

Tax Evasion and Fiscal Sustainability: A Panel Assessment Using Informal-Economy Proxies

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ABSTRACT

This study examines the relationship between informal economic activity and fiscal vulnerability, using the size of the informal economy as an empirical proxy for the tax-compliance problem associated with tax evasion. The analysis combines the World Bank Informal Economy Database, the World Bank Worldwide Governance Indicators (WGI) 2025 revision, and macroeconomic fiscal data supplied in the authors' existing workbook. The verified estimation sample comprises seven countries: Brazil, Germany, Ghana, Kenya, Nigeria, the United Kingdom, and the United States, observed annually from 2010 to 2020, yielding 77 country-year observations. The primary outcome is public debt-to-GDP, interpreted as fiscal vulnerability rather than as a positively oriented sustainability index. The primary explanatory variable is the World Bank Dynamic General Equilibrium (DGE) estimate of informal output as a percentage of official GDP; the Multiple Indicators Multiple Causes (MIMIC) measure is used for robustness. A country and year-fixed-effects model with country-clustered standard errors produced a negative but statistically non-significant association between DGE informality and debt-to-GDP ($\beta = -6.271$, $p = .104$). The random-intercept model produced a more negative estimate ($\beta = -2.833$, $p < .001$), while the Hausman test did not reject the random-effects specification at the 5% level ($\chi^2 = 6.804$, $p = .147$). The study findings submit that the relationship between informality and fiscal outcomes is sensitive to model specification and measurement. Policy implications should lay emphasis on revenue administration, institutional quality and transparent fiscal governance without assuming that reducing informality mechanically reduces public debt. (World Bank, 2024; World Bank, 2026; International Monetary Fund [IMF], 2026)

Keywords: Tax Evasion; Informal Economy; Fiscal Vulnerability; Public Debt; Institutional Quality; Panel Data; Tax Compliance

INTRODUCTION

Fiscal sustainability depends on a government's capacity to finance public expenditure and service public liabilities over time. Domestic revenue mobilisation is therefore an important component of fiscal capacity. Persistent non-compliance with tax obligations can narrow the effective tax base, shift the burden towards compliant taxpayers and constrain resources available for public services. Yet deliberate tax evasion is difficult to measure directly in internationally comparable country-year data. (Allingham & Sandmo, 1972)

This study addresses that measurement problem explicitly. Instead of combining heterogeneous country-specific tax-evasion estimates, it uses the World Bank Informal Economy Database. The database provides model-based estimates of informal output, including DGE and MIMIC measures, for up to 196 economies over 1990–2020. Informal output is not synonymous with illegal tax evasion; it is therefore used as a proxy for the broader tax-compliance environment. (World Bank, 2024; Elgin et al., 2021)

The study also corrects a conceptual problem in the earlier manuscript. Public debt-to-GDP is treated as a measure of fiscal vulnerability: higher debt ratios generally imply greater fiscal pressure, other things equal. The analysis consequently does not use an unexplained 'Fiscal Sustainability Index' whose construction and direction were not documented in the earlier version.

Problem Statement

The earlier version reported a 28-country, 420-observation panel and regression coefficients that could not be reproduced from the supplied data. The verified data assembled for this revision instead provide a balanced seven-country panel for 2010–2020. The narrower design permits a reproducible empirical analysis while avoiding unsupported expansion of the sample.

Objectives

1. To estimate the association between informal economic activity and public debt-to-GDP.
2. To assess whether government effectiveness and macroeconomic conditions are associated with public debt-to-GDP.
3. To compare fixed-effects and random-effects estimates.
4. To test robustness using the MIMIC informal-economy measure, lagged DGE and first-differenced debt.
5. To derive policy implications consistent with the empirical evidence and its limitations.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Tax evasion and informality

Tax evasion is unlawful non-compliance with tax obligations, whereas informal economic activity is broader and may include legal, semi-formal, and illegal activities that are not fully captured in official accounts. The concepts overlap but are not identical. Consequently, informal-economy measures should be interpreted as proxies rather than direct measures of tax evasion. (Elgin et al., 2021)

2.2 Economic deterrence

Allingham and Sandmo (1972) model tax compliance as a decision influenced by expected benefits from evasion and expected costs of detection and punishment. This framework suggests that credible enforcement can influence compliance but does not imply a one-to-one relationship between informal activity and public debt.

