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Original Article

The Strategic Governance Paradox: Institutional Continuity and Environmental Quality Trends Amidst Political Regime Transitions in Ethiopia (1996-2025)

Yohannes Desalegn Negasa [1, ✉], Shiferaw Muleta Eyana [1]

1. *Development Studies, Addis Ababa University, Addis Ababa, ETH*

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Abstract

This study examines the strategic alignment between institutional governance and environmental outcomes in Ethiopia from 1996 to 2025. Using an explanatory mixed-methods design, it investigates how national strategic frameworks - from the post-Derg developmental state to the Prosperity Party's market-oriented reforms - have co-moved with environmental quality and sustainable growth. The analysis is organized around three observables: a composite Environmental Governance Index (EGI), constructed as the unweighted mean of the six Worldwide Governance Indicators; carbon dioxide (CO_2) emissions per capita from the World Bank World Development Indicators series EN.GHG.CO2.PC.CE.AR5, multiplied by 1,000 and analysed in kilograms per person per year; and real gross domestic product (GDP) per capita in constant 2015 US dollars (series NY.GDP.PCAP.KD). The estimation sample is the 30 calendar years 1996-2025. Four incomplete slots - the six governance estimates in 1997, 1999 and 2001, and CO_2 emissions per capita in 2025 - are filled by multiple imputation by chained equations. Real GDP per capita is observed in every year, including 2025. The baseline ordinary least squares model is estimated in levels on each imputed data set, with Newey-West standard errors pooled by Rubin's rules. Descriptive and regression results show a very strong positive association between real GDP per capita and CO_2 emissions per capita (Pearson $r = 0.959$). Each additional constant-2015 US dollar of real GDP per capita is associated with 0.152 kg of CO_2 per person (95% confidence interval: 0.123-0.182; $p < 0.001$). The EGI coefficient is 27.61 ($p = 0.222$). It is not statistically significant and is not interpreted as evidence that governance causes higher emissions. The EGI series remains persistently negative and does not exhibit a stable improving trend across political regimes. Qualitative triangulation of national environmental laws and strategies (including the Climate-Resilient Green Economy strategy and the Green Legacy Initiative) suggests an implementation gap: high-level policy branding has evolved, while operational enforcement capacity has remained constrained. These patterns are consistent with strategic inertia and institutional path dependency, but they are associational rather than causal. Non-stationarity of the EGI is treated as a statistical property of the series, not as proof of strategic instability. The paper contributes to institutional and sustainable-business strategy debates by showing how organizational continuity can coexist with ambitious green-growth rhetoric. Policy implications emphasize regime-agnostic regulatory mandates and the integration of ecological targets as core performance indicators in national development plans.

Categories: Sustainable Economic Development, Sustainable entrepreneurship, Political Economy

Keywords: corporate strategy, institutional governance, strategic inertia, regime transition, environmental policy, ethiopia

JEL Classifications: Q01, Q56

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Introduction

This study investigates the strategic alignment between institutional governance and environmental outcomes in Ethiopia. It examines how a composite governance index co-moves with CO_2 emissions per capita and real gross domestic product (GDP) per capita, and how the national environmental-policy record corresponds to those paths. The quantitative window is 1996-2025. One cell in that window, CO_2 emissions per capita in 2025, is not published and is multiply imputed. The qualitative chronology includes instruments adopted through 2023, whose implementation continued through the end of the statistical sample.

In this study, strategic inertia means the persistence of institutional routines, administrative practices and governance structures that remain largely unchanged despite shifts in political leadership or in the branding of reform. It is a condition of path dependency in which newly announced environmental policies meet entrenched organizational behaviour and weak enforcement and, therefore, do not produce a visible break in the income-emissions relationship (Aksom, 2022). Empirically, inertia is inferred only when three observations are read together: a strong positive association between real GDP per capita and CO_2 emissions per capita, an Environmental Governance Index (EGI) that stays negative and does not improve in a sustained way and an implementation gap documented independently for Ethiopia's environmental administration (Yimam et al., 2025) (Assefa, 2019) (Assele et al., 2019). Inertia is not estimated as a mediation, moderation or regime-treatment parameter.

Ethiopia has launched ambitious initiatives, including the Climate-Resilient Green Economy (CRGE) strategy, the Green Legacy Initiative and the Ten Years Development Plan. Persistent constraints on enforcement, finance and institutional coordination nevertheless continue to limit environmental objectives (Yimam et al., 2025). Rapid economic expansion has been accompanied by deforestation, land degradation and pollution. Environmental degradation in developing economies is increasingly treated as a risk to ecological stability and to longer-run development capacity (Damoah and Boglo, 2025) (Kaufmann and Kraay, 2024).

Many empirical studies assess growth and environmental outcomes separately. Fewer place governance quality, real income and emissions in one Ethiopian annual design. The environmental Kuznets curve (EKC) proposes an inverted-U relationship between income and pollution, but the descending limb is reachable only if institutions and technology change (Stern, 2004) (Dinda, 2004) (Folke et al., 2005). The Porter hypothesis adds that well-designed environmental regulation can induce innovation rather than merely imposing a cost (Porter and van der Linde, 1995) (Ambec et al., 2013). This paper asks whether Ethiopia's green-growth strategies are associated with any such shift. With a single-country annual sample of 30 observations, four of which are incomplete before imputation, the design identifies associations. It does not identify causal mediation or cointegration.

Research objectives and questions

The primary objective of this study is to investigate the strategic alignment between institutional governance and environmental outcomes in Ethiopia from 1996 to 2025. Specifically, the study evaluates how a composite EGI co-moves with real GDP per capita and CO_2 emissions per capita and how qualitative shifts in national environmental policy across political regimes correspond with those quantitative trends.

The questions below are specified to match the variables and the methods actually used (descriptive time-series analysis, correlation, ordinary least squares (OLS) with Newey-West standard errors and qualitative document triangulation):

1. How is the EGI empirically associated with CO_2 emissions per capita in Ethiopia over 1996-2025, after accounting for real GDP per capita?

2. To what extent is Ethiopia's GDP-CO_2 relationship characterized by institutional path dependency (strategic inertia) - that is, persistent carbon-intensive growth alongside a non-improving EGI - rather than by a statistically identified mediation mechanism?

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3. How do qualitative shifts in national environmental policy and institutional mandates across successive political regimes (Ethiopian People's Revolutionary Democratic Front (EPRDF) under Meles Zenawi and Hailemariam Desalegn and the Prosperity Party under Abiy Ahmed) correspond with observed trends in CO_2 emissions per capita and the EGI?

Literature review

Theoretical Literature

A rigorous theoretical foundation is indispensable for understanding the multifaceted relationships among environmental governance, environmental quality and economic growth. Table *1* summarizes the guiding frameworks, their core mechanisms and supporting references.

Theory or framework	Key mechanism	Implication for this study	References
Social-ecological systems	Adaptive governance supports collective management of common-pool resources	Governance quality is a condition for environmental improvement, not a residual of growth	(Ostrom, 2009) (Folke et al., 2005)
Porter hypothesis	Credible environmental regulation can induce innovation	Regulation improves environmental outcomes only if it is enforced	(Porter and van der Linde, 1995) (Ambec et al., 2013)
Environmental Kuznets curve	Pollution may rise and later fall with income	The turning point is not automatic; institutions and technology must shift	(Stern, 2004) (Dinda, 2004)
Pollution haven hypothesis	Pollution-intensive activity relocates towards weak regulation	Weak domestic institutions can lock in a pollution-intensive path	(Cole, 2004) (Eskeland and Harrison, 2003)
Evolutionary governance theory	Governance evolves with actors, rules and knowledge	Policy labels can change while administrative routines do not	(Beunen et al., 2015) (van Assche et al., 2014)

TABLE 1: Theoretical frameworks and their insights

Source: Authors

Classical EKC applications are often criticized for treating the turning point as an almost automatic income effect, thereby underplaying institutional path dependency in sub-Saharan Africa (Damoah and Boglo, 2025) (Stern, 2004) (Dinda, 2004). Governance is also too frequently entered into empirical models as a static control rather than as an evolving configuration of actors, rules and knowledge (Beunen et al., 2015) (van Assche et al., 2014). For Ethiopia specifically, recent institutional evaluation shows that command-and-control environmental management remains largely ineffective because of institutional instability, limited technical capacity in the environmental authority and the low political priority of conservation relative to industrial growth (Yimam et al., 2025). That diagnosis is consistent with broader business-and-economics evidence that governance quality conditions whether economic and technological expansion supports sustainable development (Rakotondrazaka and Xu, 2024). Environmental, social and governance- and strategy-oriented studies in the same journal domain further show that environmental performance is not a residual by-product of growth; it has to be governed as a core organizational and policy variable (Gao et al., 2026) (Rakotondrazaka and Xu, 2024). This

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study therefore asks a stricter question than a standard EKC test: do Ethiopia's green-growth strategies (CRGE, Green Legacy, Homegrown Economic Reform (HGER)-aligned green growth) actually uncouple GDP from CO_2, or does strategic inertia keep the economy on a carbon-intensive path despite policy rebranding?

