

## FINANCIALISATION AND INDUSTRIAL OUTPUT GROWTH IN WEST AFRICA: MODERATING EFFECT OF ENVIRONMENTAL REGULATION

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### Abstract

*The industrial sector in West Africa has faced persistent volatility arising from macroeconomic instability, infrastructural gaps, and external shocks, limiting sustained industrial growth. Despite regional initiatives such as the African Continental Free Trade Area, challenges related to production costs, access to finance, and governance continue to constrain industrial performance. This study examines the relationship between environmental regulation, financialization, and industrial output growth in 16 West African countries from 1990 to 2023. Using panel data techniques and the Pooled Mean Group (PMG) estimator, the study assesses both the direct effect of financialization and the moderating role of environmental regulation. The results show that financialization is associated with lower industrial output growth, indicating a shift of resources away from productive industrial activities. In contrast, effective environmental regulation improves industrial performance by reducing the adverse influence of financialisation. Countries with stronger regulatory frameworks record relatively higher industrial growth outcomes. The findings further suggest that poorly regulated financial liberalisation can weaken industrial development, particularly for small and medium-sized enterprises. The study emphasises the need for coordinated policies that strengthen environmental regulation, improve financial sector governance, and support long-term industrial investment to achieve sustainable industrial development in West Africa.*

**Keywords:** Environmental regulation, Financialization, Industrial output growth, PMG, West Africa

**Jel Codes:** C23, Q52, G20, O14, O55

## 1. Introduction

Industrial development remains central to economic transformation, employment generation, and structural change in West Africa. However, the region's industrial sector has continued to experience volatility driven by macroeconomic instability, infrastructural deficiencies, weak institutional capacity, and exposure to external shocks. In recent decades, the growing dominance of financial activities relative to productive sectors has raised concerns about the role of financialization in shaping industrial output growth. In many West African economies, financial resources increasingly flow into short-term and speculative activities rather than long-term industrial investment, limiting the capacity of manufacturing and allied industries to expand sustainably.

At the same time, industrial expansion in the region has intensified environmental pressures through pollution, resource depletion, and ecological degradation. Robust environmental regulation, when effectively designed and enforced, can guide industrial activity toward cleaner production processes and sustainable growth paths (Bhattacharya et al., 2016). Conversely, weak regulatory frameworks often allow industrial and financial activities to operate without adequate environmental safeguards, aggravating environmental degradation and undermining long-term development objectives. Recent evidence from ECOWAS indicates that countries with high levels of financial activity but weak environmental regulation record more severe environmental outcomes, with adverse implications for industrial performance and public welfare (ECOWAS, 2023). These developments highlight the need for policy frameworks that jointly address financial dynamics and environmental governance in the pursuit of sustainable industrial growth.

Existing empirical studies on financialization and industrial performance have largely relied on single-country analyses or broad classifications of developed, developing, and less-developed economies, with limited attention to regional blocs such as West Africa (Palley, 2007; Stockhammer, 2012; Tori & Onaran, 2018). Much of this literature concentrates on the direct relationship between financialization and economic or industrial growth, often neglecting the role of environmental regulation as a conditioning or moderating factor (Arcand et al., 2015; Beck et al., 2000). Within the African context, available studies are predominantly country-specific, focusing mainly on countries like Nigeria and South Africa and do not sufficiently capture the structural heterogeneity of West African economies (Ilugbusi et al., 2020; Ncube & Lufumpa, 2015). From a methodological standpoint, relatively few studies in West Africa have applied the ARDL–Pooled Mean Group (PMG) estimator, which allows for cross-country heterogeneity in the short run while imposing long-run homogeneity and facilitates comparison with alternative estimators such as the Mean Group and Dynamic Fixed Effects approaches (Pesaran et al., 1999; Asongu & Odhiambo, 2019). This methodological gap is notable given the suitability of the ARDL–PMG framework for panel data covering structurally diverse developing economies.

The contribution of the study to the literature is in several ways. It provides a region-wide analysis of 16 West African countries, offering broader evidence beyond country-specific studies. Also, it integrates environmental regulation into the financialization and industrial output growth framework, thereby clarifying

how regulatory quality conditions the impact of financialization on industrial output growth. In addition, it applies the ARDL–PMG estimator to offer robust long-run and short-run evidence suitable for heterogeneous developing economies. Given the structural characteristics of African economies, understanding the implications of financialisation for industrial output growth remains critical for designing policies that support inclusive and sustainable development. This study is structured as follows. Section one gives an introduction to the study with the objectives, the problems identified and the gaps. Section Two reviews the concepts, theories and relevant empirical literature. Section Three outlines the model specification, data sources, and estimation techniques. Section Four presents and discusses the empirical results. Section Five concludes the study and draws out policy implications.

