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Political Stability and Rice Yield in West Africa: The Role of the National Rice Development Strategy

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Keywords

Political stability, Rice yield, National Rice Development Strategy (NRDS), West Africa, Policy measures, Panel data analysis, Moderation effect

Abstract

This study examines the effect of political stability on rice yield improvement in nine West African countries from 1995 to 2023, focusing on the role of the National Rice Development Strategy (NRDS). Using Feasible Generalized Least Squares panel estimations that address heteroskedasticity and serial correlation, the results indicate that political stability alone does not significantly affect rice yields. However, the NRDS framework positively moderates this relationship, making the effect statistically significant. These findings indicate that the contribution of political stability to economic development depends on its interaction with institutional and policy initiatives. Sustained rice yield improvement under the NRDS requires coherent policy measures and institutional stability. The long-term impact of human capital development highlights the importance of continuous investment in education and skills, with benefits that accumulate gradually and decisively for agricultural productivity and resilience. Good governance also improves productivity by strengthening administrative capacity and supporting efficient resource allocation.

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서아프리카 지역의 정치적 안정이 쌀 생산성에 미치는 영향 분석

이은정*

Keywords

정치적 안정성, 쌀 생산성, 국가 쌀 개발 전략, 제도적 요인, 서아프리카

Abstract

본 연구는 서아프리카 9개국을 대상으로 국가 쌀 개발 전략(National Rice Development Strategy: NRDS) 프로젝트 시행 전후 시기에 정치적 안정성이 쌀 생산성 향상에 미치는 영향을 분석하였다. 이를 위해 이분산성과 오차항 간의 상관관계를 고려한 일반화 최소제곱법(GLS) 선형모형(xtgls, STATA 16)을 적용하였다. 분석 결과, 평상시에는 정치적 안정성이 쌀 생산성에 통계적으로 유의한 영향을 미치지 않았으나, NRDS 프로젝트 시행 기간에는 정치적 안정성과의 교호작용이 긍정적이고 유의하게 나타남에 따라, NRDS 프로젝트가 정치적 안정성과 쌀 생산성 간의 관계를 조절하는 역할을 수행하고 있음을 확인하였다. 또한 Granger 인과관계 검증 결과, 정치적 안정성이 쌀 생산성 향상에 필요한 정책 수단을 직접적으로 강화하지 못한 점은 NRDS 프로젝트의 조절 효과와 함께 제도적 요인과 농업 생산성 간의 관계에 대해 기존 연구들이 상반된 결론을 제시한 이유를 부분적으로 설명해 준다. 한편, 인적자원의 육성이 쌀 생산성 향상을 위한 핵심적인 정책 수단임이 확인되었다. 이러한 결과는 국가 차원의 프로젝트가 목표를 달성하기 위해서는 이를 뒷받침할 수 있는 정치적 안정의 확보와 제도적 역량 강화가 병행되어야 함을 시사한다.

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1. Introduction

Political instability refers to unpredictable policies, fragile institutions, frequent leadership changes, coups, civil unrest, or a lack of legitimacy. This instability can result in state dysfunction, social disorder, and negatively affect economic growth and productivity (Aisen & Veiga, 2013). In West Africa, political instability is a recurring challenge that significantly shapes the region's socio-political landscape.

Most West African countries experienced relative political stability during the first decades after independence, particularly from the 1960s to the early 1980s. From the early 2000s, however, the region experienced a marked rise in coups and attempted coups, with 8 successful coups between 1963 and 2003, increasing to 17 between 2004 and 2023 (see appendix). Countries such as Mali (2020, 2021), Burkina Faso (2022), and Niger (2023) experienced significant political instability, which military leaders often justified by citing corruption, loss of trust in civilian leadership, or failure to address jihadist insurgencies. These three countries withdrew from the Economic Community of West African States (ECOWAS) in January 2025 after ECOWAS demanded the restoration of democratic rule (Reuter, 2025). In other cases, resource competition and unresolved grievances, such as in Guinea (2008, 2021) and Mali (2012), contributed to unrest in the region (Everiss, 2021; Prospect, 2020).

Economic and social conditions have contributed to political instability in the region. In the late 2010s, increasing inequality, chronic food shortages, persistent unemployment, and government inefficiency led to mass uprisings, often led by the middle class and educated youth, as seen during the Arab Springs (Cubitt, 2014; Diwan, 2013). These events highlight the connection between socio-economic performance and political instability.

Real GDP per capita in West Africa increased by 76 percent, rising from USD 1,018 in 1995 to USD 1,914 in 2015, before slightly declining to USD 1,901 in 2023 (FAO, 2025). Amid political instability in the region, military regimes in Rwanda, Ethiopia, Uganda, Eritrea, and Gambia established relatively stable political conditions. Rwanda, Ethiopia, and Uganda experienced notable economic growth, while Eritrea and Gambia did not.

These events and phenomena raise an important question: is political stability alone sufficient to drive economic growth in West Africa? While some countries experienced

growth during periods of political stability, others did not. Agriculture is especially vulnerable in this context. Episodes of unrest can cause the migration or conscription of agricultural labour, delay land reforms, and disrupt land ownership rights, creating uncertainty for both farmers and investors (Justino, 2012; Kimenyi et al., 2014). Political stability, therefore, directly affects agricultural productivity.

