Research Article

Assessing the Impact of Governance Quality on Agricultural Output in Iraq (2003–2024): Evidence from the ARDL Approach

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Abstract | Current study examines how good governance influences agricultural productivity in Iraq during 2003Q1–2024Q4, drawing on six key World Bank indicators: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. Recognizing the strategic importance of the agricultural sector for economic growth in fragile states, the analysis employs the Autoregressive Distributed Lag (ARDL) model to capture both short and long-term dynamics using quarterly time series data. The results reveal a stable long-term equilibrium relationship, with model explaining a significant share of the variation in agricultural GDP (R^2 = 0.93; F-statistic = 8.87; $p < 0.01$). Among governance dimensions, control of corruption and political stability exert the strongest influence, with long-term elasticity of 6.189 and 1.491, respectively, both significant at the 5% level. Short-term estimates align with these findings, showing that control of corruption contributes 5.164 units and political stability 0.635 units to agricultural GDP. Error correction term (-0.834; $p < 0.01$) is negative and highly significant, suggesting that approximately 83% of short-term imbalances are corrected in the following quarter. Overall, the evidence highlights the critical role of transparent institutions, anti-corruption strategies and Political Stability in enhancing agricultural productivity and resilience. By contrast, weak administrative infrastructure and limited farmer engagement constrain performance. The study recommends extensive institutional reforms to strengthen governance as a foundation for transforming Iraq's agricultural sector and ensuring long-term economic stability.

Received | May 14 2025; **Accepted** | Aug 29, 2025; **Published** | November 29, 2025
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Citation | Drebee, H.A., A.A. Abd, M.K.A. Ali and S. Alhasan. 2025. Assessing the impact of governance quality on agricultural output in iraq (2003–2024): evidence from the ARDL approach. Sarhad Jurnal of Agriculture, 41(4): 1996-2012.
DOI | https://dx.doi.org/10.17582/journal.sja/2025/41.4.1996.2012
Keywords | Governance indicators, Agricultural GDP, Agricultural productivity, ARDL Model, Iraq.

Introduction

Administration has become a central theme in development economics and is widely regarded as an important factor of why certain countries achieve rapid and more sustainable growth than others. It refers to institutional policies through which decisions are made, executed and monitored to improve effectiveness of political, economic and social systems (UNESCAP, 2014). Governance directly influences the society welfare and quality of life, as it involves various stakeholders, including state institutions, political parties, business enterprises, military and NGOs (Pere, 2015). While these stakeholders play significant role in decision making, government ultimately defines the legal frameworks and regulatory standards that enable the public and private sectors to contribute significantly in the development of a nation. In contexts where governance is weak or ineffectual, economic growth may cause structural discrepancies and deepen social inequality (Pere,2015).

Benefits of efficient administration are broad and multidimensional. Strong institutional arrangements reduce corruption by strengthening transparency and accountability, ensure democratic values, and support international cooperation based on trust and respect for international law. Improvements in governance, such as protecting and expanding civil liberties, have a notable positive impact on social well-being and economic resilience (Stead, 2015). Three major dimensions are commonly linked with governance: first, encouraging collaboration among government, civil society, and the private sector; second, confirming accountability, transparency, justice, foresight, and democratic participation in decision-making; and third, defining normative standards and frameworks that guide institutional behavior at both national and international levels (Janssen and Voort, 2016). Globerman and Shapiro, 2002 emphasized that a strong governance infrastructure is essential for both economic performance and food security, particularly in developing economies.

Agriculture, as an economic sector, makes a fundamental contribution to economic growth, particularly in developing nations. It provides employment opportunities, supplies raw materials to industry, and contributes to food self-sufficiency. Growth in agricultural output stimulates the broader economy through various direct and indirect channels. Despite its importance, the agricultural sector continues to face major challenges, including limited skilled labor, insufficient capital, and underutilization of modern technologies that are necessary for innovation in agriculture. International development initiatives generally emphasize improvements in irrigation infrastructure, the efficient use of fertilizers, and the establishment of training centres to facilitate the adoption of modern agricultural approaches. However, the effectiveness of such programs often fails when not supported by strong governance frameworks. As confirmed by Lio and Liu (2008), countries with more effective administrative systems are able to achieve higher levels of agricultural productivity with the same inputs, highlighting the critical role of governance in improving technological efficiency and ensuring the sustainability of sectoral transformations.

