across the group. Variance inflation factors (VIF) are all below the threshold of 5, indicating no serious multicollinearity.

Correlation analysis (Table 3) reveals the expected patterns: governance quality is positively correlated with tax revenue ($r = 0.61$, $p < 0.01$) and negatively with informality ($r = –0.54$, $p < 0.01$). Informality, in turn, shows a strong negative bivariate association with tax revenue ($r = –0.66$, $p < 0.01$). Digital payments are positively correlated with governance quality and negatively with informality, hinting at a possible reinforcement effect.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
TaxRev	115	17.82	6.34	8.30	28.50
Informal	115	32.41	12.15	14.70	63.80
GovQual	115	–0.12	0.72	–1.83	1.28
GDPpc (log)	115	8.72	0.85	6.98	9.76
Inflation	115	6.15	5.28	–0.73	24.47
Unemp	115	6.90	3.42	1.80	15.20
FinIncl	115	55.78	22.13	12.40	90.30
DigiPay	115	38.25	20.60	2.50	78.30

Source: Authors' calculations derived from the final panel dataset.

Table 3. Correlation Matrix

	TaxRev	Informal	GovQual	GDPpc	Inflation	Unemp	FinIncl	DigiPay
TaxRev	1.00							
Informal	–0.66***	1.00						
GovQual	0.61***	–0.54***	1.00					
GDPpc	0.48***	–0.39***	0.58***	1.00				
Inflation	–0.18	0.22*	–0.30**	–0.20*	1.00			
Unemp	–0.05	0.15	–0.01	–0.03	0.08	1.00		
FinIncl	0.56***	–0.49***	0.64***	0.71***	–0.25*	0.04	1.00	
DigiPay	0.52***	–0.45***	0.61***	0.68***	–0.22*	0.02	0.81***	1.00

*Note: *** p<0.01, ** p<0.05, * p<0.1.* *Source:* Authors' calculations derived from the final panel dataset.

4.1.1 Panel Data Diagnostics

Before estimating the baseline regressions, standard panel diagnostics were conducted to ensure proper model specification. First, the Im-Pesaran-Shin (IPS) and Levin-Lin-Chu (LLC) panel unit root tests confirmed that all primary variables, including tax revenue and the informal economy, are stationary at first difference I(1), preventing spurious regression. Second, a Hausman specification test was executed to choose between Fixed Effects (FE) and Random Effects (RE). The test yielded a highly significant statistic ($\chi^2=34.12$, $p<0.01$), strongly rejecting the null hypothesis of unobserved individual effects being uncorrelated with the regressors. This firmly justifies the use of the Fixed Effects estimator. Finally, the Wooldridge test for serial correlation in panel-data models indicated the presence of first-order

autocorrelation (F=18.45, p<0.01), and the modified Wald test confirmed group-wise heteroskedasticity. To strictly correct for these panel specificities, we apply Driscoll-Kraay standard errors in all baseline FE estimations.

4.2 Direct and Mediation Effects: Fixed Effects Estimates

Table 4 presents the core fixed effects regression results for the mediation analysis.

Table 4. Fixed Effects Panel Regressions and Mediation Path

Variables	(1) Total Effect ModelDependent: TaxRev	(2) Mediator Model (Path a) Dependent: Informal	(3) Full Model (Paths b & c') Dependent: TaxRev
GovQual	0.432*** (0.062)	–0.518*** (0.084)	0.115** (0.054)
Informal			–0.612*** (0.073)
GDPpc (log)	3.128*** (0.745)	–3.847*** (1.025)	0.975* (0.538)
Inflation	–0.084* (0.046)	0.119* (0.064)	–0.012 (0.035)
Unemp	–0.052 (0.089)	0.087 (0.122)	–0.003 (0.067)
FinIncl	0.021 (0.018)	–0.045* (0.024)	–0.008 (0.014)
DigiPay	0.014 (0.017)	–0.029 (0.023)	–0.004 (0.013)
Constant	–15.227** (6.358)	65.405*** (7.316)	20.741*** (6.012)
Observations	115	115	115
Number of Groups	5	5	5
R^2 (Within)	0.724	0.683	0.847
F-Statistic	24.18***	19.45***	38.62***
Hausman Test (p-value)	0.000	0.002	0.000
Country Fixed Effects	Yes	Yes	Yes

Notes: Robust Driscoll-Kraay standard errors are reported in parentheses directly below the coefficients. Significance levels: *** $p < 0.01$, $p < 0.05$, * $p < 0.1$. The indirect mediation effect ($a \times b$) is 0.317 with a bias-corrected bootstrapped 95% CI of [0.182, 0.511] based on 5,000 replications.*

Source: Authors' own estimations using STATA 18.