2.3 Institutional quality and fiscal exchange

Institutional quality can influence both revenue mobilisation and taxpayer behaviour through administrative effectiveness, accountability, predictability, and public trust. The WGI Government Effectiveness measure is therefore included as a governance control. (Kaufmann & Kraay, 2024; World Bank, 2026)

DATA AND METHODOLOGY

3.1 Data sources

The primary informal-economy data are from the World Bank Informal Economy Database. The database contains DGE and MIMIC estimates of informal output as a percentage of official GDP and covers up to 196 economies over 1990–2020. The WGI 2025 revision supplies annual Government Effectiveness estimates for 1996–2024. Debt-to-GDP, real GDP growth. (World Bank, 2024; World Bank, 2026; IMF, 2026)

World Development Indicators were reviewed as the intended source for trade openness. WDI defines trade as the sum of exports and imports of goods and services as a percentage of GDP. However, the actual annual trade observations were not contained in the uploaded files and were not inserted by assumption. Trade openness is therefore excluded from the reported regression. (World Bank, 2026)

3.2 Sample and panel construction

The final sample consists of Brazil, Germany, Ghana, Kenya, Nigeria, the United Kingdom and the United States. The common estimation period is 2010–2020, producing 77 observations (7 countries $\times$ 11 years). All observations used in the primary model are complete.

Variable	Source	Years	Role
Debt-to-GDP	IMF WEO data in authors' workbook	2010–2020	Dependent variable
DGE informal output	World Bank Informal Economy Database	2010–2020	Primary proxy
MIMIC informal output	World Bank Informal Economy Database	2010–2020	Robustness proxy
Government Effectiveness	World Bank WGI 2025 revision	2010–2020	Institutional control
Real GDP growth	IMF WEO data in authors' workbook	2010–2020	Control
Inflation	IMF WEO data in authors' workbook	2010–2020	Control

Model specification

The baseline model is:

$$Debt_it = \alpha + \beta_1 DGE_it + \beta_2 GDPG_it + \beta_3 GE_it + \beta_4 INF_it + \mu_i + \lambda_t + \varepsilon_it$$

Debt is public debt-to-GDP; DGE is informal output as a percentage of official GDP; GDPG is real GDP growth; GE is the WGI Government Effectiveness estimate; INF is inflation; μ_i represents country effects; and λt represents year effects.

Estimation strategy

Fixed-effects and random-intercept models are estimated. The FE estimates use country-clustered standard errors. A conventional Hausman test compares the slope estimates. Diagnostic tests assess heteroskedasticity, serial correlation, cross-sectional dependence, and within-panel multicollinearity. Because there are only seven countries, all inferential results are interpreted as exploratory.

RESULTS

4.1 Descriptive statistics

Variable	Mean	SD	Min	Max	N
debt	64.673	29.093	6.700	132.600	77
dge	26.878	15.458	7.953	55.929	77
mimic	28.519	15.929	8.070	56.859	77
gdp_growth	2.695	3.558	-10.000	14.000	77
ge_est	0.491	1.038	-1.138	1.966	77
inflation	5.818	4.706	0.000	17.500	77

Mean debt-to-GDP is 64.67%, while mean DGE informal output is 26.88% of official GDP. DGE ranges from 9.17% to 55.93%. The Government Effectiveness estimate has a mean of 0.49 in the WGI standard-normal scale. (World Bank, 2026)

Correlation matrix

Variable	debt	dge	mimic	gdp_growth	ge_est	inflation
debt	1.000	-0.850	-0.838	-0.408	0.781	-0.723
dge	-0.850	1.000	0.993	0.220	-0.911	0.810
mimic	-0.838	0.993	1.000	0.227	-0.940	0.813
gdp_growth	-0.408	0.220	0.227	1.000	-0.271	0.209
ge_est	0.781	-0.911	-0.940	-0.271	1.000	-0.793
inflation	-0.723	0.810	0.813	0.209	-0.793	1.000

The unconditional correlations are high for several variables, especially between DGE and Government Effectiveness. The appropriate within-panel VIF values, however, are low, ranging from approximately 1.03 to 1.20. This indicates that the fixed-effects transformation removes much of the cross-sectional collinearity.

