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WAEMU's Urban Jungle: Can Good Governance Tame the Green Monster?

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Urbanization in West African Monetary Union (WAEMU) has been rapid but can lead to environmental degradation. This study investigates the relationship between urbanization and environmental degradation from 2002 to 2022. While urbanization alone is not a major culprit, it can exacerbate environmental problems when combined with other factors. Strong institutions, particularly effective governance, are crucial for mitigating these impacts. The study recommends strengthening institutions, improving regulations, and fostering regional cooperation to address WAEMU's environmental challenges.

I. Introduction

Urbanization, the shift of population from rural to urban areas, has been a defining characteristic of the 21st century. This rapid growth, particularly in developing regions like West Africa, has led to a myriad of environmental challenges (Akadiri & Akpan, 2024). The Economic Community of West African States (ECOWAS) region or West African Monetary Union (WAEMU) is no exception. As cities within WAEMU expand, they grapple with issues such as pollution, deforestation, and resource depletion (Maishanu et al., 2019; Zickgraf et al., 2016).

The environmental impacts of urbanization in WAEMU are multifaceted and interconnected (Mboup & Oyelaran-Oyeyinka, 2019). Increased population density can exacerbate air and water pollution, as well as solid waste management problems. The expansion of urban areas often leads to deforestation, habitat destruction, and biodiversity loss. Moreover, the growing demand for resources, including energy and water, can strain natural ecosystems and contribute to climate change. While urbanization presents significant environmental challenges, the extent and severity of these impacts are not solely determined by population growth. Institutional quality, or the effectiveness and efficiency of governance structures, plays a crucial role in shaping the relationship between urbanization and the environment (Akadiri & Akpan, 2024). Well-governed cities are better equipped to manage environmental challenges through effective policies, regulations, and enforcement

mechanisms. Conversely, weak institutions can exacerbate environmental problems by fostering corruption, inefficiency, and a lack of accountability.

Previous research has explored the complex interplay between urbanization and environmental impacts in various contexts (Adebayo et al., 2023; Saint Akadiri et al., 2019). Bayale et al. (2021) examined renewable energy production and environmental sustainability in WAEMU. Skidmore et al. (2016) investigated rural population growth and land-tenure conflict in Mali. However, the specific role of institutional quality in shaping the environmental impacts of urbanization in WAEMU has received less attention in the existing literature. While some studies have acknowledged the importance of good governance in addressing environmental challenges, a comprehensive analysis of how institutional factors influence the relationship between urbanization and environmental outcomes in the region is still lacking.

This study fills this gap by examining the environmental impacts of urbanization in WAEMU and assessing the role of institutional quality in mitigating or exacerbating these effects. Through empirical analysis, this study provides insights into the factors that drive environmental degradation in WAEMU's urban areas and identifies effective strategies for promoting sustainable urbanization.

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II. Methodology and Data

As stated earlier, the objective of this study is to explore how urbanization influences environmental outcomes in WAEMU and to examine whether institutional quality could moderate this relationship. To proceed, we draw upon the empirical frameworks established in prior studies (e.g., U. F. Akpan & Atan, 2016; U. Akpan & Kama, 2023; Ali et al., 2019; Gaiya et al., 2024) and formulate our baseline model as follows:

$$EnvQ_{it} = \phi + \beta_1 Urbz_{it} + \beta_2 InstQ_{it} + \psi Z_{it} + \mu_i + \lambda_t + \epsilon_{i,t} \quad (1)$$

Where $EnvQ_{it}$ denotes a measure of environmental quality, $Urbz_{it}$ is urbanization, $InstQ_{it}$ represents a measure of institutional quality, and Z_{it} is a vector of control variables, namely real GDP and trade openness. μ_i accounts for the country-specific heterogeneity, λ_t and $\epsilon_{i,t}$ captures the time-specific fixed effects and the error term, respectively. To investigate the moderating effect of institutional quality on the urbanization-environmental nexus, we specify the extended model as follows:

$$EnvQ_{it} = \phi + \beta_1 Urbz_{it} + \beta_2 InstQ_{it} + \beta_3 (Urbz_{it} \times InstQ_{it}) + \psi Z_{it} + \mu_i + \lambda_t + \epsilon_{i,t} \quad (2)$$

In this extended model, the interaction term ($Urbz_{it} \times InstQ_{it}$) allows us to capture how the impact of urbanization on the environment may vary depending on the quality of institutions within WAEMU.