Despite its significant agricultural potential, Iraq has experienced a noticeable decline in the sector's share of GDP, from 22% in 1953 to less than 5% in recent years, largely due to governance-related limitations, including corruption, institutional decline, and continuous political instability. In the aftermath of the 2003 U.S.-led occupation, Iraq entered a period of deep political and economic disruption that profoundly altered its governance landscape. The dismantling of state institutions, the spread of sectarian divisions, and mounting security crises severely diminished the capacity of public administration and weakened institutional effectiveness. These conditions fostered a surge in corruption, eroded public confidence in government, and undermined the rule of law, leaving long-lasting constraints on economic management and the formulation of development priorities. In this regard, Sebudubudu (2010) highlighted that good governance is fundamental for promoting economic stability and alleviating poverty, underscoring the importance of governance reforms in fragile economies like Iraq. Even though governance is widely regarded as a critical factor for agricultural development at the international level, there remains a shortage of empirical econometric research investigating this relationship within the specific context of post-conflict Iraq. The majority of previous studies have focused on broader macroeconomic performance or general governance evaluations, providing limited insight into the direct influence of governance indicators on sector-specific outcomes, particularly agricultural GDP (GDPA).

To address this research gap, the current study examines the effect of six World Bank governance indicators on GDPA in Iraq, using an Autoregressive Distributed Lag (ARDL) model. By highlighting an area that has received limited attention, the study provides new empirical evidence and offers important recommendations for improving governance and enhancing agricultural productivity in fragile state contexts.

Model specification and data

Since the 1990s, development economists have increasingly recognized good governance as a vital catalyst for sustainable development. The World Bank conceptualized good governance through six major indicators: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

- **Voice and Accountability (VA):** Refers to extent to which citizens can contribute to the selection of their government, exercise freedom of expression and influence policymaking through institutional systems.
- **Political Stability and Absence of Violence (PS):** Reflects the likelihood of political instability and violence, including terrorism, and indicates the degree to which politicians accept the legitimacy of state institutions.
- **Government Effectiveness (GE):** Assesses the quality of public services, the capacity of the civil service, and the degree of independence from political pressures in handling resources and delivering essential services.
- **Regulatory Quality (RQ):** Assesses the ability of the government to formulate and implement sound policies and regulations that promote private sector development, justice, and access to opportunities.
- **Rule of Law (RL):** Reflects the extent to which individuals and institutions are guaranteed to abide by societal rules, including contract enforcement, property rights, and the impartiality of the judicial system.
- **Control of Corruption (CC):** Assesses the extent to which state authorities refrain from using their position for personal gain, ranging from small- to large-scale corruption, and evaluates the strength of institutional safeguards established to prevent, monitor, and address such practices.

Significant fluctuations in the historical trends of PS and CC are closely linked to major political and security events in Iraq. Specifically, PS declined sharply twice: first in 2006–2007 during the peak of the civil conflict, and then in mid-2014 following the ISIS offensive and the capture of Mosul. However, after the territorial defeat of ISIS in 2017, PS showed a slight improvement, mainly due to stabilization efforts. Meanwhile, CC deteriorated notably between 2008 and 2010, amid the expansion of patronage networks, and once again during the 2014–2015 security crisis. From early 2018 onwards, CC experienced a modest recovery, thanks to intensified anti-corruption campaigns and donor–led reforms in public spending, which also had a positive spill over effect on agriculture-related projects.