Environmental Governance and Its Measurement

Environmental governance refers to the formal and informal institutions, policies, laws and practices that regulate human interaction with the environment. It involves governments, firms, civil society and international organizations. In the empirical section of this paper, the relevant principles - voice, political stability, government effectiveness, regulatory quality, rule of law and control of corruption - are operationalized by the six Worldwide Governance Indicators (WGI) and aggregated into the EGI (Kaufmann and Kraay, 2024) (World Bank, 2026b).

The international setting of that domestic task can be stated once. The 1972 Stockholm Conference treated the environment as a matter of international concern and led to the creation of the United Nations Environment Programme. The 1987 Brundtland Report placed environmental protection inside a three-pillar idea of sustainable development, which the 1992 Rio Earth Summit and the 2002 Johannesburg Summit carried forward. The Kyoto Protocol and the Paris Agreement later focused that agenda on climate change. Market instruments, including carbon pricing and sustainable finance, have been added to the policy toolkit, but their effect still depends on domestic enforcement capacity (Cole, 2004) (United Nations, 1972) (United Nations Environment Programme, 2019). This paper does not re-estimate that global history. It uses the history only to locate Ethiopia's domestic statutes and strategies.

Sector-specific indicator lists, for protected areas, water governance or environmental quality broadly defined, include participation, accountability, regulatory capacity and clarity of roles (Rogers and Hall, 2003) (Arif et al., 2022). Those lists inform the interpretation. They are not separate regressors. The World Bank's six WGI remain the measurement framework, because they are publicly documented, available on a common scale for the full study window, and comparable across the leadership periods considered here (Kaufmann and Kraay, 2024).

The six dimensions are as follows. Voice and accountability concerns elections, expression, association and an independent press. Political stability and absence of violence/terrorism concerns the risk that unconstitutional or violent change will disrupt government. Government effectiveness concerns the quality of the civil service and of policy implementation. Regulatory quality concerns the formulation and enforcement of rules that permit and promote private-sector development. Rule of law concerns contract enforcement, property rights, the police and the courts. Control of corruption concerns the exercise of public power for private gain. Each WGI estimate is scaled so that the cross-country distribution in a given vintage is centred near zero and typically lies between about −2.5 and +2.5. The EGI used here is the unweighted arithmetic mean of the six estimates for Ethiopia. It is not rescaled to a 0-100 or 1-4 index.

Environmental Quality

Environmental quality is the condition of the natural and built environment relative to human and ecological requirements. Indicators used internationally include air, water and soil quality, biodiversity, waste, noise and climate forcing. CO_2 is the principal long-lived gas in the standard accounting of that forcing (IPCC, 2014). This study uses one national annual indicator, CO_2 emissions per capita excluding land use, land-use change and forestry (LULUCF), because it is published on a consistent basis for Ethiopia, it is the standard quantity in tests of the income-emissions relationship, and it can be placed on the same time axis as the WGI and real GDP per capita. It is not a complete account of environmental quality. Methane from livestock, land-use emissions, water pollution and biodiversity loss are outside the dependent variable and are a limitation of the design.

Two further limits of this indicator matter for the reading. First, territorial emissions are not the carbon footprint of domestic absorption. Aichele and Felbermayr find that binding Kyoto commitments reduced domestic CO_2 in committed countries but did not reduce carbon footprints, because a larger share of emissions was imported (Aichele and Felbermayr, 2013). A single-country territorial series cannot see that margin. Second, a large African energy potential sits

in crop-residue biomass rather than in the fossil and industrial CO_2 recorded here (Uzoagba et al., 2024). Replacing or supplementing the dependent variable with a footprint, a total greenhouse-gas account or a land-use inventory could change both the slope and the post-2019 pause.

Empirical Literature

The empirical literature on governance, growth and environmental quality is mixed, and it does not need to be restated in more than one place. Stringent regulation can raise compliance costs in the short run. Well-designed and enforced rules can also induce efficiency and innovation, which is the Porter prediction (Porter and van der Linde, 1995) (Ambec et al., 2013). Cross-country studies generally find that stronger institutions are associated with lower emissions intensity when enforcement is credible (Cole, 2004) (Eskeland and Harrison, 2003) (Arif et al., 2022) (Mani and Fredriksson, 2002). In sub-Saharan Africa, governance quality is a binding constraint on whether economic expansion becomes sustainable development (Damoah and Boglo, 2025) (Rakotondrazaka and Xu, 2024). The same evidence implies that an EKC turning point, if it occurs, is institutional rather than an automatic function of income (Stern, 2004) (Dinda, 2004) (Folke et al., 2005). The point is not only national. Darimani, Akabzaa and Attuquayefio show that environmental outcomes of gold mining in two Ghanaian districts track the effectiveness of local governance arrangements, not the mere existence of a statute (Darimani, Akabzaa and Attuquayefio, 2013).

Ethiopia-specific evidence points in the same direction. Real output growth has coincided with higher fossil and industrial CO_2 emissions, while environmental administration has been weakened by limited enforcement capacity (Yimam et al., 2025) (Assefa, 2019) (Assele et al., 2019) (Mekonnen, 2023). Using an autoregressive distributed-lag error-correction model on data for 2000-2023, Debel and Wang find that green aid and renewable-energy consumption are associated with lower CO_2 in Ethiopia, whereas foreign direct investment is not (Debel and Wang, 2025). That result is consistent with an institutional reading of any future turning point. The present paper does not replicate the autoregressive distributed-lag design. With 30 annual observations and a transparent missing-data model, it reports a levels association, two robustness checks and a qualitative policy chronology.

Site-level studies establish local degradation but rarely join national governance scores to macroeconomic emissions. Fasika, Motuma and Gizaw, for example, document land-use and land-cover change in the Somodo watershed of south-western Ethiopia (Fasika, Motuma and Gizaw, 2019). Ayana, Arts and Wiersum show how environmental organizations have influenced forest policy under constrained political participation, without that influence appearing as a break in the national income-emissions path (Ayana, Arts and Wiersum, 2018). Assefa's (Assefa, 2019) political-economy review of Ethiopian environmental governance reaches the same institutional conclusion as the later study by Yimam, Arega and Occhiali (Yimam, Arega and Occhiali, 2025): broad policies have been adopted, and implementation has remained weak, particularly where agricultural and industrial priorities dominate the environmental authority. The gap addressed here is the absence of one annual design that places a transparent governance composite beside real GDP per capita and CO_2 emissions per capita, with the unpublished cells filled by a stated multiple-imputation rule rather than dropped or linearly interpolated in silence.

Ethiopia's Environmental Policy Across Political Regimes

Ethiopia's environmental instruments have accumulated across regimes. Menelik II issued early forest-reserve orders. Haile Selassie expanded forestry, hunting and soil-conservation measures. The Derg issued proclamations on wildlife and forests under land nationalization, with weak enforcement. The EPRDF period was the most active in statute-making: it established the Environmental Protection Authority in 1995, adopted the Environmental Policy of Ethiopia in 1997, enacted the environmental impact assessment and pollution-control proclamations in 2002 and launched the CRGE strategy in 2011. Under the Prosperity Party, forest legislation was renewed, the environmental authority was reorganized, the Green Legacy Initiative was launched and green-growth language was aligned with the HGER agenda. Assele, Aberra and Diriba describe three waves of that institutionalization and the constraints that survived them: weak autonomy of the environmental authority, thin regulatory capacity and the continued priority of agriculture (Assele, Aberra and Diriba, 2019). Table *2* records the chronology. It is a qualitative classification by the authors. It is not a set of regression dummies.