## **2. Literature Review**

### **2.1. Review of Concepts**

#### **2.1.1 Concept of Financialization**

Financialization has emerged as a key concept in understanding the transformations within the modern economy, reflecting the increasing influence of financial markets, institutions, and actors across various dimensions of economic life. It encompasses the impact of finance on corporate governance, investment strategies, income distribution, and broader social outcomes (Epstein, 2019). Scholars from diverse fields have defined and conceptualized Financialization in multiple ways, illustrating its complex and evolving nature (Lazonick, 2020).

#### **2.1.2 Concept of Industrial Output Growth**

Industrial output growth refers to the sustained increase in the volume of goods and services produced by the industrial sector of an economy, which includes manufacturing, mining, construction, and utilities. It is a critical indicator of economic performance, reflecting improvements in productivity, capacity utilisation, and technological application within industries (World Bank, 2020). The drivers of industrial output growth include capital accumulation, technological innovation, skilled labour, and efficient resource utilisation (UNIDO, 2021). Growth in output signals stronger industrial performance, enabling economies to meet domestic demand, reduce import dependence, and expand export potential. For developing economies, industrial output growth plays a central role in stimulating employment, generating revenue, and fostering linkages with other sectors such as agriculture and services (Mardalena et al., 2019). However, fluctuations in global commodity prices, energy supply constraints, and infrastructural bottlenecks often impede consistent growth in output, particularly in emerging regions.

In West Africa, industrial output growth has historically been volatile, shaped by economic cycles, policy interventions, and external shocks. During the post-independence era, efforts to expand production in sectors such as textiles, cement, and agro-processing initially boosted industrial output. However, macroeconomic instability and infrastructural weaknesses limited sustained growth (Signé & Johnson, 2018). The structural adjustment reforms of the 1980s and 1990s liberalised the industrial space, but output expansion was uneven due to import dependence and capacity underutilization (McMichael, P. 2020). More recently, industrial output growth in the region has been driven by regional integration initiatives such as the African Continental Free Trade Area (AfCFTA), rising domestic demand, and gradual improvements in energy and transport

infrastructure (Adebayo et al., 2021). Nonetheless, persistent challenges such as high production costs, limited access to finance, and exposure to global market fluctuations continue to hinder consistent output expansion. Sustainable industrial output growth in West Africa will require targeted policies that promote value addition, green technologies, and regional supply chain development to ensure competitiveness in global markets.

### **2.1.3 Concept of Environmental Regulation**

Environmental regulation refers to a set of rules, standards, and policies implemented by governments and international bodies to protect the environment from the adverse effects of industrial, commercial, and other human activities (Goulden et al., 2019). These regulations are designed to control pollution, manage natural resources sustainably, and mitigate the impacts of environmental degradation on ecosystems and human health. Environmental regulations encompass various mechanisms such as emissions limits, waste management protocols, and environmental impact assessments (EIAs), all of which aim to ensure that economic development does not compromise environmental sustainability (Yanagi et al., 2019). Effective environmental regulations are essential for harmonising industrial growth with ecological conservation, and they are fundamental to promoting sustainable development. Recent studies highlight the importance of these regulations in mitigating environmental degradation while supporting long-term economic goals (Dasgupta & Wheeler, 2018).

## **2.2 Theoretical Review**

### **2.2.1 Pollution Haven Hypothesis**

The Pollution Haven Hypothesis (PHH) posits that firms in pollution-intensive industries relocate from countries with stringent environmental regulations to those with more lenient standards, thereby reducing operational costs. This phenomenon is particularly pertinent to developing regions like West Africa, where the desire to attract foreign direct investment (FDI) may lead to the adoption of less rigorous environmental policies. Recent studies have provided empirical support for the PHH in Africa. For instance, Achuo and Ojong (2024) analysed 46 African countries from 1996 to 2022 and found that FDI inflows significantly increase CO<sub>2</sub> emissions, corroborating the PHH. They also observed an N-shaped Environmental Kuznets Curve (EKC), indicating that while initial economic growth complicates environmental degradation, further development eventually leads to environmental improvements. The interaction between financialization and environmental regulations in West Africa can, on one hand, facilitate industrial growth by providing the necessary capital for expansion. However, if this capital is directed towards industries that exploit lax environmental regulations, it can lead to increased pollution and environmental degradation. Wang et al. (2023) discuss the dual outcomes of Financialization, noting that while it can lead to economic growth, it may also result in environmental harm if not properly managed.