Both Fixed Effects and Random Effects estimators were employed to estimate the models, with Hausman (1978) tests used to determine the preferred model specification if both fixed and random effects are validated. The Fixed Effects model controls for time-invariant characteristics of the countries, while the Random Effects model assumes that these individual effects are uncorrelated with the independent variables.

Guided by the availability of institutional measures, the dataset spans 2002 to 2022. Environmental quality (EnvQ) is quantified using CO₂ emissions expressed in metric tons per capita. Institutional quality (InstQ) is captured by six commonly accepted indicators: control of corruption (COC), government effectiveness (GOE), regulatory quality (REG), voice and accountability (VOA), political stability (POL), and rule of law (ROL). Each institutional metric is measured on a percentile scale from 0 (lowest quality) to 100 (highest quality). Real GDP and trade openness serve as control variables. All data were extracted from the World Bank's World Development and Governance Indicators databases except for CO₂ emissions data, which is drawn from Ritchie et al. (2023). All variables except the institutional indicators were log-transformed to facilitate coefficient interpretation. A summary of the descriptive statistics for these variables is presented in Table 1.

In terms of the a priori expectations, urbanization's impact on environmental quality depends on its management. Poorly managed urbanization can harm the environment, while effective management can support sustainable practices. Strong institutions are expected to promote environmental sustainability by enforcing laws, managing re-

sources, and fostering eco-friendly technologies. Economic activities may harm the environment through increased production and energy use, but higher incomes can lead to cleaner technologies and stricter regulations. Trade openness could shift pollution-intensive industries to countries with weaker environmental laws, potentially increasing environmental degradation (U. F. Akpan & Abang, 2015; U. Akpan & Kama, 2023).

III. Results

Table 1 displays the baseline results indicating the direct impact of urbanization and institutions on environmental outcomes in WAEMU. The p -values of the diagnostic tests reported at the bottom of the table confirmed the fixed effect models as the preferred model across all the estimations. Evidence from the results indicates that urbanization positively impacts environmental damage in WAEMU. However, the evidence was insignificant at the conventional 5% level—suggesting that the variable might not be a key driver of environmental issues within the economic block. With respect to the direct impact of institutions, results show that institutional quality matters for environmental protection, which supports the findings of Akpan & Kama (2023). Aside from corruption control, all other measures of institutions turned up with expected negative and significant coefficients with environmental damage. Notably, the strongest influence comes from government effectiveness, which captures the government's capacity to design and enforce sound policies, as well as its commitment to upholding these policies. This finding is consistent with the conclusions reached in earlier studies (U. Akpan & Kama, 2023) and underscores the necessity of enhancing institutional frameworks to achieve sustainable environmental outcomes in WAEMU.

Table 2, which presents results from the extended model, reveals that urbanization poses significant environmental challenges in WAEMU, as evidenced by the positive and significant coefficients in most models, except for Equations (3) and (7). The findings also highlight the crucial role of institutions in addressing these challenges. Not only do institutions have a direct and significant negative impact on environmental degradation, but they also play a mediating role in ensuring effective urban planning and management to mitigate the environmental costs of urbanization. These results suggest that enhancing institutional quality is vital for reducing the environmental impact of urbanization in the region, providing a strong case for policymakers to prioritize institutional strengthening as part of sustainable urban development strategies.

A. Robustness Check

For robustness, we follow the approach adopted by Gaiya et al. (2024) to compute an index for institutional quality using the principal component analysis (PCA) methodology. The index was then used to replace institutional quality in equations (1) and (2). Re-running these models, we obtained the results shown in Table 3. Findings were consistent with previous results—improvement in institutional

quality could help mitigate environmental damage in WAEMU. The impact of urbanization is still positive but only significant at 10% for model 3—consistent with our baseline results. The most intriguing finding is the counter-intuitive result that the interaction between institutional quality and urbanization exacerbates environmental problems rather than alleviates them. This could imply that in WAEMU, the current state of institutional frameworks may not be adequately equipped to manage the environmental challenges posed by urbanization.¹ This failure could stem from weak regulation enforcement, inefficient planning, limited public participation, resource and technical constraints, and a short-term focus influenced by political instability. Strengthening these institutional weaknesses could be essential for mitigating the environmental impacts of urbanization and promoting sustainable development in the zone.