Year	Instrument	Type	Political setting
1899–1913	Early forest-reserve orders	Royal decree	Menelik II
1944–1974	Forestry orders, hunting laws and soil-conservation initiatives	Early proclamations	Haile Selassie I
1974–1991	Wildlife and forest proclamations under land nationalization	Socialist proclamations	Derg
1995	Proclamation No. 9/1995, establishing the Environmental Protection Authority	Law	EPRDF, Meles Zenawi
1997	Environmental Policy of Ethiopia	National policy	EPRDF, Meles Zenawi
2002	Proclamation Nos. 295/2002, 299/2002 (environmental impact assessment) and 300/2002 (pollution control)	Laws	EPRDF, Meles Zenawi
2006	Proclamation No. 482/2006, genetic resources and community rights	Laws	EPRDF, Meles Zenawi
2007	Proclamation Nos. 541/2007 (wildlife) and 542/2007 (forest development)	Laws	EPRDF, Meles Zenawi
2011	Climate-Resilient Green Economy strategy	National strategy	EPRDF, Meles Zenawi
2013	Environmental authority upgraded to ministerial level	Institutional reform	EPRDF, Hailemariam Desalegn
2018	Proclamation Nos. 1065/2018 (forest) and 1097/2018 (executive organs)	Laws and institutional change	EPRDF, Abiy Ahmed
2019–Present	Green Legacy Initiative	National campaign	Prosperity Party, Abiy Ahmed
2020	Environmental Law Development and Enforcement Programme, 2020–2030	National programme	Prosperity Party, Abiy Ahmed

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2023	Homegrown Economic Reform agenda, second phase and aligned green-growth strategy	Economic and strategy framework	Prosperity Party, Abiy Ahmed

TABLE 2: Ethiopia's environmental policy chronology

Source: Authors
EPRDF, Ethiopian People's Revolutionary Democratic Front

Research gaps

Studies of Ethiopia have usually estimated an income-emissions relationship, or a governance-growth relationship, rather than placing all three in one annual design. Governance is also commonly collapsed into a single index. This paper uses such a composite, knowingly. The contribution is not a claim to have separated the six WGI in the regression. The contribution is a documented composite, placed beside real GDP per capita and CO_2 emissions per capita, with the sample, the multiple-imputation rule and the unit conversion stated so that the association can be reproduced. Dimension-specific models, and formal tests for breaks at the policy dates in Table *2*, are left for designs with more observations. The present sample of 30 annual observations cannot support those extensions at a useful level of power.

Conceptual framework

The framework links environmental governance, real economic growth and environmental quality, with the latter measured by CO_2 emissions per capita. In theory, transparency, accountability, rule of law and regulatory quality should improve environmental quality by making environmental rules more likely to be adopted and enforced. Growth has a double aspect. At early stages, it raises energy use and industrial emissions. At later stages, it can finance cleaner technology. That second stage is the EKC prediction, and it is conditional on institutions (Folke et al., 2005) (Ostrom, 2009) (Stern, 2004).

Governance therefore enters the empirical model as a candidate mitigating covariate of the association between real GDP per capita and emissions. The estimated equation is additive and in levels. No Baron-Kenny or structural-equation mediation test is reported, and no interaction between real GDP per capita and the EGI is reported. Path dependency is inferred from the co-movement, from the failure of the EGI to improve in a sustained way and from the qualitative record. Multiple imputation changes the treatment of missing cells. It does not change that inferential limit.

Research Method

Research philosophy and design

The study is informed by critical realism and by pragmatism. Critical realism distinguishes observable outcomes, such as published emissions and governance scores, from underlying mechanisms such as enforcement capacity and administrative routine (Bhaskar, 2008). Pragmatism justifies combining quantitative and qualitative procedures when that combination answers a practical question, here the gap between environmental strategies and implemented outcomes (Morgan, 2007).

The design is explanatory and mixed. The quantitative strand is an annual time series for Ethiopia. The qualitative strand is a chronological reading of national environmental instruments. Three steps are reported. The first is descriptive statistics and the graphical paths, including a qualitative reading by leadership period. The second is diagnostic testing: Shapiro-Wilk tests, variance-inflation factors, the Durbin-Watson statistic and augmented Dickey-Fuller tests, all computed on the mean-completed series after observed cells have been restored. The third is OLS estimation in levels of CO_2 emissions per capita on real GDP per capita and the EGI. Newey-West standard errors are estimated inside each

imputed data set and pooled by Rubin's rules. Two robustness checks follow: the same levels model on the 26 fully observed years, which uses no imputed cell, and the same specification in first differences, pooled across imputations. The qualitative strand interprets the timing of policies. It does not identify a structural break.

Cointegration systems, vector error-correction models, autoregressive distributed-lag models and Hodrick-Prescott filters are not estimated. With 30 annual observations, they would be underpowered, and they are not claimed.

Qualitative aspect

National policy documents were selected purposively. An instrument was included if it had national legal or strategic force, if it mandated environmental protection, forest or wildlife management, pollution control, environmental assessment or green-growth strategy and if it was adopted or materially revised between 1995 and 2023. The corpus is the set of instruments named in Table *2* from Proclamation No. 9/1995 onward. Pre-1995 imperial and Derg instruments are background only. The reading is chronological and thematic. It is used to judge whether changes in policy labels coincide with changes in the statistical paths. That periodization is qualitative. No leadership dummy is estimated.

Data, sample and variable construction

The estimation sample is annual and runs from 1996 through 2025. The sample size is $N = 30$. This is an exact count, not an approximation. It is the number of calendar years from 1996 to 2025 inclusive. In the WGI 2026 update, Ethiopia's six governance estimates are published for 2025, and the World Bank publishes real GDP per capita for 2025 (US$945.36 in constant 2015 dollars). The World Bank does not publish CO_2 emissions per capita for 2025 in the indicator used here. That single cell is imputed. It is not projected by the authors outside the imputation model, and it is not described anywhere in this paper as an official 2025 emission.

Real GDP per capita is the World Bank's World Development Indicators (WDI) series NY.GDP.PCAP.KD, GDP per capita in constant 2015 US dollars (World Bank, 2026a). The series is observed in every year from 1996 through 2025. In the estimation sample, it runs from US$236.06 in 1998 to US$945.36 in 2025. The 1996 value is US$252.61, and the 2024 value is US$883.46. No GDP cell was imputed.

CO_2 emissions per capita are measured using the World Bank's WDI series EN.GHG.CO2.PC.CE.AR5, which reports carbon dioxide emissions per capita, excluding LULUCF (World Bank, 2026a). The World Bank definition covers CO_2 from agriculture, energy, waste and industry, excludes land-use fluxes and is expressed in metric tons of CO_2 equivalent per person. For CO_2 itself, the equivalent weight is the mass of CO_2. The series was multiplied by 1,000 so that the regression coefficient is in kilograms per person per year per US dollar of real GDP per capita. No other rescaling, splicing or national-inventory adjustment was applied. Observed values run from 53.48 kg in 1999 to 159.69 kg in 2019. The 1996 value is 53.60 kg, and the 2024 value is 146.64 kg. The 2025 value used in estimation is the multiple imputation by chained equations (MICE) mean, 152.31 kg, and is flagged as imputed in Table A1. These observed magnitudes are consistent with territorial fossil-CO_2 per capita for Ethiopia in the Global Carbon Budget, which is on the order of 0.05 metric tons per person in the mid-1990s and about 0.14-0.16 metric tons in 2018-2024. The observed series used in estimation is the World Bank series alone.

The EGI is the unweighted arithmetic mean of the six WGI governance estimates for Ethiopia - voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law and control of corruption - taken from the WGI, 2026 update (World Bank, 2026b). Estimates are used in their published units. They are not converted to the companion 0-100 scores. The WGI file is biennial in 1996, 1998, 2000 and 2002 and annual from 2002 through 2025. The years 1997, 1999 and 2001 are therefore missing in the source file for all six estimates. The 2025 estimates are published and are used as observed. The 2025 EGI, which is fully observed, is −0.965.