Fixed-effects regression

Variable	Coefficient	SE	t	p	95% CI
dge	-6.271	3.859	-1.625	0.104	[-13.834, 1.292]
gdp_growth	-0.607	0.609	-0.996	0.319	[-1.800, 0.587]
ge_est	-18.631	13.135	-1.418	0.156	[-44.376, 7.114]
inflation	-0.289	0.440	-0.658	0.511	[-1.150, 0.572]

The FE model has $R^2 = 0.959$ and adjusted $R^2 = 0.944$. The DGE coefficient is -6.271 and is not statistically significant at the 5% level ($p = .104$). Thus, the verified data do not establish a statistically significance within-country association between informal output and debt-to-GDP in the preferred FE specification.

Random-effects model and Hausman test

Variable	Coefficient	SE	z	p	95% CI
dge	-2.833	0.636	-4.457	0.000	[-4.078, -1.587]
gdp_growth	-0.511	0.456	-1.121	0.262	[-1.404, 0.382]
ge_est	-19.697	8.364	-2.355	0.019	[-36.090, -3.303]
inflation	-0.338	0.412	-0.820	0.412	[-1.145, 0.469]

The random-intercept estimate for DGE is -2.833 ($p < .001$). The Hausman statistic is $\chi^2(4) = 6.804$, $p = 0.147$. At the conventional 5% level, the null is not rejected.

Diagnostic tests

Test	Statistic	p-value	Conclusion
Breusch–Pagan heteroskedasticity	50.135	0.0002	Heteroskedasticity detected
Wooldridge-style serial-correlation test	15.723	0.0002	Serial correlation detected
Pesaran CD	-1.660	0.0969	No significant cross-sectional dependence at 5%
Mean within-panel VIF	1.142	—	No serious within-panel collinearity

The presence of heteroskedasticity and serial correlation supports the use of clustered standard errors in the FE specification. However, with seven clusters, conventional cluster-robust asymptotics are weak, which is an important limitation.

Robustness checks

Specification	Proxy/outcome	Coefficient	SE	p	95% CI	N
Primary DGE, FE (clustered SE)	DGE	-6.271	3.859	0.104	[-13.834, 1.292]	77
MIMIC, FE (clustered SE)	MIMIC	-1.280	2.869	0.655	[-6.904, 4.343]	77
Lagged DGE, FE (clustered SE)	Lagged DGE	-7.580	4.253	0.075	[-15.915, 0.756]	70
First-difference debt, DGE	DGE	-0.152	0.747	0.839	[-1.615, 1.311]	70

The robustness results do not confirm a stable relationship. The MIMIC specification is negative but non-significant ($\beta = -1.280$, $p = .655$). The lagged-DGE model is negative and marginal at the 10% level ($\beta = -7.580$, $p = .075$). The first-difference model is near zero and non-significant ($\beta = -0.152$, $p = .839$).

DISCUSSION

The principal finding is that the relationship between informal economic activity and public debt is specification-sensitive. The FE model, which controls for unobserved time-invariant country characteristics and common year shocks, does not identify a statistically significant association. The RE model produces a significant negative coefficient, but the difference is driven partly by between-country variation. The Hausman test does not reject RE at 5%, yet the small number of countries makes that result fragile.

The sign of the relationship should also be interpreted carefully. Because debt-to-GDP measures fiscal vulnerability, a negative coefficient would imply that higher informality is associated with lower debt, which is not the simple theoretical prediction that tax evasion weakens fiscal capacity. This divergence is one reason not to infer a causal fiscal benefit from the negative coefficient. It may reflect omitted institutional, structural or macroeconomic differences.

The robustness evidence is particularly important. Substituting MIMIC for DGE removes statistical significance; lagging DGE produces only weak evidence; and first-differencing debt removes the relationship. The conclusion is therefore that the verified data do not establish a stable empirical effect of informal economic activity on fiscal vulnerability.