Previous studies have examined the general relationship between political stability and economic growth, but few have focused specifically on the agricultural sector. This study addresses this gap by analysing the relationship between political stability and rice yield within the framework of the National Rice Development Strategy (NRDS), using panel data from nine West African countries. Figure 1 shows that these countries displayed different patterns of political stability and rice yield over a 29-year period: the first half without the initiative and the second half with its implementation. This division enables an examination of the moderating effect of the NRDS on the relationship between political stability and rice yield.

This study contributes to the broader discourse on political stability and economic development by showing that this relationship can be influenced by a national initiative such as the NRDS, which supports economic development. The study also examines how policy measures support the project's objective, even when institutional constraints, including political instability and widespread corruption, are present.

Amid declining political stability in the region, severe droughts and rising fuel prices in late 2006 significantly increased agricultural production costs, causing global food prices to rise in 2007. Food price volatility has resulted in widespread food insecurity and political unrest across the region. This instability is most severe in countries that rely heavily on imports for more than 40 percent of consumed rice to meet rapidly growing demand driven by population growth and urbanisation. While rice was already a staple in Guinea, Mali, and Senegal, other countries, where sorghum, millet, maize, cassava, and yam were the primary staples, imported rice to address the rapid increase in urban consumption (see Table 1). The 2007–2008 price spike and food shortages led to protests, threatening regimes, particularly in Côte d'Ivoire, which had only recently emerged from the First Ivorian Civil War (2002–2007), and in Niger, which remained chronically vulnerable to drought, locust infestations, and high food prices.

Table 1. Staple matrix

Country	Primary staples	Secondary staples	Rice status	Short note
Burkina Faso	Millet, Sorghum	Maize, Rice	Secondary	Rice small share; import-dependent; urban consumption rising.
Côte d'Ivoire	Cassava, Plantain, Yam, Maize	Rice	Secondary (urban primary)	High rice consumption in cities; logistics disrupted by 2002–2007; conflict; import reliant.
Ghana	Maize, Cassava, Plantain	Rice	Secondary (rising)	Rapid demand growth, especially urban; imports met large share.
Guinea	Rice	Cassava, Maize	Primary	Rice is the national staple, but production is less than consumption.
Mali	Millet, Sorghum, Rice	Maize	Primary	Increased irrigated rice cultivation; strong role in urban diets.
Niger	Millet, Sorghum	Maize, Rice	Secondary	chronic aridity; relied on imports; exposed to shocks (e.g., 2005 crisis).
Nigeria	Cassava, Yam, Maize	Rice	Secondary (urban strong)	Fast demand growth; imports increased; policy oscillations
Senegal	Rice	Millet, Sorghum	Primary	Very high import dependence; urban preference for broken rice.
Togo	Cassava, Maize, Yam	Rice	Secondary	Rice importance rose significantly; domestic output limited

In 2008, African countries met in Japan at the Fourth Tokyo International Conference on African Development (TICAD IV). During this conference, the National Rice Development Strategy (NRDS) was launched through the Coalition for Africa Rice Development (CARD), Japan International Cooperation Agency (JICA), and sustainably growing Africa's food systems (AGRA) to promote rice production.

The National Rice Development Strategy (NRDS), launched in 2009, aimed to double rice production within ten years. Although overall production increased, this growth resulted mainly from cropland expansion (see Table 2), while rice yield rose by only 11 per cent during the same period (Lee, 2024). However, dependence on land expansion was unsustainable because it caused environmental degradation and triggered political tensions between countries regarding territorial encroachment. In response to these issues, a second phase of the NRDS began in 2019, shifting the focus to achieving self-sufficiency through yield improvement rather than further farmland expansion.

Table 2. Cropland expansion over periods (multiples)

Year	Benin	Burkina Faso	Côte d'Ivoire	Ghana	Mali	Niger	Nigeria	Senegal	Togo	Overall
1995-2008	2.2	0.8	-0.4	0.3	0.6	-0.2	0.3	0.8	-0.1	0.2
2009-2023	2.3	1.3	0.8	1.3	0.7	0.7	1.5	1.9	1.5	1.3

Figure 1. Rice productivity and Political Stability and Absence of Violence/Terrorism index between 1995–2023

Source: WB (2025) and FAO (2025).

2. Literature Review

A substantial body of research highlights the importance of political stability in achieving development goals. Stability is linked to the accumulation of physical and human capital, reducing risks, increasing returns on investment, and maintaining balance among stakeholders during transitions. Bresser-Pereira (2008) identifies good governance as a key factor in supporting sustainable economic growth in developing countries. His study suggests that countries should develop national development strategies through democratic decision-making and coordinate policy measures to achieve political and economic objectives.

Aisen and Veiga (2013) argue that the negative impact of political instability is stronger in non-OECD countries and in countries with weaker institutional frameworks. Campos and Nugent (2002) found that the negative relationship between political instability and economic growth is only short-term and more pronounced in Sub-Saharan African countries, providing no empirical evidence of a causal and negative long-term

relationship between the two. However, Hussain (2014) noted that the causality between political instability and economic growth is not necessarily one-way because poor economic performance may create unrest in the regime.

Some studies have shown that the impact of corruption on economic growth varies depending on factors such as political stability, transparency, and institutional capacity. Ibrahim et al. (2015), Drury et al. (2006), and Hodge et al. (2009) found that corruption can temporarily ease bureaucratic processes and attract foreign investment; however, it ultimately harms long-term economic growth.