Such governance dimensions are not independent of one another; rather, they are strongly interwoven and together define the institutional infrastructure that influences agricultural efficiency. For example, PS provides a predictable environment for public administration, thereby strengthening GE. Similarly, RL improves CC by safeguarding the impartial application of legal provisions. Taken together, these administrative indicators establish a dependable institutional environment that encourages investment, promotes the equitable allocation of resources, and drives comprehensive development within the agricultural sector. In this study, it is planned to investigate the implementation of the financial model, in which these governance indicators affect the agricultural sector in Iraq, as measured by Agricultural GDP (GDPA), and are specified as follows:

$$GDPA_t = \propto + \beta_1 VA_t + \beta_2 PS_t + \beta_3 GE_t + \beta_4 RQ_t + \beta_5 RL_t + \beta_6 CC_t + \varepsilon_t$$

Where:

$GDPA_t$: Agricultural GDP at time t.

VA_t, PS_t, GE_t, RQ_t, RL_t, CC_t: Indicators of Governance at time t.

$\propto$: Constant term.

βi: Coefficients representing the impact of each governance indicator on GDPA.

ε_t: Error term.

It is estimated that the coefficients (βi) will be positive. This anticipation is based on the hypothesis that good governance improves institutional efficiency, minimizes ambiguity, reinforces regulatory and legal procedures, and limits corruption factors, all of which collectively create a conducive environment for agricultural development. The expected associations between governance indicators and GDPA in Iraq are conceptually demonstrated in the following framework:

This system provides the basis for subsequent empirical analysis. The conceptual model is built on

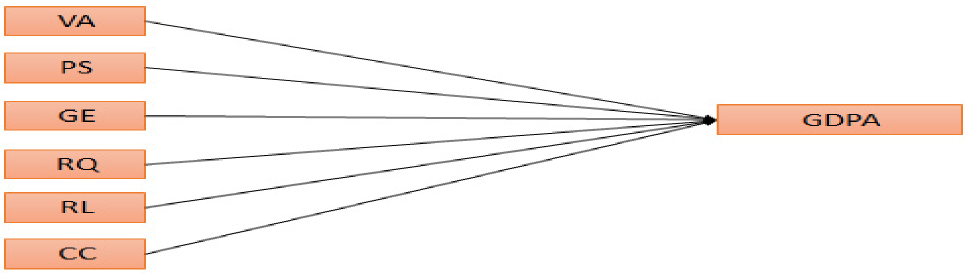

Figure 1: *Conceptual framework: impact of governance indicators on GDPA in iraq.*

Table 1: *Data sources and variables.*

variables	Description	Expected sign	source	Measurement unit
GDPA	Agricultural GDP	-	Central statistical org., Iraq	Billion iraqi dinars
AV	Accountability and voice	(+) Positive	World bank governance gndicators	Index (range: -2.5 to 2.5)
PS	Political Stability and absence of violence	(+) Positive	World bank governance indicators	Index (range: -2.5 to 2.5)
GE	Government effectiveness	(+) Positive	World bank governance indicators	Index (range: -2.5 to 2.5)
RQ	Regulatory quality	(+) Positive	World bank governance indicators	Index (range: -2.5 to 2.5)
RL	Rule of law	(+) Positive	World bank governance indicators	Index (range: -2.5 to 2.5)
CC	Control of corruption	(+) Positive	World bank governance indicators	Index (range: -2.5 to 2.5)

evidence that governance quality is a fundamental institutional condition for achieving sustainable agricultural development. Each governance domain influences the environment in which agricultural practices take place, either by enabling or limiting access to essential inputs, services, and market opportunities. For example, when residents, particularly those in rural communities, are able to express their desires and engage in policy processes, agricultural policies are more likely to be comprehensive and aligned with local priorities. PS minimizes uncertainty surrounding production cycles, the development of infrastructure, and market access, thus creating a safe setting for agricultural investment. GE regulates the efficiency and timeliness with which agricultural services, such as extension support, input supply, and irrigation systems, are delivered, making it an important factor in enhancing sectoral productivity. Likewise, RQ creates a transparent and predictable policy environment that permits farmers to secure credit, resolve land tenure–related disputes, and meet licensing requirements without being subject to unnecessary administrative hurdles. RL further supports these conditions by protecting property rights, ensuring the enforcement of contracts, and strengthening institutional trust, which is important for both smallholder farmers and large-scale investors in the agricultural sector. Meanwhile, CC plays a cross-cutting role by ensuring that public resources allocated to the agricultural sector are not misused, thereby allowing programs and investments to effectively reach their intended beneficiaries.