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POLICY IMPLICATIONS

6.1 Strengthen revenue administration

Improve taxpayer identification, filing, third-party reporting and risk-based audit systems while maintaining due-process safeguards.

6.2 Improve institutional effectiveness

Professionalize tax administration, strengthen accountability and reduce opportunities for corruption.

6.3 Reduce compliance costs

Simplify registration, filing, and payment procedures, particularly for small firms and informal businesses transitioning into the formal sector.

6.4 Improve taxpayer trust

Increase transparency in the use of tax revenue and link tax collection to visible public services.

6.5 Improve measurement

Develop consistent tax-gap and informal-economy measures rather than combining heterogeneous country estimates.

6.6 Avoid causal overstatement

Policy should not assume that reducing informality will automatically lower public debt; revenue, expenditure, growth, and institutional factors interact.

CONCLUSION

The revised analysis provides a transparent empirical test using consistent annual informal-economy measures and a verified seven-country panel. The preferred FE model does not find a statistically significant association between DGE informal output and the public debt-to-GDP ratio. The RE estimate is significant but is not supported consistently by robustness specifications. The evidence, therefore, does not justify the original manuscript's strong claim that tax evasion has a statistically robust adverse effect on fiscal sustainability.

The study's more defensible contribution is to show the importance of measurement and model specification. Future research should expand the country sample, incorporate annual fiscal-balance and trade-openness data, and use direct tax-gap or administrative compliance measures where available.

LIMITATIONS OF THE STUDY

Several limitations should be considered when interpreting the findings of this study. First, the empirical analysis is based on a relatively small balanced panel of seven countries observed annually from 2010 to 2020, yielding 77 country-year observations. While this restricted sample was deliberately adopted to ensure that the analysis was based only on verified and consistently available observations, it limits statistical power and constrains the external validity of the findings. The small number of countries also means that conventional cluster-robust inference should be interpreted cautiously, particularly because the diagnostic results indicate the presence of heteroskedasticity and serial correlation and only seven country clusters are available. (World Bank, 2024)

Second, the study uses informal economic output as a proxy for the broader tax-compliance environment rather than a direct measure of tax evasion. This is an important conceptual limitation. Informal economic activity encompasses legal, semi-formal and illegal activities that are not fully captured in official economic statistics and is therefore not synonymous with deliberate tax evasion. The DGE measure used in the baseline model and the MIMIC measure employed for robustness capture dimensions of informality but cannot directly establish the extent of tax revenue deliberately concealed from tax authorities. (Elgin et al., 2021; World Bank, 2024)

Third, public debt-to-GDP is used as the principal indicator of fiscal vulnerability. Although the ratio provides a useful and widely recognised measure of fiscal pressure, it does not capture the full multidimensional concept of fiscal sustainability. Debt sustainability can also depend on fiscal balances, interest-payment obligations, debt maturity and composition, revenue-generating capacity, economic growth, and institutional conditions. Accordingly, the findings should be understood as relating specifically to the relationship between informality and public debt rather than to fiscal sustainability in its entirety.

Fourth, the debt-to-GDP, real GDP growth and inflation variables are drawn from the IMF World Economic Outlook data contained in the authors' existing workbook, whereas the World Development Indicators were considered for trade openness. The absence of verified annual trade observations in the supplied data meant that trade openness was excluded from the reported regression rather than being introduced through assumptions or unverified observations. This omission limits the extent to which the model captures the broader external economic environment that may influence both informality and fiscal outcomes. (IMF, 2026; World Bank, 2026)

Fifth, the study's observational design limits causal interpretation. The negative coefficients obtained for the informal-economy measures should not be interpreted as evidence that greater informality improves fiscal outcomes. Indeed, the preferred fixed-effects specification produces a negative but statistically non-significant coefficient, while the random-effects result is not consistently supported by the robustness analyses. The first-difference specification, for example, yields a near-zero, statistically insignificant coefficient.