Campos and Nugent (2002) argued that the long-term relationship between political instability and economic growth depends on the manner of government change rather than its frequency. Their findings indicated that political instability resulting from regime changes is not necessarily harmful; it can be neutral or even beneficial to growth when regime changes occur through democratic and peaceful processes, such as regular elections. However, instability involving violence or unconstitutional actions tends to reduce economic performance.

Messer et al. (1998) and Kimenyi et al. (2014) estimated the impact of conflict on agricultural productivity through case studies in countries such as Rwanda, Sudan, Somalia, Mali, and Nigeria. Their findings indicate that conflict significantly reduces agricultural performance, with estimated declines of 12.3 percent in overall agricultural productivity and up to 50 percent in rice production. Agbahey et al. (2021) attributed these losses mainly to labour displacement, disruption of food value chains, and restricted access to public agricultural services and credit facilities.

Justino (2012) emphasised the long-term and intergenerational effects of conflict, highlighting a cycle between violence and poverty. Conflict destroys physical assets (e.g. homes, land, and livestock) and human capital, which leaves affected households unable to recover, even after conflict ends. This legacy passes to subsequent generations through childhood malnutrition, increased child labour instead of schooling, and lower educational attainment, which leads to reduced future income and ongoing poverty.

Several studies have highlighted the impact of policy measures on rice yield. Hazrana and Mishra (2024) and Lee (2024) examined the effects of government expenditure on agricultural extension services and input subsidies in Bangladesh and Burkina Faso, respectively. They found that government interventions resulted in a 20 percent increase

in rice yield in Bangladesh and an improvement of 4.1 hectograms per hectare in Burkina Faso.

Similarly, Calicdan et al. (2020), using a case study of a major rice-producing region in the Philippines, found that government budget allocations significantly increased rice yield, improved farmer incomes, and reduced reliance on rice imports. Alabi and Abu (2023) argue that nations should increase government expenditure on irrigation and make more effective use of ODA in the agricultural sector to improve productivity. In contrast, FAO (2017) evaluations reported that agricultural ODA has often been disproportionately allocated to institutional capacity building and governance support, while comparatively less funding has been directed to farm-level interventions, such as extension services or input provision, which directly affect yields.

Lee (2024) found that in Burkina Faso, private loans, FDI, and ODA targeted at agriculture significantly improved rice yield. In contrast, the direct impact of remittance on rice yield was negative, indicating that remittance may contribute indirectly by enhancing human capital, particularly through the education of family members, which could improve long-term agricultural decision-making and labour quality.

Trade liberalisation under WTO agreements has significantly influenced the agricultural sector. Matsuyama (1992) argued that higher agricultural productivity can limit industrialisation in closed economies by reducing the labour surplus available for industry, but may accelerate growth in open economies through comparative advantage. This demonstrates the importance of market openness in determining whether agricultural gains support or restrict broader development. Agbahey et al. (2021) warned that inconsistent and short-term government interventions in agricultural trade have increased price and trade volatility, which undermines food security in sub-Saharan Africa. In contrast, Mwangi et al. (2020), using data from 40 sub-Saharan African countries (1990–2015), found evidence of bidirectional causality between trade and agricultural productivity: imports of inputs such as fertilisers and machinery increased productivity, which then raised import demand. Sunge and Ngepah (2020) also found that agricultural trade liberalisation can significantly increase Total Factor Productivity (TFP), but only when supported by effective governance.

The role of education in improving agricultural productivity has been widely examined. Antle (1984) argued that human capital and infrastructure limit farmers' capacity to

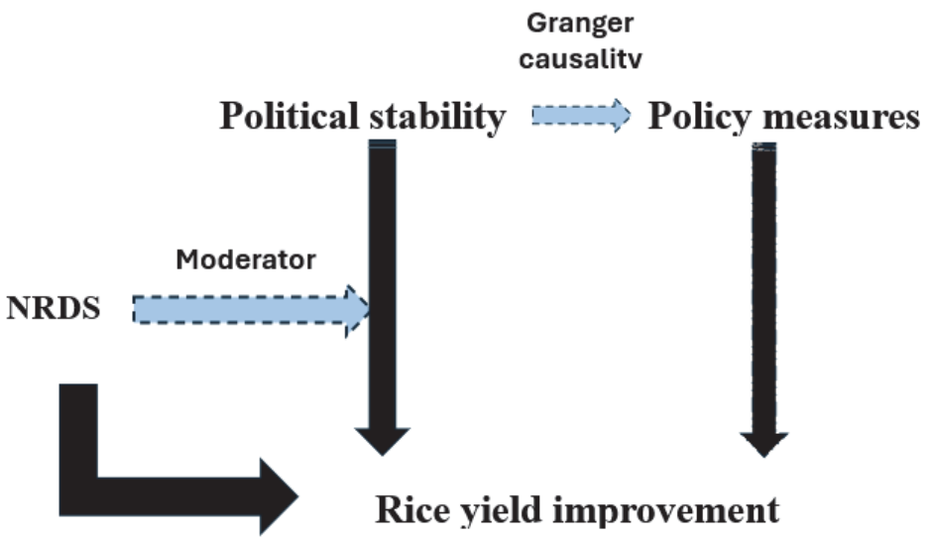
adopt technology, which affects rice productivity in India. Djomo and Sikod (2012), in a case study of Cameroon, suggested that policies should prioritise enhancing farmers' human capital through investment in education and training programmes specific to the agricultural sector. WB (2007) highlighted that rural education and health services are essential for technology adoption and participation in modern value chains, while FAO (2017) stated that human development policies are necessary for inclusive agricultural growth. Asfaw et al. (2011) provided empirical evidence from Sub-Saharan Africa supporting this view, finding that better-educated and healthier farmers are more likely to adopt improved seeds and modern practices, which lead to higher yields. Collectively, these studies indicate that human development policies are central to strengthening agricultural productivity and supporting sustainable growth.