Taken together, these governance indicators interact in complex ways to shape agricultural performance by influencing institutional credibility, the efficiency of resource allocation, and the overall investment climate in rural areas. This conceptual framework offers a hypothetical basis for the empirical analysis, highlighting how developments in governance can translate into higher agricultural productivity in Iraq. It aligns with established theoretical perspectives that focus on the role of governance quality in driving economic and sectoral development, highlighting the importance of evaluating its effect on agricultural performance (Stead, 2015).

To provide a better understanding of the econometric specification, Table 1 indicates the main variables used in this study, along with their conceptual definitions, projected effects on GDPA, original sources of data, and corresponding units of calculation.

To examine the link between agricultural indicators and agricultural productivity, this study employed the ARDL approach, which is well suited for time-series data where variable integration shows a combination of integration orders, especially I(0) and I(1). The

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Table 2: *Description of the variables used in the study.*

	GDPA	VA	PS	GE	RQ	RL	CC
Mean	6,175	-1,119	-2,416	-1,310	-1,201	-1,698	-1,366
Median	5,790	-1,063	-2,428	-1,251	-1,137	-1,32	-1,371
Maximum	9,519	-0,948	-1,846	-1,048	-0,991	-1,448	-1,209
Minimum	3,863	-1,643	-2,480	-1,749	-1,6515	-1,838	-1,489
Std. Dev.	1,475	0,182	0,314	0,227	0,186	0,107	0,090
Skewness	0,415	-1,665	-0,345	-0,736	-1,022	0,770	0,355
Kurtosis	2,374	5,008	3,301	2,311	3,043	2,606	1,830
Jarque-Bera	0,901	1,605	0,473	2,205	3,483	2,107	1,561
Probability	0,637	0,183	0,789	0,331	0,175	0,348	0,458
Sum	123,490	-22,393	-48,.323	-26,212	-24,014	-33,971	-27,316
Sum sq. Dev.	41,343	0,6348	1,880	0,980	0,659	0,218	0,155

ARDL bounds testing approach was used to evaluate the presence of a long-term equilibrium relationship between the variables. In addition, the Error Correction Model (ECM) was included to capture short-term dynamics and estimate the adjustment speed, as deviations from the long-term equilibrium are corrected over time.

Table 2 indicates that all governance indicators in Iraq have negative values, reflecting significant governance challenges, including weak institutional performance, limited transparency, and insufficient public accountability. These circumstances create an insecure environment that undermines overall economic development and hinders the growth of the agricultural sector. Among the governance indicators, PS had the lowest average value at -2.416, followed by RL at -1.698, and CC at -1.366. These Figures highlight the severity of governance challenges, particularly in terms of maintaining political order, upholding legal frameworks, and combating corruption.

Regarding agricultural output, the average GDPA during the study period was 6.174 billion Iraqi dinars, with values ranging from a minimum of 3.863 billion to a maximum of 9.518 billion dinars annually. This reflects substantial variability in agricultural output across the examined years. The results also indicate that all variables follow a normal distribution, as confirmed by the application of the Jarque-Bera test. Given that their p-values are higher than the standard significance threshold, we fail to reject the hypothesis of normality for all variables.

Methodology

To examine how governance indicators are related to the agricultural output of Iraq, this study adopts a time-series econometric framework to capture both short-term and long-term fluctuations in equilibrium patterns. The characteristics and functional requirements of the dataset are considered. The analysis begins with the initial step required to confirm the suitability of the ARDL model (mostly stationarity tests). The functional process is performed in a logical sequence: First, the stationarity test is used to identify the order of integration of the variables; then the ARDL bounds testing procedure is applied to confirm whether there is a long-term equilibrium relationship; and finally, short-term dynamics are estimated using an error correction model that adjusts deviations from the long-term equilibrium.