IV. Conclusion

This study reveals that urbanization in WAEMU significantly contributes to environmental degradation, especially when considering broader models. While the direct impact was initially found to be insignificant, the extended analysis highlights urbanization's substantial role in environmental challenges. Institutional quality, particularly government effectiveness, plays a critical role in mitigating

these effects. Strong institutions are essential for effective urban planning and management, helping to reduce the environmental costs of urbanization and achieve sustainable outcomes in the region.

To address the environmental challenges posed by urbanization in WAEMU, this study recommends several key policy measures. First, policymakers should focus on building strong, effective institutions that can tackle environmental issues and promote sustainable urban growth. This involves enhancing regulatory frameworks, boosting transparency and accountability, and investing in capacity-building for government officials. In addition, policies should be implemented to support sustainable urban development. This includes promoting compact city designs, improving public transportation, and investing in green infrastructure. Stricter environmental regulations, the promotion of renewable energy, and investment in waste management infrastructure are also crucial to protecting ecosystems, reducing pollution, and mitigating climate change. Finally, strengthening regional cooperation among WAEMU member states is essential to address shared environmental challenges such as transboundary pollution and climate change, ensuring a coordinated and effective response across the region.

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¹ This was evident in the descriptive statistics of the data (not shown here to reduce word count), where the average score for each institutional variable was below the 37th percentile, highlighting the region's pervasive institutional weaknesses.

Table 1. Urbanization, Environment and the Role of Institutions in WAEMU: Results Without Interaction Terms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
<i>URBZ</i>	0.189* (0.105)	0.040 (0.194)	0.118 (0.092)	0.134 (0.097)	0.155 (0.103)	0.251 (0.157)	0.092 (0.097)	0.150 (0.119)	0.083 (0.109)	0.111 (0.113)	0.117 (0.100)	0.152 (0.110)
<i>RGDP</i>	0.662*** (0.105)	0.440*** (0.152)	0.801*** (0.091)	0.762*** (0.096)	0.682*** (0.100)	0.427*** (0.136)	0.586*** (0.091)	0.523*** (0.108)	0.777*** (0.112)	0.727*** (0.114)	0.719*** (0.097)	0.650*** (0.104)
<i>OPEN</i>	0.456*** (0.099)	1.737*** (0.181)	0.253*** (0.089)	0.297*** (0.094)	0.416*** (0.095)	0.894*** (0.147)	0.384*** (0.087)	0.530*** (0.107)	0.406*** (0.097)	0.446*** (0.101)	0.387*** (0.092)	0.458*** (0.101)
<i>COC</i>	-0.088 (0.059)	0.376*** (0.090)										
<i>GEF</i>			-0.270*** (0.039)	-0.251*** (0.042)								
<i>REQ</i>					-0.253*** (0.083)	0.016 (0.121)						
<i>POL</i>							-0.123*** (0.022)	-0.089*** (0.027)				
<i>VOA</i>									-0.196*** (0.066)	-0.170** (0.068)		
<i>ROL</i>											-0.183*** (0.041)	-0.154*** (0.045)
Constant	-21.111*** (1.296)	-20.154*** (1.598)	-21.927*** (1.107)	-21.495*** (1.163)	-20.315*** (1.227)	-18.637*** (1.576)	-17.490*** (1.273)	-17.595*** (1.478)	-21.556*** (1.265)	-21.076*** (1.292)	-20.735*** (1.183)	-20.062*** (1.266)
<i>R</i> -squared	0.696		0.770		0.711		0.748		0.710		0.730	
Wald <i>F</i> -Test	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
BP LM test		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Hausman test	(0.000)		(0.0003)		(0.000)		(0.000)		(0.004)		(0.000)	

Standard errors are reported in parentheses for the estimated parameters while the values for the diagnostic tests are *p*-values. ***, **, and * represent statistical significance at 1%, 5%, and 10% levels, respectively