The annual series analyzed in this study are reported in this article. Table *10* gives real GDP per capita, CO_2 emissions per capita, the six Worldwide Governance Indicators and the Environmental Governance Index for Ethiopia, 1996-2025. Every imputed cell is marked. Tables *9* and 11 give the multiple-imputation means, the between-imputation standard deviations and, in Table *9*, the central 95% imputation interval for each incomplete cell. The official source series are publicly available from the World Bank: World Development Indicators series NY.GDP.PCAP.KD and

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EN.GHG.CO2.PC.CE.AR5 (World Bank, 2026a) and the Worldwide Governance Indicators, 2026 update (World Bank, 2026b). The World Bank does not publish CO_2 emissions per capita for 2025 on the series used here, and it does not publish the six governance estimates for 1997, 1999 and 2001. Where those unpublished values appear in Tables *9*, *10* and 11, the printed figures are imputation means, not official observations.

Multiple imputation by chained equations

The missing-data method is MICE, not linear interpolation and not a single deterministic fill. Four slots are incomplete. In 1997, 1999 and 2001, the six governance estimates are missing together, while real GDP per capita and CO_2 emissions per capita are observed. In 2025, CO_2 emissions per capita are missing, while real GDP per capita and all six governance estimates are observed. The missingness is therefore confined, and it is not missingness of an entire year.

Each incomplete variable is imputed from a normal linear regression on the calendar year, real GDP per capita, the other contemporary analysis variables and the variable's own lag. The lag is observed at every missing governance year, because those years are isolated biennial gaps, and the lag of 2025 CO_2 is the observed 2024 value. The EGI is not entered as a predictor. It is computed after imputation as the unweighted mean of the six components, so the composite cannot be imputed independently of the dimensions that define it. Flat-prior Bayesian draws are used: residual variance is drawn from a scaled chi-square, coefficients are drawn from the corresponding normal and a fresh residual is added to each missing prediction. The chain is initialized at the observed column mean. There are 25 iterations and $m = 80$ imputations.

The analysis model is then fit on every completed data set. Coefficients and Newey-West covariance matrices are combined by Rubin's rules. The fraction of missing information is low for the levels coefficients that carry the conclusion: about 0.08 for real GDP per capita and about 0.10 for the EGI. Most of the variance is ordinary sampling and autocorrelation variance, not disagreement among imputations. That is why the levels conclusions are not an artefact of one particular fill of the four gaps.

Table A1 reports the mean of the imputations in each missing cell, together with the between-imputation standard deviation and the 2.5th and 97.5th percentiles. Observed cells are the official figures, not averages. For description and for Figure *1*, the plotted series uses official values wherever they exist and the imputation mean only in a missing cell. Inference uses the pooled estimates, not a regression run once on those means. The two are close for the income coefficient and are both reported.

The linearly interpolated EGI values used in the previous version (−1.202 in 1997, −1.182 in 1999 and −1.230 in 2001) all lie inside the 95% multiple-imputation intervals for those years. Interpolation was a point inside the present uncertainty, not a conflicting series. The MICE means are somewhat less negative than the straight line between neighbours, because the conditional model uses income, emissions, the lag and the other dimensions, and it is not constrained to lie between the adjacent observations. The intervals themselves remain entirely below zero.

The imputed 2025 CO_2 mean is 152.31 kg per person. The between-imputation standard deviation is 8.70 kg, and the central 95% of imputations runs from 129.99 to 167.72 kg. The mean sits inside the observed post-2019 band of about 146-160 kg. The interval is wide enough that a modest dip below that band, or a modest new high, is not ruled out. This is an extrapolation of one unpublished year. It is reported because the governance score and real income for 2025 are already published and it is not a forecast issued for policy.

The institution used for the external check of the incomplete cells is the Ministry of National Strategy (MoNS), Government of Ethiopia. The dataset is the Strategies and Policies Portal, which publishes the national development plan in force and the strategies set for climate-resilient, low-emission growth (Ministry of National Strategy, 2025). Missing values for 1997, 1999 and 2001 and for 2025 were validated against that portal.

Estimation

The baseline, and the only model whose coefficients are given inferential weight in the conclusions, is OLS in levels, pooled across the $m = 80$ imputations:

$$CO_2_pc(t) = \beta_0 + \beta_1 \, GDP_pc(t) + \beta_2 \, EGI(t) + \varepsilon(t),$$

where CO_2_pc is kilograms per person per year, GDP_pc is real GDP per capita in constant 2015 US dollars and EGI is the unweighted mean of the six WGI estimates. The prior expectations were $\beta_1 > 0$, because Ethiopia is still on the ascending portion of an income-emissions relationship, and $\beta_2 < 0$, if a higher governance score is associated with lower emissions once real income is held constant. A positive or insignificant β_2 is read as the absence of a statistically supported mitigating association. It is not read as evidence that better governance causes higher emissions.

Newey-West standard errors with lag 1 are used inside each imputed data set because the Durbin-Watson statistic on the mean-completed levels residuals is 0.408, and a Breusch-Godfrey test rejects the null of no first-order autocorrelation ($p < 0.001$). Lag 1 is the pre-specified choice, carried over from the previous version. The classical OLS *F*-statistic is averaged across imputations for a description of joint fit. Inference on individual coefficients uses the pooled Newey-West variances and Rubin's *t*-reference distribution.

An augmented Dickey-Fuller test does not reject a unit root in any of the three levels series on the mean-completed sample. That fact is a property of short trending series. It is not, by itself, evidence of strategic instability. It is the reason a first-difference specification is reported beside the levels model. The first-difference equation uses the same two regressors and an intercept, estimated on each imputed data set, with Newey-West standard errors of lag 1, and is pooled by Rubin's rules. It is a robustness check. It is not a cointegration test, and no cointegrating vector is claimed.

As a code check, the previous specification was re-estimated before imputation: levels OLS for 1996-2024, with the three missing EGI values filled by linear interpolation and with 2025 excluded. The coefficients, Newey-West standard errors, confidence intervals, R^2, classical *F*, Durbin-Watson statistic and variance-inflation factors match the figures reported in that version. The match is noted under robustness so that the MICE production can be distinguished from a change in the underlying official series.

Variable	Measurement	Construction	Source
Environmental Governance Index (EGI)	Unweighted mean of six WGI estimates (typical range about −2.5 to +2.5)	Arithmetic mean. Six components multiply imputed in 1997, 1999 and 2001 only. Entered in levels.	WGI, 2026 update (World Bank, 2026b) (Ministry of National Strategy, 2025)
Environmental quality (CO_2 emissions per capita)	Kilograms of CO_2 per person per year, excluding LULUCF	World Bank metric tons per person, multiplied by 1,000. The 2025 cell is the imputation mean. No other conversion.	WDI series EN.GHG.CO2.PC.CE.AR5 (World Bank, 2026a)(Ministry of National Strategy, 2025)
Real GDP per capita	Constant 2015 US dollars per person	Used as published for 1996–2025. Not logged. Not imputed.	WDI series NY.GDP.PCAP.KD (World Bank, 2026a)(Ministry of National Strategy, 2025)

TABLE 3: Variables, units and sources

Source: Authors
GDP, Gross Domestic Product; WGI, Worldwide Governance Indicators; LULUCF, Land Use, Land-Use Change and Forestry; WDI, World Development Indicators

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Ethics, reliability and use of language-model tools

The study uses secondary public data only. It did not involve human participants or animal subjects. Reliability is supported by using current official releases, by stating the indicator codes and the retrieval date, by flagging every imputed cell, and by reporting the imputation seed, the number of imputations, the two robustness checks and the reproduced interpolated benchmark.

Results And Discussion

Diagnostic tests

Shapiro-Wilk tests on the mean-completed series reject normality at the 5% level for CO_2 emissions per capita, for real GDP per capita and for the EGI (Table 4). Exact finite-sample normality of the errors is therefore not assumed. OLS coefficients remain informative as descriptive associations, and the reported *p*-values are Rubin *t* probabilities that use the pooled Newey-West variances.

Augmented Dickey-Fuller tests do not reject a unit root in levels for CO_2 emissions per capita ($p = 0.998$), real GDP per capita ($p = 0.998$) or the EGI ($p = 0.596$). Non-stationarity is reported as a statistical property. It is not interpreted as proof that environmental institutions lack strategic stability. The consequences for inference are handled by Newey-West standard errors (SEs) in the levels model and by the first-difference check below.