Statistical analysis

Statistical analysis is a fundamental step in time-series analysis because it assesses whether the statistical properties of a series remain constant over time. Failure to account for non-stationarity can result in misleading regression results (Drebee *et al*., 2014). Economic indicators, such as GDP and inflation, are often characterized by non-stationary patterns (Drebee *et al*., 2022).

$$E(X_t) = \mu$$

$$\mathrm{Var}(x_t) = (x_t - \mu)^2 = \sigma^2$$

$$\mathrm{Cov}(t, t+k) = E(x_t - \mu)(x_{(t+k)} - \mu)$$

Stationarity of variables is generally evaluated through unit root tests.

Augmented dickey-fuller test (ADF)

The Augmented Dickey-Fuller (ADF) test is widely used to assess the stationarity of time series. It improves upon the original Dickey-Fuller test by including lagged differences to correct for autocorrelation in the residuals:

$$\Delta y_t = \alpha_1 + a_1 t + \delta y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + \varepsilon_t$$

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Within the ADF test, the procedure estimates whether a time series contains a unit root, indicating non-stationarity. The null hypothesis assumes the presence of a unit root, while the alternative hypothesis implies its absence, representing.

$$H_0{:}\delta=1 \quad \text{VS.} \quad H_1{:}\ \delta<1$$

Phillips –perron test (PP)

The Phillips-Perron (PP) approach addresses autocorrelation in the residuals of the unit root test equation using non-parametric corrections to the standard errors, making it more robust to serial correlation and heteroscedasticity than the ADF test. This procedure is often considered more reliable, particularly in small sample sizes. If there is a discrepancy between the outcomes of the two methods, the findings from the PP test are generally preferred.

Kwiatkowski-phillips-schmidt-shin test (KPSS)

KPSS analysis, as proposed by Kwiatkowski *et al*. (1992), complements ADF analysis by further assessing stationarity. In contrast to ADF and Phillips-Perron (PP) analysis, which assume non-stationarity under the null hypothesis, KPSS analysis assumes stationarity under the null hypothesis. This contrasting assumption allows for a more comprehensive assessment of stationarity by using both types of tests in conjunction.

Determining the optimal lag length

The best gap length was chosen on the basis of many statistical standards, namely Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC) and Hannan Quinn Criteria (HQ).

Co-Integration

Co-integration refers to a long-term equilibrium relationship among non-stationary variables that become stationary when combined. Common methods for analysing co-integration include the Engle-Granger Test, Johansen's procedure, and ARDL bounds testing approach.

Engle granger test

The Engle Granger technique is appropriate for analyzing co-integration in a bivariate system, characteristically over a long time span. In this method, one variable is considered as dependent while the other is considered independent.

Johanson and juselius test

The Johansen–Juselius method evaluates co-integration in multivariate settings and employs two statistics, the Trace test and the Maximum Eigenvalue test, to determine the number of co-integrating vectors.

Vector error correction model (VECM)

Engle and Granger, (1987) emphasized that the presence of a long-term equilibrium relationship, or co-integration, suggests a potential link between variables. Since the typical Granger causality method does not fully capture this, they suggested embedding it within an ECM. This approach allows for the detection of both the direction and strength of causality, with the error correction term serving as evidence of a long-term association when statistically significant.

Vector auto regressive model (VAR)

Vector Auto regression (VAR) models demonstrates linear interdependence among k variables recorded over same time period (t = 1, 2, …, T). The system is denoted in vector form (y) of dimension k × 1, where every element signifies a variable (y_{it}).

Auto regressive distributed lag (ardl)

Co-integration tests, such as Engle–Granger and Johansen–Juselius, require variables to be integrated in the same order, usually I(1), and are less efficient in small samples. The ARDL approach, introduced by Pesaran *et al*. (1996), overcomes these limitations by allowing a mixture of I(0) and I(1) variables, which is not permitted in I(2) cases. By incorporating appropriate lags, the ARDL model captures both short- and long-term dynamics within the same framework. The first step involves testing for co-integration through the Unrestricted Error Correction Model (UECM).