3. Analytical frame and Methodology

3.1. Analytical Frame

Figure 2 presents the analytical framework. First, political stability may directly improve rice yield. Second, political stability creates an environment that enables governments to adopt and implement appropriate policy measures, which strengthens the overall performance and success of the project. Third, the primary purpose of the NRDS is to improve rice yield; in this context, the NRDS may influence the relationship between political stability and rice yield by reinforcing the conditions under which political stability leads to productivity gains.

Figure 2. Analytical framework



3.2. Data

The study examines nine West African countries (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, Nigeria, Senegal, and Togo) that experienced political instability at some point from 1995 to 2023 and are commonly implementing the NRDS project (see Appendix).

The dependent variable in this study is rice yield, measured in tons per hectare. The predictor variables are grouped into two main categories: institutional factors and policy measures. Policy measures are further classified into three key dimensions: fiscal, social development, and economic development.

Additionally, the study introduces the NRDS as a moderator that may affect the relationship between political stability and rice yield. The analysis treats other relevant indicators that may influence project performance as covariates.

Time series variables are converted to 2015 constant USD prices to adjust for inflation. Monthly data are aggregated into annual values using arithmetic means. Approximately 2 percent of values are missing; these are imputed using the exponential smoothing (ETS) algorithm.

3.2.1. Institutional Factors

Political stability is measured using the Political Stability and Absence of Violence/ Terrorism Index (PSI),1 as published by the World Bank.

Although political stability can be defined in various ways, this study defines it specifically through the PSI. The PSI is expressed in standard normal distribution units, ranging from approximately -2.5 to 2.5. It reflects the probability that a government will be destabilised or overthrown by unconstitutional or violent actions, including politically motivated violence and terrorism.

Control of corruption is assessed using the Control of Corruption Index (CCI), which also ranges from approximately -2.5 to 2.5. The CCI measures perceptions of the extent to which public power is used for private gain, covering both minor and major forms of corruption, as well as the influence of elites and private interests.

3.2.2. Policy Measures Based on Their Primary Area of Focus

3.2.2.1. Fiscal Measures

Budget soundness refers to the difference between the percentage of general government gross revenue over GDP and the percentage of general government gross debt over GDP. Government expenditure in agriculture is measured as the share of agricultural expenditure over total government expenditure. For countries without available data, values were estimated using the regional average share (percentage). Credit extended to the agricultural sector by domestic financial institutions is reported in USD million.

3.2.2.2. Social Development Measure

This study uses the Human Development Index (HDI) as a proxy to measure the level of social development. HDI assesses overall achievement in three dimensions of human development: health, measured by life expectancy at birth; education, measured by mean years of schooling for adults aged 25 years and older and expected years of schooling for children of school-entering age; and standard of living, measured by gross national income per capita.

3.2.2.3. Economic Development Measures

Agricultural Gross Fixed Capital Formation (GFCF) refers to investment in physical assets for farming that expand or maintain production capacity. It measures the net additions to fixed assets used in agriculture, such as land improvements, irrigation systems, machinery, livestock for breeding, and plantation crops (USD million). Economic openness is defined as the ratio of the sum of import and export amounts to gross domestic product (GDP). Official Development Assistance (ODA) to agriculture is measured in USD million.

3.2.2.4. Moderator

NRDS is a dummy variable coded 1 for the project period (2009–2023), and 0 otherwise, used to isolate the impact of the national initiative. A moderator can affect this relationship by strengthening or weakening the causal link, and in some cases, it may change the direction of the relationship (Sharma, 1981; Söderlund, 2023).

3.2.2.5. Covariates

Election years, whether presidential or general, can increase political instability in the region. In the data set, a value of 1 indicates the occurrence of either type of election in a given year, and 0 indicates none. Annual precipitation is measured in millimetres. Annual temperature refers to the mean annual temperature in degrees Celsius. The average international rice price (USD per metric ton) is based on Thailand white indicative milled rice, 5 percent broken, which accounts for 28–36 per cent of the international rice supply. Total fertiliser consumption, in kilograms per hectare, represents the annual amount of all types of fertilisers used by farmers. Foreign Direct Investment (FDI) in agriculture is measured in USD million. Where country-level data are unavailable, missing values are estimated using the regional average share of total FDI. FDI is often affected by conflict and political instability. Remittance invested in agriculture is measured in USD million, with missing values estimated by applying a 6 per cent share to the total remittance inflows received by each country. GDP per capita is measured in USD.

3.3. Methodology

Ordinary least squares (OLS) and fixed-effects models assume that error terms are homoscedastic and uncorrelated across panels in panel data analysis. In practice, these assumptions are often violated because some countries experience greater variation in outcomes due to global and regional shocks, such as global food price spikes, regional droughts or floods, and input price volatility. The Generalized Least Squares (GLS) model addresses these issues by weighting the data according to the error variance–covariance structure, which results in more efficient coefficient estimates. Therefore, this study uses the GLS linear model with heteroskedastic and correlated errors (xtgls) in STATA 16, which is suitable for long panels covering nine countries:

$$Yit=\alpha+\beta Xit+uit, i=1..N,\ t=1,.T,$$

where Yit is rice yield for country i at time t, Xit is the vector of predictors, α is the constant term, β is the vector of coefficients to be estimated, ui is the error term, N is the number of countries in the panel, and T is the number of time periods observed.