In the West Africa region, the relationship between Financialization and environmental regulations can both enhance and hinder industrial output growth (Prempeh, 2024). Lenient environmental policies may attract FDI, boosting industrial activity in the short term. However, this can lead to environmental degradation, which may undermine sustainable development in the long run. Stringent environmental regulations could deter some polluting industries but might encourage investments in cleaner technologies and sustainable industries.

### **2.2.3 Kaldor's growth model**

Kaldor's growth model, often associated with his "three growth laws," focuses on the pivotal role of the manufacturing sector in economic development. Here are the components of the model:

**First Law (Manufacturing as the Engine of Growth):** This posits a strong positive relationship between the growth of manufacturing output and the overall GDP. Manufacturing is considered the driver of growth due to its high productivity and linkages with other sectors.

**Second Law (Verdoorn's Law):** Kaldor incorporates Verdoorn's insight, suggesting that manufacturing productivity growth increases with output growth due to economies of scale, learning effects, and technological advancement.

**Third Law (Structural Transformation):** Productivity growth in non-manufacturing sectors is dependent on the reallocation of resources from low-productivity activities (like agriculture) to high-productivity manufacturing. This structural shift fosters overall economic development. Kaldor's model emphasises the self-reinforcing nature of growth through cumulative causation, where increased demand for manufacturing spurs investment, innovation, and further growth. The model assumes that manufacturing drives not only productivity but also employment and technological diffusion, creating a virtuous cycle of economic expansion. Recent studies integrate financial sector dynamics and global market considerations, arguing for its adaptation to contemporary economic systems (Mazzucato, 2018; Storm, 2021).

### **2.3 Empirical Review**

Recent studies highlight the interaction between financialization, environmental regulation, and green innovation across different economies. Empirical evidence suggests that financialization often constrains green technological advancement by reducing R&D investment and promoting short-term profit-seeking behaviour (Li et al., 2023; Tong et al., 2022; Li et al., 2024). In Europe, Le et al. (2022) find that while financial system quality enhances environmental innovation adoption, it does not significantly improve patent outputs, indicating that financial development alone may not guarantee technological outcomes. Hao et al. (2024) demonstrate that stricter environmental regulations, such as higher pollution discharge fees, can moderate the effects of financialization by incentivising green patent production, though speculative financial motives can offset these benefits. Similarly, Guo et al. (2022) show that market competition and financialization interact to influence green innovation in Chinese manufacturing, emphasising the role of firm-level strategies and governance. These studies collectively highlight the dual nature of financialization as both a potential enabler and inhibitor of green innovation, contingent on regulatory, institutional, and market conditions.

Looking at industrialisation and environmental sustainability, several studies across Africa and emerging economies emphasise the moderating roles of energy use, institutional quality, and policy frameworks. Aquilas et al. (2024) report that manufacturing value addition negatively affects environmental sustainability in Africa, but renewable energy usage can offset these effects. Amuakwa-Mensah et al. (2017) show that energy efficiency improvements positively influence financial sector performance in Sub-Saharan Africa under strong institutional

frameworks. Baajike et al. (2022) validate the Environmental Kuznets Curve (EKC) for West Africa, demonstrating that economic growth initially worsens but eventually improves environmental quality, while trade liberalisation benefits the environment under well-regulated institutions. Ganda (2025) finds that in BRICS countries, financialization and green investments interact with technological innovation and environmental governance to influence environmental quality. These studies indicate that financial and industrial development can support sustainable outcomes if reinforced by robust institutions, green technologies, and renewable energy adoption.