Finally, potential endogeneity and omitted-variable concerns cannot be completely eliminated within the present design. Institutional quality, fiscal policy, economic structure, revenue administration, and other country-specific factors may simultaneously influence informal economic activity and fiscal outcomes. Although Government Effectiveness is included as a control and country and year effects are incorporated into the preferred specification, the available data and small sample do not permit sufficiently strong identification of causal relationships. The results should therefore be regarded as exploratory evidence concerning statistical associations rather than definitive estimates of causal effects. (Kaufmann & Kraay, 2024)

Future Research

Future research should build on the present findings by extending both the scope of the data and the methodological approach. First, subsequent studies should expand the country sample substantially and, where consistent data permit, extend the observation period. A larger and longer panel would improve statistical power,

increase variation across countries and over time, and enhance the external validity of the findings. It would also provide a stronger basis for applying estimation techniques that require larger panels.

Second, future research should incorporate verified fiscal-balance and trade-openness indicators. The inclusion of fiscal-balance measures would provide a more comprehensive assessment of fiscal conditions than reliance on debt-to-GDP alone, while trade openness could capture an important dimension of countries' integration into the international economy. The present study deliberately excluded trade openness because the relevant annual observations were not available in the supplied dataset.

Third, future studies should seek to employ more direct measures of tax evasion and tax compliance. Tax-gap estimates, tax-administration compliance indicators, audit outcomes, taxpayer registration and filing data, and other administrative measures could provide a closer empirical representation of tax evasion than informal-economy estimates. Such measures would also help distinguish the effects of genuine tax evasion from those arising from broader informal economic activity.

Fourth, future research should examine the role of institutional quality more extensively. Rather than treating Government Effectiveness solely as a control variable, subsequent studies could investigate whether institutional quality moderates or mediates the relationship between informality and fiscal outcomes. Variables relating to regulatory quality, control of corruption, rule of law, government effectiveness, accountability, and tax-administration capacity may help explain why similar levels of informal activity produce different fiscal outcomes across countries. The present study already identifies institutional quality as an important component of the policy response. (Kaufmann & Kraay, 2024)

Fifth, researchers should investigate possible nonlinear relationships. The effect of informal economic activity on fiscal outcomes may not be constant across countries or levels of informality. For example, the fiscal implications of informality may become more pronounced after particular thresholds of informal activity, institutional weakness, or public indebtedness are reached. Panel threshold models and other nonlinear specifications could therefore provide insights that linear models cannot capture.

Finally, future studies should employ estimators and identification strategies capable of addressing the potential endogeneity between informality and fiscal outcomes. Depending on the size and structure of the expanded dataset, dynamic panel estimators, instrumental-variable approaches, system GMM, panel threshold models, or other appropriate techniques could be considered. Stronger approaches to endogeneity would help distinguish whether changes in informal economic activity precede changes in fiscal outcomes or whether fiscal and macroeconomic conditions themselves influence the level of informality.

Importantly, future research should retain the caution demonstrated in the present study regarding causal interpretation. The current evidence does not establish a stable causal relationship between informal economic activity and public debt-to-GDP. Rather, the principal contribution of the analysis is to demonstrate that the observed relationship is sensitive to measurement, model specification, and estimation strategy.

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Appendix A. Figures

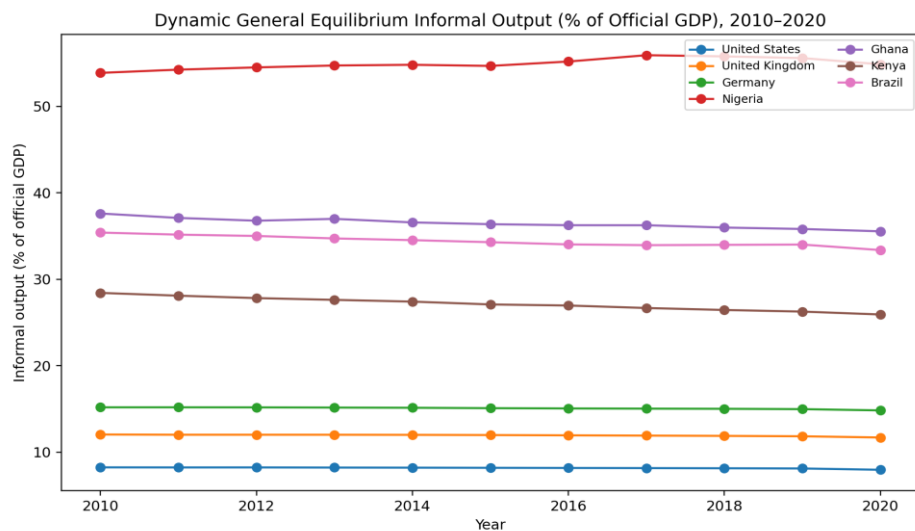


Figure 1. DGE informal output trends, 2010–2020.