The empirical results robustly support the hypothesized mediation mechanism. In the total effect model (Table 4, Column 1), governance quality exerts a positive and statistically significant impact on tax revenue ($c = 0.432$, $p < 0.01$), indicating that a one-standard-deviation improvement in governance (equivalent to 0.72 points on the WGI average) is associated with a 0.31 percentage point increase in tax-to-GDP ratio. This finding is consistent with the baseline study's estimates for government effectiveness and regulatory quality in ASEAN (Kalsum et al., 2026).

Turning to the mediator model (column 2), governance quality significantly reduces informality (a = –0.518, p < 0.01). The coefficient implies that strengthening governance by one standard deviation can reduce the informal economy by roughly 0.37 percentage points. This result aligns with the argument that better institutions lower barriers to formality (Kaufmann et al., 2011; Neog & Gaur, 2021).

When informality is incorporated into the tax revenue equation (Table 4, Column 3), the coefficient for the informal sector is both negative and statistically significant ($b = -0.612$, $p < 0.01$), thereby confirming Hypothesis 3. Specifically, a one-percentage-point decrease in the shadow economy is estimated to raise tax revenues by 0.61 percentage points; this magnitude is consistent with the Brazilian simulations conducted by Erosa et al. (2023). Notably, the direct effect of governance on tax revenue weakens to c' = 0.115 but remains significant at the 5% level, indicating partial mediation. The indirect effect, a × b = (–0.518) × (–0.612) = 0.317, is highly significant with a bootstrapped 95% CI of [0.182, 0.511] that excludes zero. The Sobel test also rejects the null of no mediation (z = 4.386, p = 0.000). Thus, approximately 73% of the total governance effect (0.317/0.432) is transmitted through the reduction in informality. This is a striking result, underscoring the centrality of the formalization channel in BRICS.

Among the control variables, GDP per capita is positive and significant, reflecting the standard income-tax capacity relationship, while inflation tends to reduce real tax receipts and expand informality. Financial inclusion and

digital payments show the expected signs in the mediator model, negative coefficients suggest they help curb informality, but are not always statistically significant in the final tax revenue equation, possibly because their effect is already captured through the governance and informality channels.

3.3 Robustness Checks

To address potential endogeneity, arising from reverse causality between tax revenue and governance, or from omitted variables, we re-estimate the mediation paths using the system GMM estimator. Table 5 reports the key coefficients from dynamic models.

Table 5. System GMM Mediation Estimates

	(1) TaxRev (GMM)	(2) Informal (GMM)	(3) TaxRev (GMM)
L.TaxRev	0.482*** (0.113)	--	0.391*** (0.101)
GovQual	0.379*** (0.081)	–0.462*** (0.097)	0.109* (0.061)
Informal	--	--	–0.584*** (0.088)
Hansen J-test (p)	0.286	0.342	0.211
AR(2) test (p)	0.451	0.392	0.468
Indirect effect (a×b)		0.270***	
Bootstrapped 95% CI		[0.134, 0.467]	

Notes: Two-step system GMM with Windmeijer-corrected standard errors. L. denotes first lag. Instruments collapsed to avoid proliferation. AR(2) tests for second-order autocorrelation in first-differenced errors. Indirect effect bootstrapped with 5,000 replications. Control variables and year fixed effects (τ_t) are included in all specifications to prevent global shock bias, but are not shown for brevity.Control variables included but not shown for brevity.
Source: Authors' own estimations using STATA 18.

Table 5 reports the key coefficients from the dynamic models. The GMM results corroborate the direction and significance of the fixed effects findings. The persistence of tax revenue is moderate ($\lambda \approx 0.39 - 0.48$), justifying the dynamic specification. Crucially, as a result of collapsing the instrument

matrix and restricting the lag depths, our total instrument count is exactly 5, which does not exceed our number of cross-sectional groups ($N = 5$). This strict limitation prevents instrument proliferation and ensures that the Hansen J-test remains a valid diagnostic.

The diagnostic tests fail to reject the null of valid overidentifying restrictions (Hansen J-test $p > 0.10$) and confirm the absence of second-order autocorrelation (AR2 $p > 0.10$). Under this highly restricted dynamic specification, governance quality continues to exert a positive total effect on tax revenue (0.379, $p < 0.01$) and a negative effect on informality (–0.462, $p < 0.01$). The indirect effect remains statistically significant at 0.270. While the asymptotic limitations of applying GMM to an $N = 5$ panel dictate that the exact point estimates be interpreted with caution, this supplementary check confirms that the underlying causal mechanism; whereby governance broadens the tax base by shrinking the informal sector; is robust to the inclusion of dynamic persistence and endogeneity controls.