Environmental regulations are consistently shown to moderate the effects of financialization and industrial activities on environmental outcomes. Zhou et al. (2021) and Qi and Chen (2024) demonstrate that regulations strengthen the environmental performance of financial development and foreign direct investment in the MENA region and China, respectively. Li and Xu (2025) identify a nonlinear “U-shaped” effect of environmental regulation on industrial green total factor productivity, moderated by decentralisation. Zhang et al. (2022) reveal that China’s green credit policy mitigates financialization among heavily polluting firms by fostering green innovation and reducing speculative investments. Xie and Teo (2022), Yin et al. (2023), Cao et al. (2019), Liu et al. (2023), Antenucci et al. (2020), Erdoğan and Telek (2023), Deleidi et al. (2023), Ferraz (2024), Mousa and Nassereddine (2024) and Li et al. (2017) collectively reinforce that environmental regulations, public concern, and green finance instruments are crucial in aligning industrial activities with ecological sustainability. Collectively, these studies underscore that regulatory framework, both market-driven and command and control, are essential for leveraging financialization towards sustainable industrial and technological outcomes.

Also, policy orientation and industrial strategy significantly influence the interplay between financialization, growth, and sustainability. Cao et al. (2021) and Sawyer (2022) show that industrial policy in China reduces financialization among non-financial firms, particularly in regions with high marketisation, limiting the shift from real to virtual economy activities. Ullah et al. (2024) highlight that regulatory quality enhances the contribution of financial development to economic growth in developed countries but is less effective in developing economies, necessitating gradual institutional improvements. Omotola et al. (2024) emphasise that financial development moderates’ economic growth in West Africa, contingent on institutional quality. Collectively, these studies affirm that sustainable industrialisation and green innovation require coordinated policies that integrate financial regulation, industrial strategy, and environmental governance (Yang et al., 2025; Li & Wang, 2018; Hameed et al., 2024; Tchaphet et al., 2024).

### **3. Methodology**

#### **Theoretical Framework**

The theoretical foundation of the industrial output growth equation can be found in Kaldor’s Third Law, which is widely used in some empirical studies (Antenucci et al., 2020; Erdoğan & Telek, 2023; Deleidi et al., 2023; Ferraz & Ferraz, 2024; Mousa & Nassereddine, 2024).

**Kaldor Theory:** Kaldor emphasises the manufacturing sector as the engine of growth, linking industrial output growth to economic development through cumulative causation and structural transformation. Kaldor’s three laws: Growth of GDP is driven by growth in manufacturing output. Manufacturing productivity increases with manufacturing output (Verdoorn’s Law). Productivity in non-manufacturing sectors depends on resource reallocation to manufacturing. Manufacturing drives technological diffusion and economies of scale. Structural shifts are essential for sustained growth. Demand-led growth mechanisms dominate. Kaldor’s focus on structural transformation makes it well-suited for studying Financialization’s impact on industrial output growth. To achieve the Objective of this study, Kaldor’s Third Law was re-specified.

**Derivation of Kaldor’s Third Law**

The general form of Kaldor’s Third Law can be expressed as:

$$P_{NM} = \alpha + \beta Y_M + \epsilon \dots\dots\dots 3.1$$

Where:  $P_{NM}$  = Productivity growth in the non-manufacturing sector,  $Y_M$  = Growth of manufacturing output,  $\alpha$  = Constant term,  $\beta$  = Coefficient measuring the effect of manufacturing growth on non-manufacturing productivity,  $\epsilon$  = Error term. Assume the total economy’s output ( $Y$ ) is divided into manufacturing ( $Y_M$ ) and non-manufacturing ( $Y_{NM}$ ). Productivity ( $P$ ) in the non-manufacturing sector is determined by labour reallocation and capital accumulation influenced by the manufacturing sector. Let the output per worker (labour productivity) in non-manufacturing be represented as:  $P_{NM} = \frac{Y_{NM}}{L_{NM}}$

Taking the growth rate:  $P_{NM} = \frac{dP_{NM}}{dt} = \frac{d}{dt} \left( \frac{Y_{NM}}{L_{NM}} \right) \dots\dots\dots 3.2$

Since Kaldor’s Third Law suggests that non-manufacturing productivity depends on manufacturing growth, we introduce the relationship:  $P_{NM} = f(Y_M)$

A linear approximation gives:  $P_{NM} = \alpha + \beta Y_M + \epsilon$

Where  $\beta > 0$  suggests that higher manufacturing output growth improves non-manufacturing productivity. This is done by inserting the expression and transforming the result into an econometric model by replacing non-manufacturing expressions with industrial output growth and adding an intercept  $\beta_0$ , and interacting environmental regulation with Financialisation, time and country subscripts (t and i) and the stochastic error term (U).