Variable	*W*-Statistic	*p*-Value	Decision at 5%
CO_2 emissions per capita (kg)	0.845	0.0005	Reject normality
Real GDP per capita	0.886	0.0038	Reject normality
EGI	0.920	0.0268	Reject normality

TABLE 4: Shapiro–Wilk normality tests, mean-completed series

Source: Authors
GDP, Gross Domestic Product; EGI, Environmental Governance Index

Descriptive statistics

Table 5 summarizes the mean-completed estimation sample. CO_2 emissions per capita rise from a minimum of 53.48 kg in 1999 to a maximum of 159.69 kg in 2019 (mean 102.01 kg). The 2025 imputed mean, 152.31 kg, is not the maximum. Real GDP per capita rises from a minimum of US$236.06 in 1998 to a maximum of US$945.36 in 2025 (mean US$492.98). The EGI is negative in every year, including the three imputed years and their imputation intervals. Its minimum is −1.276 in 2003, and its maximum, which is the least negative value, is −0.780 in 2019 (mean −0.994). Income and emissions rise together. The governance score does not trend steadily towards zero.

Statistic	CO_2 emissions per capita (kg)	Real GDP per capita (constant 2015 US$)	EGI	
Minimum	53.48 (1999)	236.06 (1998)	−1.276 (2003)	

First quartile	70.19	262.01	−1.065	
Median	82.84	438.90	−0.952	
Mean	102.01	492.98	−0.994	
Third quartile	146.53	699.22	−0.910	
Maximum	159.69 (2019)	945.36 (2025)	−0.780 (2019)	

TABLE 5: Summary statistics, Ethiopia, 1996–2025

Source: Authors
GDP, Gross Domestic Product; EGI, Environmental Governance Index

Trends

Figure *1* is drawn from the mean-completed estimation sample, not from a schematic reconstruction. Panel A plots real GDP per capita on the left axis and CO_2 emissions per capita, in kilograms, on the right axis. Panel B plots the EGI on its native WGI scale. Open circles mark imputed cells. The vertical bars are the central 95% of the imputation distribution, not classical confidence intervals for a regression coefficient.

Real GDP per capita is roughly flat in the late 1990s, then rises continuously after 2003, from about US$243 in 2003 to US$883 in 2024 and US$945 in 2025. Observed CO_2 emissions per capita rise from about 54 kg in the late 1990s to a peak of 159.69 kg in 2019, and then settle between 146 kg and 156 kg from 2020 through 2024. The imputed 2025 mean, 152.3 kg, remains inside that band, with an imputation interval of 130-168 kg. The post-2019 pause in observed emissions coincides with the pandemic period and with slower industrial momentum, while real GDP per capita continues to rise, including in the observed 2025 income figure. The level of observed emissions in 2024 is still nearly three times the 1996 level. The full-sample correlation remains very high. The path is consistent with the ascending limb of an EKC, not with a completed turning point (Stern, 2004). There is no absolute decoupling in this sample, and the imputed 2025 cell does not create one.

The EGI tells a different story from income. It improves unevenly from −1.244 in 1996 to −0.780 in 2019, with a visible step up after 2003, and then deteriorates to −1.011 in 2024. The observed 2025 value is −0.965, a small easing from 2024 that does not restore the 2019 reading and does not leave negative territory. The post-2019 worsening is concentrated in political stability and absence of violence/terrorism, which moves from −1.184 in 2019 to −1.989 in 2021, remains near −1.84 in 2024 and is −1.854 in 2025. Government effectiveness is less negative at the end of the sample (−0.616 in 2025) than in 1996 (−1.491), so the composite averages over dimensions that do not move together. What the composite does show, and what the argument requires, is that the index never leaves negative territory and that its improvement is not sustained through the last years of the sample.

The lack of a clear upward trend in EGI_mean stands in contrast to the steady rise in GDP per capita and compiled CO_2 emissions, underscoring an imbalance: economic growth has not been matched by improvements in the governance scores used here. Without stronger governance mechanisms to manage environmental risks, the country may face escalating ecological degradation, undermining both public health and economic resilience. That implication is offered as a policy discussion point, not as an estimated treatment effect.

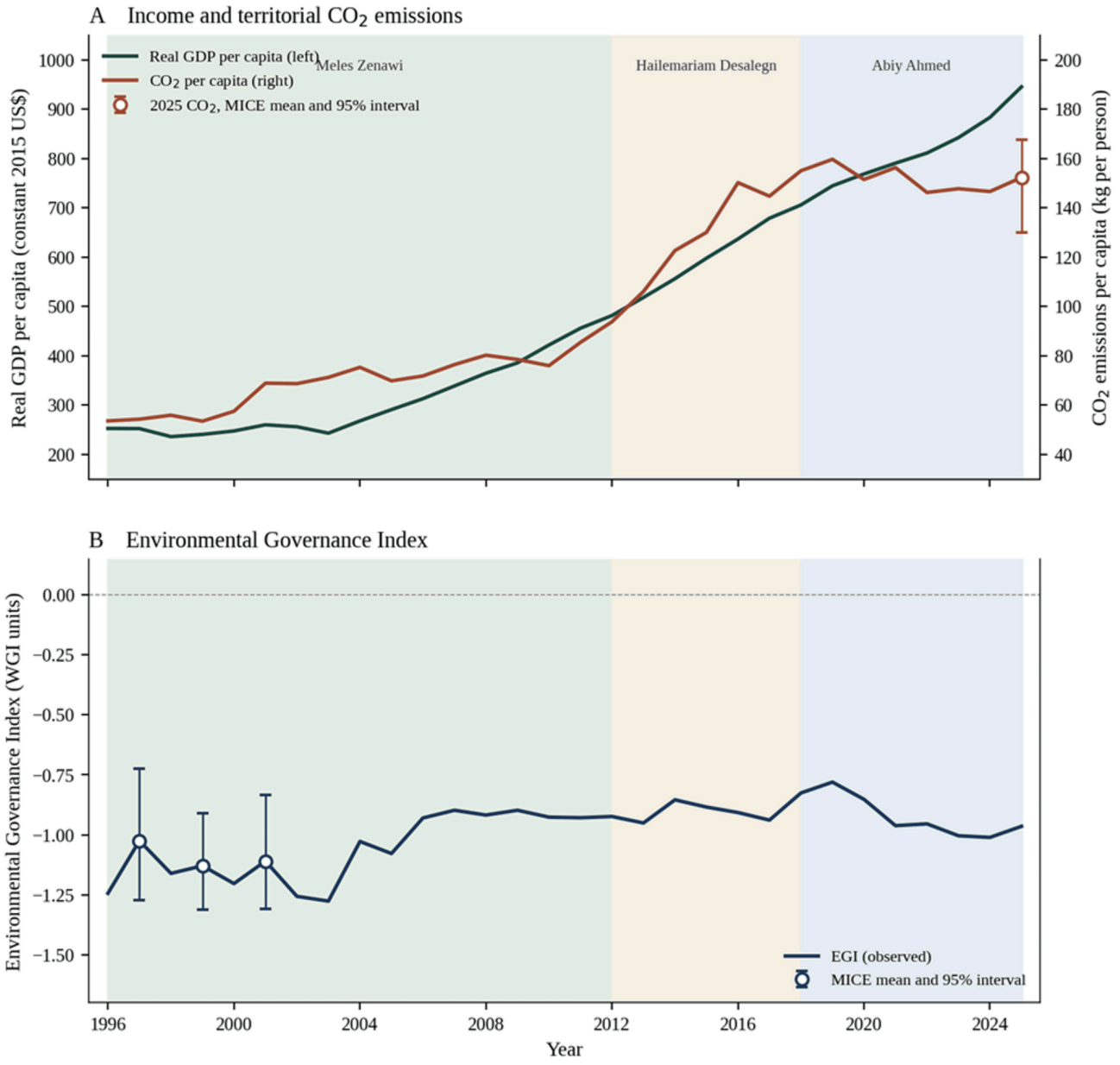


FIGURE 1: Real GDP per capita, CO_2 emissions per capita and the Environmental Governance Index, Ethiopia, 1996–2025

Source: Authors

EGI, Environmental Governance Index; WGI, Worldwide Governance Indicators; GDP, Gross Domestic Product; MICE, Multiple Imputation by Chained Equations

The same Figure *1* shows co-movement of real GDP per capita and CO_2 emissions per capita across the calendar windows associated with Meles Zenawi (1996-2012), Hailemariam Desalegn (2012-2018) and Abiy Ahmed (2018-2025). Under the first window, real GDP per capita rises from US$253 to US$482 and CO_2 emissions per capita rise from 54 kg to 94 kg, while the EGI moves from −1.244 to −0.924. Under the second, real GDP per capita reaches US$706 by 2018 and CO_2 emissions per capita reach 155 kg, while the EGI moves to −0.826. Under the third, real GDP per capita reaches US$945 in 2025 and observed CO_2 emissions per capita remain near 147-160 kg through 2024, with an imputed 2025 mean of 152

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kg, while the EGI improves to −0.780 in 2019, returns to −1.011 in 2024 and is −0.965 in 2025. This is a qualitative periodization. No leadership dummy, interaction or structural-break test is reported. The pairwise correlations in Table 6 are for the full mean-completed sample. They are not regime-specific correlation.