Model 1 examines whether political stability generally affects rice yield improvement using the xtgls model. Model 2 adds a dummy variable for the NRDS to separate the effect of the project initiative on rice yield improvement from those of political stability and other predictors. Model 3 includes an interaction term between political stability and the NRDS to assess whether the NRDS moderates the influence of political stability on rice yield improvement.

$$\text{Model 1: } yit=\alpha+\beta 1PSit+\beta Xit+uit,$$
$$\text{Model 2: } yit=\alpha+\beta 1PSit+\beta 2NRDSit+\beta Xit+uit,$$
$$\text{Model 3: } yit=\alpha+\beta 1PSit+\beta 2NRDSit+\beta 3(PSit\times NRDSit)+\beta Xit+uit.$$

where PS denotes political stability, NRDS is a dummy variable indicating the presence of the preject, X is a vector of other predictors and covariates, and u is the error term.

Rational reasoning indicates that political stability may influence policymakers' decisions to improve policy measures for NRDS implementation. To examine this

mechanism, the study uses the Dumitrescu and Hurlin Granger non-causality test, which adapts the traditional time-series Granger causality framework for panel data and tests the null hypothesis (H_0) against the alternative (H_1). This method provides evidence of the causal relationship between political stability and policy measures aimed at increasing rice yield. The analysis also considers the dynamic response to the start of the NRDS by dividing the period into two subperiods: pre-NRDS (1995–2008) and the NRDS implementation phase (2009–2023).

H_0: there is no Granger causality for any cross-sectional unit in the panel.

H_1: there is Granger causality for at least some of the cross-sectional units.

4. Results and Discussion

4.1. Descriptive Statistics

Average rice yield increased from 2.16 tonnes per hectare in the pre-NRDS period to 2.92 tonnes per hectare in the NRDS period, while political stability declined from -0.32 to -0.85 on average, as shown in Table 3. Control of corruption improved slightly from -0.62 to -0.55. Budget soundness improved from -30.59 in the pre-NRDS period to -10.82 in the NRDS period. The share of government expenditure on agriculture relative to total expenditure decreased slightly from 7.93 in the pre-NRDS period to 7.36 in the NRDS period. ODA to agriculture increased more than four times, and credit to agriculture grew more than two times in the NRDS period across countries. Agricultural GFCF rose from 1,109.83 in the pre-NRDS period to 1,959.68 in the NRDS period. Economic openness also increased by 0.04 during the NRDS period. Other policy measures increased slightly in the NRDS period.

Table 3. Descriptive statistics

			Overall period				Mean (1995–2008)	Mean (2009–2023)
			Mean	Std. Dev.	Min	Max		
Rice Yield		overall	2.55	0.82	1.06	4.75	2.16	2.92
		between		0.62	1.75	3.66		
		within		0.58	0.51	3.99		
Institutional measures	Political stability	overall	-0.59	0.81	-2.73	1.05	-0.32	-0.85
		between		0.59	-1.70	0.33		
		within		0.58	-2.59	0.59		
	Control of corruption	overall	-0.58	0.39	-1.50	0.25	-0.62	-0.55
		between		0.36	-1.17	-0.14		
		within		0.19	-1.11	-0.08		
Fiscal measures	Budget soundness	overall	-20.36	23.19	-123.70	33.85	-30.59	-10.82
		between		8.67	-31.27	-7.69		
		within		21.69	-112.79	42.86		
	Share of Government expenditure in agriculture	overall	7.64	5.85	0.62	45.68	7.93	7.36
		between		4.68	2.94	16.18		
		within		3.84	-4.46	37.14		
	Credit to agriculture	overall	286.21	699.64	0.25	5314.37	167.31	397.18
		between		599.19	2.72	1872.63		
		within		411.26	-1112.36	3727.96		
Social development measures	HDI	overall	0.44	0.08	0.24	0.61	0.40	0.48
		between		0.07	0.32	0.55		
		within		0.05	0.32	0.52		
Economic development measures	Economic openness	overall	0.54	0.16	0.17	0.93	0.52	0.56
		between		0.12	0.37	0.69		
		within		0.11	0.30	0.85		
	ODA to agriculture	overall	259.01	255.72	0.18	1354.69	89.32	417.40
		between		118.79	37.12	373.10		
		within		229.79	-113.90	1240.60		
	Agricultural GFCF	overall	1549.41	3817.66	18.20	18715.63	1109.83	1959.68
		between		3762.12	45.81	11544.62		
		within		1394.71	-4612.55	8720.41		
Covariates	Election year	overall	0.32	0.47	0.00	1.00	0.32	0.33
		between		0.07	0.24	0.45		
		within		0.46	-0.13	1.08		
	GDP per capita	overall	1032.06	586.02	213.74	2622.04	856	1218
		between		551.22	452.16	2078.33		
		within		268.88	363.72	1869.60		
	FDI in agriculture	overall	7.56	13.71	-1.42	87.03	5.80	9.20
		between		12.21	0.56	38.80		
		within		7.41	-23.71	55.79		
	Remittance to agriculture	overall	119.07	307.00	0.27	1458.66	45.67	187.58
		between		257.22	9.64	800.05		
		within		187.65	-665.98	777.68		
	Fertilizers consumption	overall	13.85	12.64	0.00	56.39	9.54	17.87
		between		9.15	0.48	31.97		
		within		9.22	-3.58	53.85		
	Precipitation	overall	800.86	437.67	48.80	1604.10	799.23	802.37
		between		453.30	83.61	1282.95		
		within		90.57	564.94	1122.01		