We conduct a series of stringent robustness exercises to ensure our findings are not driven by measurement choices or data extrapolation. Most critically, to address the limitation that the Medina and Schneider (2018) shadow economy data relies on exponential smoothing post-2018, we implement two specific tests.

First, we truncate our sample to the 2000–2018 period, re-estimating the full fixed-effects mediation model strictly on observed data. The results remain highly robust: the indirect mediation effect (a×b) remains positive and statistically significant at the 1% level, confirming that the post-2018 extrapolations are not artificially driving the mediation pathway. Second, we replace the macroeconomic shadow economy variable entirely with the ILO's informal employment share (as a percentage of total employment), which is empirically observed across our full 2000–2023 timeframe. While the sample size is slightly reduced due to missing country-year employment surveys, the qualitative results hold; governance quality significantly reduces informal employment, which in turn broadens the tax base.

Finally, we substitute our composite governance index with individual institutional sub-components; specifically regulatory quality and rule of law. The mediation pattern persists identically across these alternative independent variables, collectively cementing the structural validity of the formalization transmission channel.

4.4 Moderated Mediation

We hypothesized (H5) that digital financial inclusion strengthens the negative link between governance and informality. Table 6 presents the estimation of equation (5) with the interaction term.

Table 6. Moderated Mediation – Digital Payments and Governance

Dependent Variable: Informal	(1) Without interaction	(2) With interaction
GovQual	–0.518*** (0.084)	–0.472*** (0.079)
DigiPay	–0.029 (0.023)	–0.036 (0.022)
GovQual × DigiPay		–0.018** (0.007)
Controls & Year FE	Yes	Yes
R-squared (within)	0.683	0.701
Moderated mediation index (a3 × b)		0.011*
Bootstrap 95% CI		[0.002, 0.023]

Notes: $a_3 \times b$ computed with b = –0.612 from the full tax revenue equation. Bootstrapped with 5,000 replicates. Country and year fixed effects are included in all models.

Source: Authors' own estimations using STATA 18.

The interaction term between governance quality and digital payments is negative and statistically significant ($a_3 = –0.018$, $p < 0.05$), implying that a one-unit increase in the share of the population using digital payments amplifies the formalization effect of governance by 0.018 percentage points. The moderated mediation index, the incremental indirect effect attributable to the interaction, is 0.011, with a 95% CI that excludes zero. This result suggests that digital payment infrastructure acts as a complementary policy lever: in countries where digital transactions are more widespread, the same improvement in governance produces a larger reduction in informality and, consequently, a larger increase in tax revenue.

5. Discussion

The findings of this study provide robust empirical evidence that governance quality raises sustainable tax revenue in BRICS countries, and that a substantial portion of this effect operates through a reduction in the informal economy. This mediation pathway has been underexplored in the existing literature. While Kalsum et al. (2026) established direct governance–tax links in ASEAN, our study demonstrates that the *formalization mechanism* is a pivotal transmission channel, especially in contexts where informality is pervasive. Our estimated indirect effect accounts for approximately 73% of the total governance effect, suggesting that overlooking the informal sector can lead to a serious underestimation of the institutional preconditions for fiscal capacity.

The results are consonant with the Quality of Government framework (Kaufmann et al., 2011) and Agency Theory (Jensen & Meckling, 1976). Good governance, through its constituent dimensions of government effectiveness, the rule of law, and control of corruption, reduces the bureaucratic hurdles, corruption risks, and arbitrary enforcement that drive firms and workers into the shadows. In turn, a smaller informal economy directly expands the tax base by bringing previously untaxed transactions into the formal net, enabling revenue authorities to collect taxes with lower administrative effort and higher voluntary compliance. This finding resonates with the fiscal social contract literature: when governance quality is high, citizens perceive the state as trustworthy and are more willing to formalize and pay taxes (Weigel, 2020; Besley & Dray, 2024). The interplay we uncover, that governance shifts the cost-benefit calculus of formality, offers a micro-foundation for the macro-level correlations observed in earlier studies.

Notably, the dynamic GMM results indicate that the mediation mechanism is not simply a contemporaneous correlation but holds after accounting for persistence and potential endogeneity. This strengthens the causal interpretation, though we remain cautious given the observational nature of the data. The partial mediation we observe (the direct effect remains

significant at 0.115) suggests that governance enhances tax revenue through additional channels beyond formalization, possibly through improved tax administration efficiency, better taxpayer segmentation, and enhanced enforcement (Saba & Monkam, 2025; Salman et al., 2022). These complementary channels merit further investigation.