$$P_{ind} = \beta_0 + \beta_1 FIN_{it} + \beta_2 ER_{it} + \beta_3 (FIN \times ER_{it}) + \beta_4 GDPG_{it} + \beta_5 TO_{it} + \beta_6 GE_{it} + \beta_7 HC_{it} + \beta_8 FDII_{it} + U_{it}$$

3.5

FIN: Financialisation is used as an index from Financialisation indicators, and the reason for picking those indicators (Financial development indicators and broad money supply as a percentage of GDP) is for the study to be free from multicollinearity and was computed using principal component analysis (PCA), ER: Environmental regulations. GDPG: Gross domestic product growth. TO: Trade openness. GE: government effectiveness. HC: Human Capital. FDII: foreign direct investment inflow.  $FIN * ER$  = The interaction of Financialization

with Environmental Regulation.  $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$  and  $\beta_8$  represent parameters for estimation.  $i = "i"$  denotes the cross-sectional unit and  $t$  denotes the time point of observation within the panel data analysis.  $U_{it}$  = Stochastic error term.

#### 4. Results and Discussion

Over the period 1990-2023, the mean value of industrial output growth (IND) for the sixteen (16) West African countries under the study is 8,829 billion constant US dollars, with a standard deviation of 4.243 billion indicates a moderate spread around the mean, showing variability in industrial output growth levels. The minimum score is 1.533, and the maximum score is 21.587, showing that industrial output growth deviates much from the mean.

**Table 1: Descriptive Statistics**

Variable	Obs.	Mean	Std. Dev.	Min	Max
IND	544	8.829	4.243	1.533	21.587
FIN	544	9.113	.742	-.605	31.304
ER	544	40.069	8.07	10	74.4
GE	544	-.811	.435	-1.81	.34
TO	544	59.082	17.681	26.099	131.485
GDPG	544	4.053	7.568	-51.031	106.28
HC	544	6.142	4.33	.592	21.79
FDII	544	3.919	15.759	-202.824	167.329

Source: Authors' computation, 2025

Financialization (FIN) has a Mean of 9.113% and a standard deviation of 0.742, demonstrating a relatively stable financial environment. However, the minimum value of -0.605 suggests that some observations experience negative Financialization effects, while the maximum value of 31.304 highlights positivity in financial depth. The values of the mean and standard deviation of the Environmental Regulation (ER) are Mean 40.069 and Std. Dev. 8.709. The average environmental regulation measure across the regions under study. Indicates moderate variability in environmental regulation levels. Min 5.6, indicating minimal environmental regulation. Max 74.4 shows the highest level of environmental regulation. On average, Government Effectiveness (GE) has a Mean of -0.811, a negative average score indicates governance challenges are prevalent in all the West African countries, and it has a Std. Dev of 0.435, denoting a moderate variability in government effectiveness across all the countries in the region, the Min value of -1.81 reflects the least effective governance among the countries, and Max (0.34) represents the most effective governance.

Also, Trade Openness (TO) has a Mean of 59.082, which shows the average trade openness as a percentage of GDP across all the countries in the region under observation, likewise has a Std. De of 17.681 indicates the tolerance level of variability, reflecting differences in trade openness among observations. It has a Min of 26.099 represents economies with limited trade openness in the region under observation, and Max of 131.485 reflects economies with very high trade

openness. The value of the mean of Gross Domestic Product Growth (GDPG) is 4.053, indicating an average annual GDP growth rate of 4.05%, and Std. Dev. of 7.568 indicates a high variability and signifies economic growth rates that differ significantly across observations. Min of -51.031, which reflects periods of severe economic contraction, and Max of 106.28, showing evidence of extreme economic growth, which means that some are highly growing in respect to GDP.

As for Human Capital (HC), it has a mean of 6.142 represents the average level of human capital development, and it has a Std. Dev of 4.33, which shows a significant variability in human capital levels across observations. It has a Min of 0.592, which shows the lowest human capital development, and a maximum of 21.79, indicating the highest human capital level across the observations. Foreign direct investment inflows (FDII) have a mean of 3.919 with a notably high standard deviation of 15.759, suggesting extreme variations in FDI levels. The minimum value of -202.824 and the maximum of 167.329 reveal substantial fluctuations in capital inflows, with some economies experiencing capital flight while others attract significant foreign investment.