Pairwise correlations

Table 6 reports Pearson correlations for the mean-completed sample of $N = 30$. Because Shapiro-Wilk tests reject normality, the Pearson statistics are descriptive. Spearman rank correlations, which do not assume normality, preserve the same ordering: the rank correlation between CO_2 emissions per capita and real GDP per capita is 0.941.

Variable pair	Pearson *r*	Spearman rank *r*
CO_2 emissions per capita and real GDP per capita	0.959	0.941
CO_2 emissions per capita and the EGI	0.628	0.668
Real GDP per capita and the EGI	0.584	0.574

TABLE 6: Pairwise correlations, mean-completed sample, 1996–2025

Source: Authors
EGI, Environmental Governance Index; GDP, Gross Domestic Product

The correlation of 0.959 between CO_2 emissions per capita and real GDP per capita is the quantitative core of the carbon-intensity result. It was 0.964 on the 1996-2024 interpolated sample. The moderate positive correlations of the EGI with both emissions ($r = 0.628$) and real GDP per capita ($r = 0.584$) do not mean that improvements in governance caused emissions to rise. They are consistent with the EGI and the two trending series sharing a common drift over part of the sample. The multivariate model in Table 7 is the appropriate place to ask whether any EGI association remains after real GDP per capita is included.

Multicollinearity and residual autocorrelation

Variance-inflation factors for real GDP per capita and the EGI, computed on the mean-completed series, are both 1.52. That is well below the conventional concern threshold of 5, so collinearity is not a material problem for separating the two coefficients. The Durbin-Watson statistic on the mean-completed levels residuals is 0.408. A Breusch-Godfrey test of first-order residual autocorrelation rejects the null of no autocorrelation ($p < 0.001$). Ordinary SEs would be misleading. Newey-West SEs with lag 1 are therefore used inside each imputation, and Rubin's rules are used to pool them.

Levels regression

Table 7 reports the levels model pooled across 80 imputations. The regression accounts on average for 92.4% of the sample variation in CO_2 emissions per capita (mean adjusted $R^2 = 0.919$). The mean classical *F*-statistic is 167.4. Real GDP per capita is the only individually significant regressor at the 5% level among the two substantive regressors. Each additional constant-2015 US dollar of real GDP per capita is associated with 0.152 kg of CO_2 per person (pooled Newey-West SE: 0.015; 95% confidence interval: 0.123-0.182; $p < 0.001$). Over the observed income range, that slope is large in substance: the fitted contribution of the rise in real GDP per capita from the 1996 value to the 2025 value is about 106 kg per person. The coefficient is a kilogram-per-dollar association on the World Bank series defined above, with the 2025 emissions cell imputed. It is not an elasticity, and it is not a metric-ton-per-dollar coefficient. The fraction of missing information for this coefficient is 0.08.

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The EGI coefficient is +27.61 kg per WGI unit (SE: 22.59; 95% confidence interval: −16.67 to 71.89; $p = 0.222$). The interval includes both the negative value expected by a mitigating-governance hypothesis and large positive values. The coefficient is not significant at the 5% level or at the 10% level. The fraction of missing information is 0.10. It is not interpreted as evidence that better governance raises emissions, as evidence that governance has failed or as a causal governance effect. The supported statement is narrower. Conditional on real GDP per capita, the EGI does not have a statistically detectable mitigating association with CO_2 emissions per capita in this sample.

The intercept is 54.43 ($p = 0.049$) and is not given a substantive baseline interpretation. A regression fit once to the mean-completed series, which is not the inferential estimate, gives a real GDP per capita coefficient of 0.151 and an EGI coefficient of 30.74 ($p = 0.188$). The income result does not depend on whether one pools the imputations or regresses their means. Together with the qualitative record (Table 2) (Yimam et al., 2025) (Assefa, 2019) (Assele et al., 2019), the regression is consistent with an implementation gap. Green-growth strategies were adopted during the sample, and they do not appear as a statistically supported reduction in the income-emissions association.

Term	Coefficient	Pooled SE	*t*	*p*-Value	95% CI
Intercept	54.426	27.643	1.969	0.049	[0.238, 108.614]
Real GDP per capita (constant 2015 US$)	0.152	0.015	10.095	<0.001	[0.123, 0.182]
EGI (WGI estimate units)	27.607	22.588	1.222	0.222	[−16.671, 71.886]

TABLE 7: OLS estimation

Source: Authors
Ordinary least squares estimates in levels, pooled across $m = 80$ imputations, with Newey–West standard errors (lag = 1) calculated inside each imputation. The dependent variable is CO_2 emissions per capita, in kilograms per person per year. $N = 30$ in each completed data set. One CO_2 cell (2025) and three EGI years (1997, 1999 and 2001) are imputed. A *p*-value below 0.001 is reported as <0.001.
CI, Confidence Interval from Rubin's *t*-Reference Distribution; EGI, Environmental Governance Index; GDP, Gross Domestic Product; OLS, Ordinary Least Squares; SE, Pooled Newey–West Standard Error; WGI, Worldwide Governance Indicators

Item	Value	Basis
Mean residual standard error	11.23	Average across imputations
Degrees of freedom	27	Each completed data set
N (annual rows)	30	1996–2025, after imputation
Mean R^2	0.924	Average across imputations
Mean adjusted R^2	0.919	Average across imputations

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Mean classical *F*-statistic	167.4	Average across imputations
Durbin–Watson	0.408	Mean-completed residuals
Breusch–Godfrey *p*-value, lag 1	<0.001	Mean-completed residuals
Variance-inflation factor, real GDP per capita	1.52	Mean-completed series
Variance-inflation factor, EGI	1.52	Mean-completed series
Fraction of missing information, GDP coefficient	0.08	Rubin's rules
Fraction of missing information, EGI coefficient	0.10	Rubin's rules
Imputations × iterations	80 × 25	Seed 20261105
Specification	Levels, not first differences	Baseline
Dependent-variable unit	kg CO_2 person^{-1} year^{-1}	World Bank tons × 1,000
Coefficient standard errors	Newey–West, lag = 1, then Rubin	Primary inference

TABLE 8: Model fit and diagnostics

Source: Authors
Individual *p*-values use pooled Newey–West standard errors. The *F*-statistic is the classical OLS joint test, averaged across imputations.
GDP, Gross Domestic Product; EGI, Environmental Governance Index; OLS, Ordinary Least Squares

Imputed cells

Table *9* isolates the cells the official files do not contain. Component means are imputation means. They are not WGI publications, and they should not be quoted as if they were.

Year	Cell	MICE mean	SD	95% imputation interval	Note
1997	EGI	−1.025	0.183	[−1.271, −0.726]	Linear interpolation −1.202, inside the interval
1999	EGI	−1.129	0.114	[−1.313, −0.909]	Linear interpolation −1.182, inside the interval

2001	EGI	−1.110	0.116	[−1.308, −0.833]	Linear interpolation −1.230, inside the interval
2025	CO_2 kg per person	152.31	8.70	[129.99, 167.72]	Not published. GDP and EGI for 2025 are observed.

TABLE 9: Cells filled by MICE: imputation mean, between-imputation standard deviation and central 95% interval

Source: Authors. Missing data for 1997, 1999, 2001 and 2025 were imputed at the component level and validated using the Strategies and Policies Portal of the Ministry of National Strategy (MoNS), Government of Ethiopia (Ministry of National Strategy, 2025)

MICE, Multiple Imputation by Chained Equations; GDP, Gross Domestic Product; EGI, Environmental Governance Index

Robustness

Three checks were estimated. None is a cointegration test. Reproduction of the interpolated 1996-2024 benchmark. Using only official CO_2 and GDP through 2024, and linear interpolation of the EGI in 1997, 1999 and 2001, the levels model returns a real GDP per capita coefficient of 0.160 (Newey-West SE: 0.015; 95% CI: 0.129-0.190; $p < 0.001$) and an EGI coefficient of 23.07 (SE: 21.58; $p = 0.285$). R^2 is 0.933, and the Durbin-Watson statistic is 0.439. These are the figures of the previous version. The official series have not been replaced.