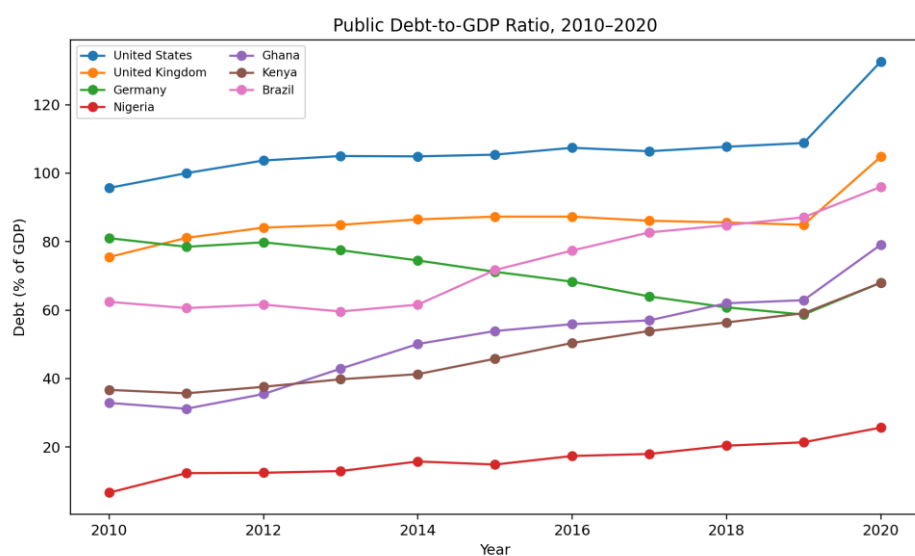


Figure 2. Public debt-to-GDP trends, 2010–2020.

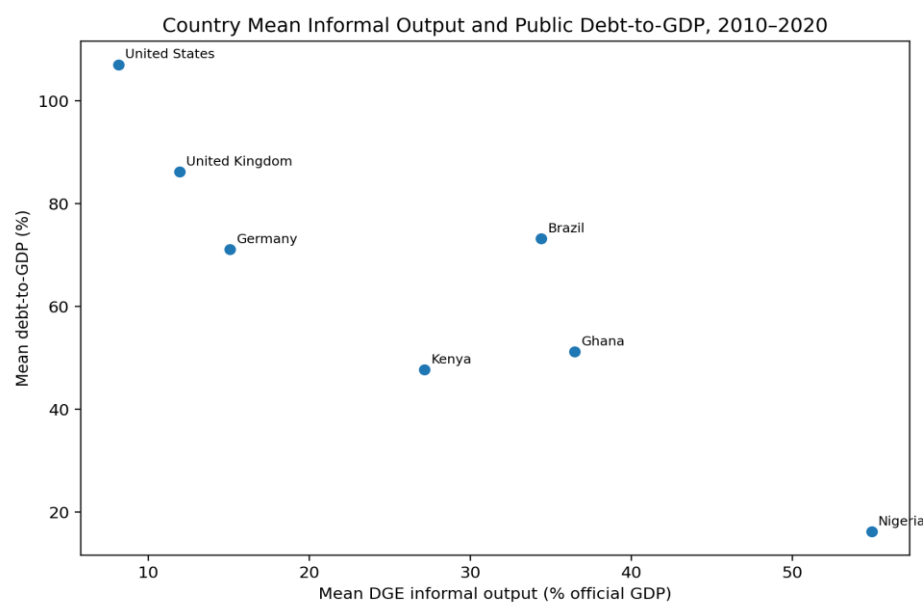


Figure 3. Country mean informal output and debt-to-GDP, 2010–2020.