(continued)

			Overall period				Mean (1995–2008)	Mean (2009–2023)
			Mean	Std. Dev.	Min	Max		
Covariates	Temperature	overall	28.11	0.83	26.50	30.01	27.96	28.24
		between		0.82	26.89	29.31		
		within		0.27	27.42	29.23		
	International Rice Price	overall	388.69	133.16	172.71	700.20	296.65	474.59
		between		0.00	388.69	388.69		
		within		133.16	172.71	700.20		
	Number of countries: 9 Number of years: 29 (pre-NRDS: 1995-2008 and the NRDS: 2009-2023) Number of observations: 261 (pre-NRDS:126 and the NRDS: 135)							

Notes: The results of the one-way ANOVA showed that rice yield increased significantly during the NRDS project period (2009–2023) compared to the pre-NRDS period (1995–2008), with an improvement of approximately 0.76 tons per hectare. This result provides strong evidence that the NRDS period is associated with higher rice productivity and supports the view that the national initiative contributed positively to yield improvement.

The results of the one-way ANOVA (Tables 4 and 5) showed that rice yield increased significantly during the NRDS project period (2009–2023) compared to the pre-NRDS period (1995–2008), with an improvement of approximately 0.76 tons per hectare. This result provides strong evidence that the NRDS period is associated with higher rice productivity and supports the view that the national initiative contributed positively to yield improvement.

Table 4. Descriptive statistics: Summary of yield

NRDS	Mean	Std.Dev.	Freq.
0	2.16	0.58	126
1	2.92	0.85	135
Total	2.55	0.82	261

Table 5. Descriptive statistics: Analysis of variance

Source	SS	Df	MS	F	Prob>F
Between Groups	37.31831	1	37.31831	69.9	0
Within Groups	138.2704	259	0.533862		
Total	175.5887	260	0.675341		

Notes: Bartlett's test for equal variances: chi2(1) = 18.4993; Prob > chi2 = 0.000

As shown in Table 6, political stability did not improve any policy measures during the NRDS period. However, political stability led to budget soundness only in the period before NRDS.

Table 6. Dumitrescu and Hurlin Granger non-causality test results

	Pre-NRDS		NRDS Period	
	W-bar	z-bar tilde	W-bar	z-bar tilde
Political stability → Control of corruption	2.8445	2.2094	2.4240	1.7452
Political stability → Budget soundness	3.9906	3.7975*	2.7337	2.1949
Political stability → Government expenditure in agriculture	2.4356	1.6429	2.5553	1.9357
Political stability → Credit to agriculture	2.2912	1.4427	1.9628	1.0755
Political stability → Economic openness	2.7812	2.1216	0.7037	-0.7530
Political stability → ODA to agriculture	0.5279	-1.0006	2.8054	2.2989
Political stability → Agricultural GFCF	4.3883	1.1141	6.5246	0.4574
Political stability → Human development	1.1827	-0.0933	2.2828	1.5401

Notes: legend: *p < 0.05; **p < 0.01; ***p < 0.001; p-values computed using 1000 bootstrap replications.

4.2. Moderation Effect and Panel Data Regression Analysis

4.2.1. Moderation Effect

As shown in Table 7, Model 3, which includes the interaction term between NRDS and political stability, had a lower AIC than Models 1 and 2, indicating greater explanatory power. This result suggests that political stability increases rice yield only when NRDS is present, while political stability alone does not have a significant effect. In other words, NRDS moderated the effect of political stability, making it a significant factor in yield improvement.

Table 7. Moderation effect of NRDS on the political stability and rice yield

Variable		Model 1	Model 2	Model 3
Institutional measures	Political stability	0.0216	0.0729	-0.0433
	Election year	0.0694	0.0444	0.0531
	Control of corruption	-0.3776**	-0.2592	-0.2659
Fiscal measures	Budget soundness	-0.0032	-0.0032	-0.003
	Government expenditure in agriculture	0.0094	0.0034	0.0001
	Credit to agriculture	-0.0005***	-0.0004***	-0.0004***
Social development measure	Human development	6.6272***	4.8808***	4.7633***
Economic development measures	Economic openness	-1.4859***	-1.2311***	-1.4511***
	ODA to agriculture	0.0002	0	0
	Agricultural GFCF	-0.0001**	-0.0001*	-0.0001*
	NRDS		0.4440***	0.5664***
	Political stability * NRDS			0.2178*
Covariates	Annual precipitation	-0.0018***	-0.0017***	-0.0017***
	Average temperature	-0.1998**	-0.2344**	-0.2244**
	Internal rice price	0.0013***	0.0008*	0.0008*
	Annual fertilisers consumption	0.0044	0.0022	0.004
	FDI in agriculture	-0.0046	-0.004	-0.0055
	Remittance to agriculture	0.0004	0.0004	0.0005
	GDP per capita	0.0003	0.0004	0.0003
	Constant	6.3941**	8.1149***	8.0334***
	N	261	261	261
	r2_a			
	Ll	-190	-190	-180
	chi2	418.6042***	456.7807***	469.0474***
	Aic	423.4573	411.1928	408.77

Notes: legend: *p < 0.05; **p < 0.01; ***p < 0.001.