Table 2. Urbanization, Environment and the Role of Institutions in WAEMU: Results with Interaction Terms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
URBZ	0.963*** (0.289)	0.189 (0.289)	0.325 (0.239)	0.408* (0.241)	0.722*** (0.252)	-0.219 (0.297)	0.353 (0.285)	0.437 (0.276)	0.753*** (0.267)	0.793*** (0.262)	0.552* (0.293)	0.704** (0.286)
RGDP	-0.028 (0.274)	0.328 (0.225)	0.642*** (0.219)	0.550** (0.220)	0.214 (0.226)	0.593*** (0.224)	0.393* (0.235)	0.315 (0.206)	0.195 (0.246)	0.147 (0.240)	0.349 (0.263)	0.190 (0.253)
OPEN	0.395*** (0.099)	1.725*** (0.200)	0.226** (0.090)	0.249*** (0.094)	0.333*** (0.096)	2.181*** (0.223)	0.361*** (0.093)	1.765*** (0.193)	0.356*** (0.098)	0.374*** (0.100)	0.360*** (0.096)	0.401*** (0.103)
COC	0.004 (0.072)	0.401*** (0.095)										
COC*URBAN	-0.002*** (0.001)	-0.002 (0.002)										
GEF			-0.253*** (0.044)	-0.233*** (0.045)								
GEF*Urban			-0.002** (0.001)	-0.002** (0.001)								
REQ					-0.247*** (0.085)	0.576*** (0.153)						
REQ*URBAN					-0.002*** (0.001)	-0.001 (0.002)						
POL							-0.099*** (0.028)	0.301*** (0.048)				
POL*URBAN							-0.001** (0.001)	-0.002 (0.001)				
VOA									-0.121* (0.070)	-0.107 (0.070)		
VOA*URBAN									-0.002** (0.001)	-0.002** (0.001)		
ROL											-0.119** (0.052)	-0.086 (0.052)
ROL*URBAN											-0.002** (0.001)	-0.002** (0.001)
Constant	-17.061***	-19.860***	-21.346***	-20.628***	-17.873***	-22.100***	-16.995***	-23.099***	-18.415***	-18.036***	-18.936***	-17.859***

	(2.124)	(1.826)	(1.681)	(1.694)	(1.699)	(1.876)	(1.643)	(1.725)	(1.867)	(1.831)	(1.865)	(1.820)
R-squared	0.716		0.780		0.734		0.744		0.723		0.729	
Wald F-Test	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
BP LM test		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Hausman test	(0.000)		(0.008)		(0.000)		(0.000)		(0.045)		(0.000)	

Standard errors are reported in parentheses for the estimated parameters while the values for the diagnostic tests are *p*-values. ***, **, and * represent statistical significance at 1%, 5%, and 10% levels, respectively.

Table 3. Urbanization, Institutions and Environment in WAEMU: Using composite Index of Institutional Quality (IQ) computed with PCA.

	(1)	(2)	(3)	(4)
	FE	RE	FE	RE
Institutional Quality (IQ)	-0.072*** (0.016)	-0.040** (0.019)	-1.246*** (0.404)	-1.400*** (0.438)
Urbz	0.089 (0.101)	0.175 (0.123)	0.184* (0.104)	0.242** (0.115)
IQ*Urbz			0.075*** (0.026)	0.086*** (0.028)
RGDP	0.727*** (0.097)	0.588*** (0.114)	0.576*** (0.108)	0.491*** (0.115)
OPEN	0.343*** (0.094)	0.530*** (0.116)	0.269*** (0.095)	0.359*** (0.107)
Constant	-20.919*** (1.179)	-19.751*** (1.363)	-18.569*** (1.404)	-17.845*** (1.468)
Observations	147	147	147	147
R-squared	0.733		0.748	
Wald F-test	161.74		157.57	60.99
P-value	(0.000)		(0.000)	(0.000)
BP LM-test		314.78		293.85
P-value		(0.000)		(0.000)
Hausman-test		54.90		36.50
P-value		(0.000)		(0.000)

Standard errors are reported in parentheses for the estimated parameters while the values for the diagnostic tests are *p*-values. ***, **, and * represent statistical significance at 1%, 5%, and 10% levels, respectively.



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