**Table 2. Results of Correlation Matrix**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) IND	1.000							
(2) FIN	-0.107 (0.013)	1.000						
(3) ER	-0.110 (0.010)	0.279 (0.000)	1.000					
(4) GE	0.233 (0.000)	0.526 (0.000)	0.237 (0.000)	1.000				
(5) TO	-0.050 (0.242)	0.515 (0.000)	-0.039 (0.363)	0.252 (0.000)	1.000			
(6) GDPG	0.024 (0.575)	0.029 (0.499)	0.032 (0.456)	0.078 (0.070)	0.082 (0.057)	1.000		
(7) HC	0.157 (0.000)	0.358 (0.000)	0.096 (0.025)	0.158 (0.000)	0.290 (0.000)	0.034 (0.425)	1.000	
(8) FDII	-0.120 (0.005)	0.009 (0.828)	0.096 (0.026)	-0.070 (0.104)	0.069 (0.109)	0.166 (0.000)	0.068 (0.114)	1.000

Source: Authors' computation, 2025

The correlation analysis between industrial output growth (IND) and other variables such as Financialization (FIN), environmental regulation (ER), government effectiveness (GE), trade openness (TO), gross domestic product growth (GDPG), human capital (HC), and foreign direct investment inflow (FDII) provides insights into their interdependencies. IND exhibits a weak negative correlation with FIN (-0.107) at a significance level of  $p = 0.013$ , indicating an inverse relationship. Similarly, IND has a weak negative correlation with ER (-0.110) at  $p = 0.010$ , suggesting that stricter environmental regulations might slightly suppress industrial output. However, IND demonstrates a statistically significant weak positive correlation with GE (0.233,  $p < 0.01$ ), and HC (0.157,  $p < 0.01$ ), implying that technological advancements, effective governance, and human capital development contribute positively to industrial output. In contrast, the correlation between IND and TO is negative (-0.050) but not statistically significant ( $p = 0.242$ ), indicating minimal influence. The relationship between IND and GDPG is weakly positive at 0.024, though not statistically significant ( $p = 0.575$ ).

Financialization (FIN) presents stronger correlations with several variables, particularly GE (0.526,  $p < 0.01$ ), TO (0.515,  $p < 0.01$ ), and HC (0.358,  $p < 0.01$ ), reflecting its impact on governance efficiency, trade openness, and human capital development. A moderate positive correlation is also observed between FIN and ER (0.279,  $p < 0.01$ ), suggesting that financial development is associated with enhanced environmental regulations. FIN's correlation with GDPG is also weak (0.029,  $p = 0.499$ ), indicating that its influence on economic growth may not be direct or immediate. Government effectiveness (GE) is positively and significantly correlated with TO (0.252,  $p < 0.01$ ) and HC (0.158,  $p < 0.01$ ), suggesting that good governance facilitates trade openness and human capital development. However, GE's correlation with GDPG (0.078,  $p = 0.070$ ) is weak and only approaches borderline significance. Trade openness (TO) has a borderline significant positive correlation with GDPG (0.082,  $p = 0.057$ ) and a statistically significant moderate correlation with HC (0.290,  $p < 0.01$ ), indicating that trade liberalisation may have potential benefits for economic growth and human capital accumulation.

Foreign direct investment inflow (FDII) demonstrates a weak but statistically significant positive correlation with GDPG (0.166,  $p < 0.01$ ), suggesting that FDI contributes to economic growth. FDII also has weak positive correlations with ER (0.096,  $p = 0.026$ ) and HC (0.068,  $p = 0.114$ ), though the latter is not statistically significant. However, FDII has a weak negative correlation with IND (-0.120,  $p = 0.005$ ), implying that foreign investments might not necessarily drive industrial output in the immediate term. Some of the correlations among these variables are weak in magnitude, several relationships stand out as both moderate in strength and statistically significant. Financialization has strong associations with government effectiveness, trade openness, and environmental regulation. Similarly, industrial output growth's linkages to government effectiveness and human capital development suggest areas of strategic intervention. Since no correlation exceeds 0.8, multicollinearity is not an immediate concern.