4.2.2. Institutional Factors

The results of Model 3 indicate that none of the institutional factors had a significant effect on rice yield improvement.

4.2.3. Policy Measures

Table 3 shows that most policy measures did not have a statistically significant effect on rice yield improvement. Government expenditure on agriculture and official development assistance (ODA) to the agricultural sector also did not show statistically

significant effects on rice yield, despite a substantial increase in average annual agricultural ODA from USD 89.3 million in the pre-NRDS period to USD 417.4 million during the NRDS period across countries in the region.

On the other hand, credit to agriculture and agricultural gross fixed capital formation (GFCF) were statistically significant, but their effects on rice yield were relatively small. In contrast, economic openness had a significantly negative effect on rice yield, whereas human development had a positive and significant impact.

4.3. Discussion

The results of the Dumitrescu and Hurlin Granger non-causality test showed that political stability did not contribute to the improvement of any policy measures during the NRDS period. This outcome aligns with the xtgls model results in Table 4, which indicate that political stability alone had no significant effect on rice yield improvement.2 Overall, these findings suggest that stability, without institutional and administrative capacity, cannot ensure the effective performance of large-scale development projects such as the NRDS.

In contrast, political stability led to budget soundness only during the pre-NRDS period, as shown in Table 3. During this phase, stable governments may have been better able to prioritise fiscal discipline. However, after the introduction of the NRDS, fiscal priorities appear to have shifted toward project-driven targets and sector commitments, which weakened the previous connection between political stability and budget soundness.

The panel data analysis results reveal several important dynamics in the West African context. The negative effect of credit to agriculture, although limited in size, contrasts with the positive findings reported by Lee (2024). This difference reflects structural constraints in the region, such as farmers' limited access to formal credit and the collateral requirements set by formal financial institutions. Summary statistics in Table 2 show large disparities across observations, with some countries and years providing little agricultural credit and others offering much higher amounts. Additionally, variation across countries is greater than variation within countries over time, highlighting persistent structural differences in credit provision.

Evidence from Burkina Faso supports this interpretation. Lee (2024), using a case study of Burkina Faso, showed that government efforts to strengthen financial support (e.g. introducing loan guarantees, establishing local bank branches, and providing targeted support for female farmers) significantly improved access to agricultural credit and contributed to increased rice yields during the NRDS period.

A similar interpretation applies to the negative effect of agricultural GFCF on rice yield improvement, although this effect is limited in magnitude. This indicates that capital investment was directed mainly toward other staple crops (Endnote 1) rather than rice, despite rapidly increasing demand for rice. Furthermore, as Lee (2024) showed, during the NRDS phase, countries in the region prioritised cropland expansion (Endnote 2) over investments that could improve productivity, such as irrigation infrastructure, mechanisation, or improved seed varieties. This pattern aligns with Antle's (1984) argument that the productivity impact of agricultural investment depends on efficient resource allocation and the adoption of complementary technologies. In this context, agricultural GFCF was allocated inefficiently and was not well connected to productivity-enhancing innovations, which limited its effectiveness and contributed to a slight negative association with rice yield improvement.

The significantly negative effect of economic openness on rice yield improvement may be due to the region's heavy reliance on rice imports, which reduces incentives for local production and limits the development of domestic rice value chains. Greater openness allows for cheaper imports that can replace domestic outputs, discouraging investment in productivity-enhancing technologies and restricting farmers' market opportunities. Consequently, rather than promoting competitiveness and innovation, trade openness in this context appears to have limited the growth of domestic rice production capacity. This finding is consistent with the warning by Sunge and Ngepah (2020), who noted that agricultural trade liberalisation can reduce productivity unless supported by effective governance, often leaving local farmers at a disadvantage without strong institutional and policy support.

At the same time, it is important to recognise that openness can create opportunities for agriculture. It enables access to improved inputs, machinery, and knowledge transfer, while also increasing market competition between domestic and foreign producers.

Conversely, the results show that human development policies are the most important

and significant measures for improving rice yields. This finding indicates that investment in education, health, and livelihoods increases farmers' ability to adopt modern technologies and improved farming practices, which leads to sustained productivity gains. Broader empirical studies, including Antle (1984), WB (2008), Asfaw et al. (2011), Justino (2012), and FAO (2017), support the view that human development policies are a central driver of rice yield improvements in the region. Public resources should also be directed toward initiatives that promote the spread of innovations across communities, generating wider spillover effects on agricultural performance.

Neither government expenditure on agriculture nor official development assistance (ODA) to the agricultural sector showed statistically significant effects on rice yield. This result contrasts with the findings of Alabi and Abu (2023), Calicdan et al. (2020), Lee (2024), and Hazrana and Mishra (2024), who reported a positive effect of government investment on rice productivity.