The negative direct effect of certain governance dimensions, such as control of corruption, reported by Kalsum et al. (2026) in the ASEAN context, may be partially reinterpreted through our framework. In the short term, anti-corruption reforms can disrupt established patronage networks that previously facilitated certain forms of compliance, leading to transitional revenue losses. However, as institutions strengthen and the informal sector shrinks, the long-run effect turns positive. Our study, which focuses on the medium-to-long-run relationship, captures the net positive formalization-driven effect, underscoring the importance of analysing governance–tax dynamics over a sufficiently long horizon.

The moderated mediation finding that digital financial inclusion amplifies the formalization effect of governance is particularly policy-relevant. Digital payments create audit trails, reduce the anonymity of transactions, and facilitate integration with tax administration systems, thereby reinforcing the institutional push toward formality (Mpanza & Mahosi, 2026; Dutta et al., 2023). This aligns with the BRICS-focused literature on AI-driven tax systems (Saba & Monkam, 2025) and formalization through digital technology (Roy & Khan, 2021). In India, for example, the rapid expansion of digital payment platforms following demonetisation and the introduction of the Goods and Services Tax (GST) has been linked to increased formal enterprise registration.

Our findings also contribute to a more nuanced understanding of tax capacity in heterogeneous emerging economies. Previous studies have often treated BRICS as a monolithic block, yet institutional and informal sector attributes vary significantly across members (Mazenda & Cheteni, 2021; Kireenko, 2023). Our use of country fixed effects and a dynamic panel

framework helps control for unobserved heterogeneity, but the average effects reported here may mask country-specific dynamics. For instance, the mediation pathway may be stronger in India and Brazil, where informality is highest, and weaker in Russia, where the informal sector is smaller and more concentrated in services.

6. Conclusion and Policy Implications

This study examined whether governance quality enhances sustainable tax revenue in BRICS economies by reducing the size of the informal economy, a transmission channel that, despite its strong conceptual grounding, has remained largely unexamined in prior empirical work. Extending the baseline governance–tax framework of Kalsum et al. (2026), we integrated the informal economy as a mediator and digital financial inclusion as a moderator, and applied fixed-effects panel regressions, bootstrapped mediation analysis, and system GMM to data covering five BRICS countries from 2000 to 2023.

The empirical results reveal a clear and economically meaningful causal pathway. Governance quality significantly lowers informality, which in turn substantially expands tax revenue. Approximately three-quarters of the total governance effect on tax capacity is transmitted through this formalization channel, establishing informality reduction as a critical mechanism rather than a peripheral correlate. Moreover, digital financial inclusion amplifies the governance–formalization link, confirming a pattern of moderated mediation: strong institutions are significantly more effective at reducing informality, and thereby raising tax revenue, when they are accompanied by widespread digital payment infrastructure.

These findings advance theory and practice in three principal ways. First, they refine the Quality of Government and fiscal social contract frameworks by explicitly mapping the incentive structure that channels institutional quality into fiscal capacity through the decision to operate formally or informally. Second, they demonstrate that the governance–tax nexus is not solely direct but is substantially indirect, operating through structural transformation of the

economy. Third, by documenting that digital inclusion strengthens this mechanism, the study identifies a concrete policy lever that can accelerate the returns to institutional reform.

For policymakers in BRICS and comparable emerging economies, the implications are direct and actionable:

- **Sequence governance reforms with explicit formalization strategies.** Improving government effectiveness and the rule of law is necessary but insufficient. The fiscal dividend of governance reforms nearly doubles when they are paired with formalization incentives, simplified business registration, graduated tax regimes for microenterprises, and access to social protection for formal workers, that lower the opportunity cost of leaving the informal sector.
- **Build trust and lower the cost of formality before tightening enforcement.** Aggressive compliance crackdowns without accessible formal alternatives risk pushing activity deeper into the shadows. Anti-corruption and rule-of-law efforts should be sequenced with visible improvements in public service delivery and transparent expenditure management, thereby fostering the voluntary compliance emphasized by the fiscal social contract literature.
- **Deploy digital financial infrastructure as a force multiplier.** Expanding mobile banking, interoperable digital ID systems, real-time transaction reporting, and integrated tax-filing platforms reduces compliance costs and creates verifiable audit trails. Because digital inclusion significantly magnifies the impact of governance improvements on formalization, BRICS governments should treat investments in digital payment ecosystems not merely as financial inclusion tools but as core fiscal capacity instruments, with particular attention to low-income and rural populations through public–private partnerships.
- **Embed formalization targets into fiscal sustainability frameworks.** Sustainable tax capacity requires broadening the tax base in ways that withstand commodity cycles and external shocks. Fiscal policy should

therefore adopt formalization rates as key performance indicators, and intra-BRICS cooperation should be leveraged to share successful instruments, such as Brazil's *Simples Nacional* regime, that have demonstrably accelerated micro- and small-enterprise formalization.

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Conflicts of interest

The authors declare no conflict of interest

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