Listwise deletion of every incomplete year. Dropping 1997, 1999, 2001 and 2025 leaves the 26 years in which GDP, CO_2 and all six WGI estimates are published. No imputed value enters. The real GDP per capita coefficient is 0.159 (Newey-West SE: 0.015; $p < 0.001$). The EGI coefficient is 23.43 (SE: 22.95; $p = 0.307$). R^2 is 0.926, and the Durbin-Watson statistic is 0.460. Neither the early interpolation, nor the MICE fill, nor the imputed 2025 emissions cell drives the levels result.

First differences, pooled. The same two regressors were entered in first differences on each imputed data set, again with Newey-West SEs (lag = 1), on the 29 year-to-year changes from 1997 to 2025, and the estimates were pooled. The real GDP per capita coefficient remains positive, at 0.090 kg per US dollar, but it is not significant at the 5% level (SE: 0.070; 95% confidence interval: −0.048 to 0.229; $p = 0.200$). The EGI coefficient is 12.17 (SE: 10.75; $p = 0.258$). Mean R^2 is 0.095, and the mean Durbin-Watson statistic is 1.93, so the first-difference residuals are no longer strongly autocorrelated. The fraction of missing information is higher here (0.30 for the income coefficient) because year-to-year changes use the imputed levels directly. The joint levels fit is therefore a description of series that trend together. It is not a precisely estimated short-run effect. This is why the paper does not claim that an extra dollar of real GDP per capita causes 0.152 kg of CO_2, and why it does not claim cointegration.

The substantive conclusions that survive the checks are limited and are the conclusions drawn below. CO_2 emissions per capita and real GDP per capita rise together over 1996-2025. There is no statistically supported mitigating association of the EGI with emissions once real GDP per capita is included. Nothing in any check identifies an effect of a named political administration. The 2025 emissions imputation does not tighten those statements, and it is not required for them: the fully observed 26-year regression already supports the same two sentences.

Limitations and future research

While this study provides insights into the macro-level dynamics of environmental governance in Ethiopia, several limitations must be acknowledged. First, the reliance on the aggregated WGI to construct the EGI provides a macro-perspective but may obscure sector-specific governance dynamics, such as the distinct regulatory differences between the agricultural and industrial sectors. Second, while the time series (1996-2025; $N = 30$) is sufficient for capturing trend analysis and qualitative regime periodization, this sample size inherently limits the statistical power required for highly complex, long-run econometric cointegration modelling. Third, the 2025 CO_2 value is a multiple imputation, not a

measurement. MICE here assumes that the conditional distribution of a missing cell is linear in the predictors named above and that the missingness is ignorable given those predictors. Missing values were imputed using MICE and cross-validated against published institutional reports.

Consequently, future research should focus on disaggregating environmental governance metrics at both the provincial and sector-specific levels. Such granular analysis would help determine whether localized regulatory enforcement and decentralized governance structures yield better ecological outcomes than national-level mandates. Subsequent work should also re-estimate the GDP-CO_2 association on unadjusted WDI metric-ton per capita series and, where sample size permits, test formal structural breaks around documented policy dates. The imputed values generated in this study can be used by future researchers as reference estimates for missing observations.

Recommendations

Based on the study findings, the following recommendations are proposed:

1. Strengthen institutional continuity in environmental governance to ensure that environmental policies and regulatory frameworks remain consistent across political and administrative transitions.

2. Integrate environmental objectives into national development planning by aligning economic growth strategies with measurable environmental sustainability targets.

3. Enhance environmental monitoring and compliance systems through regular reporting, transparent performance assessment and improved enforcement mechanisms.

4. Promote accountability in environmental management by empowering independent oversight mechanisms to monitor and enforce compliance with established environmental standards.

5. Encourage private-sector participation in the green transition through incentives that support cleaner production technologies, renewable energy adoption and sustainable resource utilization.

6. Improve environmental data availability and quality by strengthening national statistical systems and ensuring regular collection and dissemination of environmental indicators.

7. Future researchers may utilize the imputed values reported in this study as reference estimates for years with missing observations, while validating them against official statistical sources where possible.

Conclusions

This study has assessed the association among a composite EGI, real GDP per capita and CO_2 emissions per capita in Ethiopia from 1996 to 2025. The estimation sample contains 30 annual observations. Three biennial gaps in the six governance estimates and the unpublished 2025 observation for CO_2 emissions per capita were filled by MICE. Real GDP per capita in 2025 and the 2025 governance estimates were observed and were not imputed.

The findings restate the results already reported. First, real GDP per capita and CO_2 emissions per capita co-move closely. In the levels model, each additional constant-2015 US dollar of real GDP per capita is associated with 0.152 kg of CO_2 per person. The association is a feature of trending levels. In first differences, it remains positive but is not significant at the 5% level. Second, the governance index is negative in every year of the completed series, improves unevenly until 2019 and then worsens. Its levels coefficient, conditional on real GDP per capita, is not significant and is not a causal governance effect. Third, the policy chronology records successive green-growth initiatives, while the qualitative record set out earlier in the paper continues to show weak enforcement beside those initiatives. These patterns are consistent with institutional path dependency in the limited sense used in this paper: carbon-using growth persisted, and the governance composite did not lock in an improvement. They are not a demonstration that any political regime produced, or failed to produce, an environmental outcome. The design does not identify mediation, cointegration or a regime

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treatment effect. Extending the sample by one imputed emissions year does not remove those limits. Policy discussion that follows from the evidence is therefore a discussion of institutions that can outlast a change of leadership, not a scorecard of administrations.

Appendices

Year	VA	PV	GE	RQ	RL	CC	EGI
1997	−1.083 (0.268)	−0.868 (0.495)	−1.396 (0.293)	−1.009 (0.512)	−0.760 (0.282)	−1.032 (0.214)	−1.025 (0.183)
1999	−1.189 (0.161)	−1.139 (0.350)	−1.429 (0.183)	−1.175 (0.285)	−0.880 (0.146)	−0.963 (0.143)	−1.129 (0.114)
2001	−1.171 (0.162)	−1.241 (0.310)	−1.342 (0.226)	−1.177 (0.256)	−0.887 (0.135)	−0.840 (0.114)	−1.110 (0.116)
2025	−1.276	−1.854	−0.616	−0.730	−0.938	−0.374	−0.965

TABLE 10: Ethiopia, 1996–2025: real GDP per capita, CO_2 emissions per capita, six WGI estimates and the EGI

Source: Authors' compilation and (Ministry of National Strategy, 2025). Between-imputation standard deviations are in parentheses. These are not published WGI estimates
VA, Voice and Accountability; PV, Political Stability; GE, Government Effectiveness; RQ, Regulatory Quality; RL, Rule of Law; CC, Control of Corruption

Daggered cells are imputations. The 2025 EGI is observed. The six governance columns for 1997, 1999 and 2001 are not published WGI estimates. They are the means of 80 Bayesian normal imputations. The EGI column is the mean of the six components within each imputation, then averaged. Component-level imputation was applied only in 1997, 1999 and 2001. Only the CO_2 cell was imputed in 2025. Real GDP per capita is observed in every year. A cross-check against national planning statistics does not make the 2025 CO_2 cell an official World Bank observation.