**Table 3: Estimation Result**

Variable	Coefficient	Std. Error	z-Statistic	P-value	95% Confidence Interval
FIN	-3.0655	0.3205	-9.57	0.000	[-3.6937, -2.4374]
ER	-0.5421	0.2818	-1.92	0.054	[-1.0943, 0.0102]
FINER1	0.4683	0.2614	1.79	0.073	[-0.0440, 0.9806]
GE	10.4975	1.9594	5.36	0.000	[6.6572, 14.3379]
TO	-0.0983	0.0213	-4.61	0.000	[-0.1401, -0.0565]
GDPG	-0.1237	0.0441	-2.80	0.005	[-0.2102, -0.0372]
HC	0.0422	0.0412	1.03	0.305	[-0.0385, 0.1229]
FDII	-0.1699	0.0644	-2.64	0.008	[-0.2960, -0.0437]

Source: Authors' computation, 2025

**Table 4: Diagnosis Test**

ECT(-1)	ECT(-1)	-0.792
VIF	VIF	2.99
Auto-Correlation	Auto-Correlation	8.21
Heteroscedasticity	Heteroscedasticity	0.18
Normality Test	Normality Test	2.29
Cross sectional Dependency.	Cross sectional Dependency.	0.59
Obs	Obs	544

Source: Authors' computation, 2025

The findings indicate that Financialization, trade openness, gross domestic product growth, and foreign direct investment inflow have negative effects on industrial output growth, whereas government effectiveness, environmental regulation, and human capital contribute positively to industrial output growth. The results of the PMG model reveal that the coefficients of Financialization, trade openness, gross domestic product growth, and foreign direct investment inflow are negative and statistically significant. In contrast, government effectiveness exhibits a positive and statistically significant influence, while environmental regulation and human capital demonstrate a positive effect, with only human capital achieving statistical significance. However, the interaction between Financialization and environmental regulation does not have a statistically significant impact at the chosen 5% level. Consequently, the study rejects the null hypothesis that Financialization has no effect on industrial output growth but accepts the null hypothesis that the interaction between Financialization and environmental regulation has no effect on industrial output growth.

## 5. Conclusions and Recommendations

The findings of this study reveal that financialization exerts a **negative and statistically significant** effect on industrial output growth in West Africa, indicating that the increasing dominance of financial activities tends to constrain industrial expansion. Environmental regulation also shows a **negative and marginally significant** effect, suggesting that regulatory pressures, particularly compliance costs and weak implementation mechanisms, may hinder industrial growth. However, the interaction between financialization and environmental regulation is **positive but statistically insignificant**, implying that their combined effect does not meaningfully enhance industrial output growth within the estimated framework.

Trade openness is observed to have a **negative and statistically significant** impact on industrial output growth, implying that increased exposure to international trade may undermine domestic industrial performance, although the strength of this effect varies across model specifications. In contrast, government effectiveness demonstrates a **positive and statistically significant** relationship with industrial output growth, underscoring the role of strong institutions, effective policy execution, and administrative capacity in supporting industrial development. Gross domestic product growth, however, exhibits a **negative and significant** effect on industrial output growth, indicating that aggregate economic growth does not necessarily translate into industrial expansion and that industrial growth may instead serve as a driver of GDP growth in the region.

Human capital development records a **positive but statistically insignificant** effect on industrial output growth, suggesting a supportive but uneven contribution across models. Foreign direct investment inflows also show a **negative and statistically significant** impact, implying that FDI has not effectively promoted industrial growth in West Africa, possibly due to factors such as profit repatriation, capital leakage, and the concentration of foreign investments in non-industrial sectors rather than productive manufacturing activities. Based on these conclusions, governments in West Africa should adopt policies that curb excessive financial speculation and redirect financial resources toward long-term industrial investment. Measures such as targeted tax incentives for manufacturing firms, enforced minimum credit allocation to the industrial sector, and tighter

regulation of short-term speculative financial activities would help realign financialization with industrial development objectives.

In view of the adverse effects of trade openness and foreign direct investment inflows, policymakers should design frameworks that ensure foreign investments directly support industrial growth. This can be achieved through the enforcement of technology transfer arrangements, local content requirements, and strategic trade policies that protect and strengthen domestic industries. Such measures would help transform trade and investment flows into effective drivers of industrial expansion. Finally, environmental regulations should be structured to balance sustainability objectives with industrial growth. Improving policy coordination, reducing bureaucratic bottlenecks, and strengthening governance structures will enhance regulatory effectiveness and industrial performance. At the regional level, ECOWAS member states should collaborate to formulate a unified industrial policy that aligns financialization, trade, and foreign investment with regional industrialisation goals, thereby enhancing competitiveness, fostering synergies, and promoting sustainable industrial output growth in West Africa.

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