In the study region, the average share of government expenditure on agriculture decreased from 7.93 percent to 7.36 percent during the NRDS period, despite the 2003 Maputo Declaration3 and 2014 Malabo Declaration,4 which urged African governments to allocate at least 10 percent of national budgets to agriculture. Capital spending accounted for only 39 percent of agricultural expenditure between 2015 and 2021, which is well below the OECD's recommended 60 percent threshold for sustaining agricultural growth. These data suggest that limited and inefficient resource allocation may explain why government expenditure did not play a significant role in improving rice yields. The present findings indicate the need to examine the composition of agricultural spending more closely, especially in relation to NRDS project priorities. However, this analysis is limited by the lack of sufficiently detailed data.

An analysis of the sectoral distribution of agricultural ODA between the pre-NRDS period (1995–2008) and the NRDS implementation period (2009–2023) offers a possible explanation for this outcome. Although total ODA to agriculture increased significantly from USD 4,414 million in the pre-NRDS period to USD 21,041 million during the NRDS period across countries in the region, the composition of assistance shifted in ways that were less directly supportive of productivity growth. ODA allocated to government management, regulation, and planning of the agricultural sector rose from 18 percent to 22 percent, and ODA for broader, programmatic support to agricultural sector

development increased from 15 percent to 24 percent.

By contrast, ODA allocated to human capital development and direct enhancement of agricultural productivity declined sharply, from 27 percent to 17 percent. This redistribution indicates that resources became increasingly focused on policy and institutional support, rather than on interventions with immediate effects on farmers' ability to increase yields. This shift may explain the lack of significant effects on rice yield. This interpretation aligns with FAO (2017), which warned that agricultural ODA is often distributed inefficiently across subsectors, with insufficient focus on direct interventions to improve farm-level productivity. This finding highlights the need for a thorough investigation into the effectiveness of ODA-funded projects in the region, particularly regarding their design, implementation, and alignment with local needs, as Alabi and Abu (2023) and Lee (2024) proposed.

Control of corruption was negatively associated with rice yield, although this relationship was not statistically significant. This suggests that stricter anti-corruption measures may have produced unintended consequences or indicated broader institutional inefficiencies. This result is consistent with previous studies that propose corruption may, in some contexts, temporarily facilitate economic activity, particularly in environments with low transparency and weak institutions (Drury et al., 2006; Hodge et al., 2009; Ibrahim et al., 2015).

This study shows that the NRDS project was an effective measure to increase rice yield. It also changed political stability from an insignificant factor to a significant contributor, allowing political stability to positively affect rice productivity. Political stability alone does not automatically lead to higher productivity, but it can become a significant contributor when supported by national initiatives such as the NRDS. This finding helps explain the differing conclusions in previous studies. For example, Campos and Nugent (2002) and Acemoglu and Robinson (2012) found that stability alone has limited or conditional effects, especially without strong institutional frameworks. In contrast, studies such as Bresser-Pereira (2008), Aisen and Veiga (2013), Alesina et al. (1996), Messer, Cohen, and D'Costa (1998), and Sidamor et al. (2016) reported positive effects when stability was combined with effective governance and development programmes. Therefore, this study demonstrates that the effect of political stability on economic development depends on its interaction with institutional and policy initiatives.

5. Conclusion

This study examined the role of political stability in the successful implementation of the National Rice Development Strategy (NRDS) across nine West African countries. The findings show that the NRDS moderated the relationship between political stability and rice yield, increasing the effect of political stability from an insignificant to a statistically significant positive impact during the NRDS period.

The results further indicate that the success of the NRDS depends not only on the design and implementation of appropriate policy measures, but also on addressing persistent challenges, such as the misallocation of ODA toward institutional rather than productive purposes, the mistargeting of government spending and GFCF, and the continued inaccessibility of credit for farmers in several countries. Careful management of trade openness is also important to maximise positive outcomes while reducing potential drawbacks.

The long-term effect of human capital development highlights the need for sustained investment in education and skills policies, because their benefits accumulate gradually and are essential for improving agricultural productivity and resilience. The results also indicate that good governance increases agricultural productivity by strengthening administrative capacity and ensuring efficient allocation of limited resources.

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Appendix(International Crisis Group, 2025)

Togo (1963): First sub-Saharan coup; President Olympio assassinated, leading to military rule.

Nigeria (1966): Coup ousted PM Tafawa Balewa; counter-coup followed, initiating military regimes.

Sierra Leone (1967): Coup ousted PM Stevens, sparking instability.

Ghana (1979 and 1981): Jerry Rawlings led two coups, establishing long-term rule.

Liberia (1980): Samuel Doe's coup ended Americo-Liberian dominance; triggered civil war.

Burkina Faso (1980): Frequent coups began with Colonel Zerbo ousting President Lamizana.

Gambia (1994): Yahya Jammeh's coup led to 20+ years of rule.

Mauritania (2005 and 2008): Two coups overthrew Presidents Taya and Abdallahi, citing corruption.

Guinea (2008): Captain Camara led a coup after President Conté's death.

Niger (2010 and 2023): Coups ousted Presidents Tandja (unconstitutional term extension) and Bazoum (security concerns).

Côte d'Ivoire (2010-2011): Post-election crisis escalated to violence, ousting Gbagbo.

Guinea-Bissau (2012 and 2022): Election disrupted; later, a coup attempt targeted President Embaló.

Mali (2012, 2020 and 2021): Multiple coups, citing rebellion and governance failures.

Burkina Faso (2014, 2015 and 2022): Protests ousted Compaoré; transitional coups followed.

Chad (2021): Military took power after President Déby's death.

Guinea (2021): President Condé ousted by Colonel Doumbouya.