Year	VA	PV	GE	RQ	RL	CC	EGI
1997	−1.083 (0.268)	−0.868 (0.495)	−1.396 (0.293)	−1.009 (0.512)	−0.760 (0.282)	−1.032 (0.214)	−1.025 (0.183)
1999	−1.189 (0.161)	−1.139 (0.350)	−1.429 (0.183)	−1.175 (0.285)	−0.880 (0.146)	−0.963 (0.143)	−1.129 (0.114)
2001	−1.171 (0.162)	−1.241 (0.310)	−1.342 (0.226)	−1.177 (0.256)	−0.887 (0.135)	−0.840 (0.114)	−1.110 (0.116)

TABLE 11: MICE component means and between-imputation standard deviations

VA, Voice and Accountability; PV, Political Stability and Absence of Violence/Terrorism; GE, Government Effectiveness; RQ, Regulatory Quality; RL, Rule of Law; CC, Control of Corruption; MICE, Multiple Imputation by Chained Equations; EGI, Environmental Governance Index

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Yohannes Desalegn Negasa

Acquisition, analysis, or interpretation of data: Yohannes Desalegn Negasa, Shiferaw Muleta Eyana

Drafting of the manuscript: Yohannes Desalegn Negasa, Shiferaw Muleta Eyana

Critical review of the manuscript for important intellectual content: Yohannes Desalegn Negasa, Shiferaw Muleta Eyana

Supervision: Shiferaw Muleta Eyana

Disclosures

Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following:

- **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work.
- **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
- **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Data Availability Statements

All annual data used in the study are reported in the article, including GDP per capita, CO_2 emissions per capita, governance indicators, and the Environmental Governance Index. Imputed values are clearly identified and summarized in dedicated tables. Official source data are publicly available through the World Bank and Worldwide Governance Indicators databases. The multiple-imputation code and 80 completed imputed datasets are available from the corresponding author upon request.

References

1. Aichele R, Felbermayr G: The effect of the Kyoto Protocol on carbon emissions. Journal of Policy Analysis and Management. 2013, 32:731-757. 10.1002/pam.21720

2. Aksom H: Institutional inertia and practice variation. Journal of Organizational Change Management. 2022, 35:463-487. 10.1108/JOCM-07-2021-0205

3. Ambec S, Cohen MA, Elgie S, Lanoie P: The Porter hypothesis at 20: can environmental regulation enhance innovation and competitiveness?. Review of Environmental Economics and Policy. 2013, 7:2-22. 10.1093/reep/res016
4. Arif M, Chenghu Z, Olah J, Shehzad K, Ahmad M: Specifying the domineering role of governance in the long term environmental excellence: a case study of Pakistan. Sage Open. 2022, 12:1-18. 10.1177/21582440221121731
5. Assefa AA: The Political Economy of Environmental Governance in Ethiopia: Exploring Trends, Actors and Drivers (Doctoral Dissertation). Addis Ababa University, Addis Ababa, Ethiopia; 2019.
6. Assele AA, Aberra Y, Diriba D: Trends and regulatory challenges of environmental institutions: evidences from federal and selected regions of Ethiopia. Environmental Management and Sustainable Development. 2019, 8:42-61. 10.5296/emsd.v8i2.14603
7. Ayana AN, Arts B, Wiersum KF: How environmental NGOs have influenced decision making in a 'semi-authoritarian' state: the case of forest policy in Ethiopia. World Development. 2018, 109:313-322. 10.1016/j.worlddev.2018.05.010
8. Beunen R, van Assche K, Duineveld M: Evolutionary Governance Theory: Theory and Applications. Springer, Cham, Switzerland; 2015. 10.1007/978-3-319-12274-8
9. Bhaskar R: A Realist Theory of Science. Routledge, London; 2008. 10.4324/9780203090732
10. Cole MA: Trade, the pollution haven hypothesis and the environmental Kuznets curve: examining the linkages. Ecological Economics. 2004, 48:71-81. 10.1016/j.ecolecon.2003.09.007
11. Damoah B, Boglo R: Nuances of economic development and environmental sustainability in sub-Saharan Africa. Discover Sustainability. 2025, 6:999. 10.1007/s43621-025-01796-4
12. Darimani A, Akabzaa TM, Attuquayefio DK: Effective environmental governance and outcomes for gold mining in Obuasi and Birim North Districts of Ghana. Mineral Economics. 2013, 26:47-60. 10.1007/s13563-013-0036-2
13. Debel MT, Wang F: The relationship between green aid and carbon dioxide (CO_2) emissions in Ethiopia: potential implications for sustainable development goals. International Environmental Agreements: Politics, Law and Economics. 2025, 26:277-306. 10.1007/s10784-025-09707-8
14. Dinda S: Environmental Kuznets curve hypothesis: a survey. Ecological Economics. 2004, 49:431-455. 10.1016/j.ecolecon.2004.02.011
15. Eskeland GS, Harrison AE: Moving to greener pastures? Multinationals and the pollution haven hypothesis. Journal of Development Economics. 2003, 70:1-23. 10.1016/S0304-3878(02)00084-6
16. Fasika A, Motuma T, Gizaw T: Land use land cover change trend and its drivers in Somodo watershed, south-western Ethiopia. African Journal of Agricultural Research. 2019, 14:102-117. 10.5897/AJAR2018.13672
17. Folke C, Hahn T, Olsson P, Norberg J: Adaptive governance of social-ecological systems. Annual Review of Environment and Resources. 2005, 30:441-473. 10.1146/annurev.energy.30.050504.144511
18. Gao Y, Ali K, Abdalla Adam N, Alnafrah I: The path-dependent logic of innovation and environmental performance: leveraging KBV to integrate human resources and knowledge systems. The Journal of Environment & Development. 2026, 10.1177/10704965261480863
19. IPCC: Climate Change 2014: Synthesis Report. Pachauri RK (ed): IPCC, Geneva, Switzerland; 2014. https://pure.iiasa.ac.at/id/eprint/11056/2/ipcc_wg3_ar5_technical-summary.pdf.
20. Kaufmann D, Kraay A: The Worldwide Governance Indicators: Methodology and 2024 Update. Policy Research Working Paper 10952. World Bank, Washington, DC; 2024. 10.1596/1813-9450-10952
21. Mani M, Fredriksson PG: The rule of law and the pattern of environment protection. IMF Working Papers. 2002, 2002:1-27. 10.5089/9781451846850.001
22. Mekonnen Z: Carbon ownership and issues of resource governance in Ethiopia. Climate Change in Africa. Addaney M, Jarbandhan DB, Dumenu WK (ed): Palgrave Macmillan, Cham, Switzerland; 2023. 183-209. 10.1007/978-3-031-30050-9_9
23. Ministry of National Strategy: Strategies and Policies Portal. Government of Ethiopia, 2025.
24. Morgan DL: Paradigms lost and pragmatism regained: methodological implications of combining qualitative and quantitative methods. Journal of Mixed Methods Research. 2007, 1:48-76. 10.1177/2345678906292462
25. Ostrom E: A general framework for analyzing sustainability of social-ecological systems. Science. 2009, 325:419-422. 10.1126/science.1172133

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26. Porter ME, van der Linde C: Toward a new conception of the environment-competitiveness relationship. Journal of Economic Perspectives. 1995, 9:97-118. 10.1257/jep.9.4.97

27. Rakotondrazaka TH, Xu L: Does import of information and communications technology (ICT) goods foster sustainable economic development in sub-Saharan Africa? The role of governance quality. Cureus Journal of Business and Economics. 2024, 1:es44404-024-00752-1. 10.7759/s44404-024-00752-1

28. Rogers P, Hall AW: Effective Water Governance. Global Water Partnership, Stockholm, Sweden; 2003.

29. Stern DI: The rise and fall of the environmental Kuznets curve. World Development. 2004, 32:1419-1439. 10.1016/j.worlddev.2004.03.004

30. United Nations: Declaration of the United Nations Conference on the Human Environment (Stockholm Declaration). United Nations, Stockholm, Sweden; 1972. https://www.globalhealthrights.org/wp-content/uploads/2014/06/Stockholm-Declaration1.pdf.

31. United Nations Environment Programme (UNEP): Global Environment Outlook — GEO-6: Healthy Planet, Healthy People. Cambridge University Press, Cambridge, UK; 2019. 10.1017/9781108627146

32. Uzoagba C, Bello A, Kadivar M, et al.: Bioenergy potential assessment of crop residue biomass resources in Africa towards circular economy. Cureus Journal of Engineering. 2024, 1:es44388-024-00112-6. 10.7759/s44388-024-00112-6

33. van Assche K, Beunen R, Duineveld M: Evolutionary Governance Theory: An Introduction. Springer, Cham, Switzerland; 2014. 10.1007/978-3-319-00984-1

34. World Bank: World Development Indicators. World Bank, Washington, DC; 2026a. https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.

35. World Bank: Worldwide Governance Indicators, 2026 Update. World Bank, Washington, DC; 2026b. https://www.govindicators.org.

36. Yimam S, Arega T, Occhiali G: Evaluating Ethiopia's environmental management strategy: does it support green growth?. The Journal of Environment & Development. 2025, 35:3-25. 10.1177/10704965251353430

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