$$\Delta Y_i = \alpha + \sum_{n=1}^{n} \beta_1 \Delta y_{t-i} + \sum_{n=1}^{m} \beta_i \Delta X_{t-i} + \lambda_1 y_{t-i} + \lambda_2 X_{t-i} + \delta_t$$

Where λ_1 and λ_2 represent the coefficients of the long-term relationship, while β and θ represent the coefficients of the short-term relationship. Δ : indicates the first differences of the variables, and m and n refer to the lag periods. Δ: denotes stochastic error term, supposed to have zero mean, constant variance, and no autocorrelation. After assessing model, presence of a long term balance association among variables is studied through Bounds Test. This method, based on the F- and Wald statistics, evaluates H_0 of no co-integration against the alternative of a co-integrating relationship.

$$H_0: \lambda_1 = \lambda_2 = \lambda_3 = \cdots = 0 \quad \text{Vs.} \quad H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \ldots \neq 0$$

Null hypothesis is assessed through comparing F-statistic with the critical bounds proposed by Pesaran *et al*., 1997). If the statistic exceeds the upper bound, co-integration is established; if it stays below lower bound, no co-integration occurs. Values between bounds are questionable (Drebee and Razak, 2022). Once co-integration is recognized, the long-term equation is assessed.

$$y_\tau = \alpha + \sum \lambda_i y_{\tau-1} + \sum \xi_i X_{t-1} + \varepsilon_t$$

Here, ξ_i and m_i denote coefficients of the variables, while q and p represent their respective lag lengths. ε_t is stochastic error term. In 3rd stage, short- term dynamics are evaluated through the Error Correction Model (ECM), expressed as:

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta y_{t-1} + \sum_{i=0}^{q} \beta_2 \Delta x_{t-1} + \xi ECT_{t-1}$$

In this equation, ECT_{t-i} denotes error correction, while coefficients of short-term dynamics measures how model adjusts toward balance. The coefficient of the error correction term (ξ) indicates speed at which deviations from long term equilibrium are corrected over time.

Diagnostic tests

After assessing the ARDL model, analytical tests are applied to ensure validity of the results. These tests assess for violations of regression assumptions, such as serial correlation and heteroskedasticity, since their presence can distort parameter estimations and lead to poor statistical reliability. Confirming these assumptions helps verify the stability and robustness of the model.

Autocorrelation

Auto-correlation occurs when residuals are correlated across time, indicating potential model misspecification and resulting in inefficient estimates. It is commonly tested using the Breusch–Godfrey test or the Durbin–Watson statistic. The null hypothesis assumes no auto-correlation, and a p-value higher than 0.05 supports the validity of the model. Auto-correlation occurs when residuals are correlated across time, demonstrating potential model

Heteroskedasticity

Heteroskedasticity occurs when the variance of the error terms differs across observations, thereby violating a key regression assumption and resulting in biased standard errors. It is typically detected using the Breusch–Pagan or White tests. The null hypothesis assumes constant variance, and a p-value above 0.05 indicates no heteroskedasticity, thereby enhancing the reliability of estimates.

Results and Discussion

Before presenting the econometric estimations, it is important to examine the relationships among the study variables and assess the degree of interdependence between them. Such preliminary tests help identify potential issues that could compromise the validity of the results. Accordingly, Tables 3 and 4 summarize key diagnostic outcomes: Table 3 displays the correlation matrix between GDPA and the governance indicators, while Table 4 presents the Variance Inflation Factor (VIF) test results to evaluate possible multicollinearity among the governance variables. Conducting these diagnostics is essential for confirming the suitability of the data, ensuring the reliability of the estimated models, and *strengthening* the robustness of the empirical findings.

Table 3: *Correlation matrix between GDPA and governance indicators.*

	GDPA	VA	RQ	GE	RL	PS
VA	0.116	1.000				
RQ	-0.140	0.816	1.000			
GE	0.118	0.447	0.360	1.000		
RL	0.247	-0.075	0.082	0.146	1.000	
PS	0.115	0.238	0.103	0.058	-0.196	1.000

Table 3 presents the results of the correlation matrix, which provides an initial insight into the association between GDPA and the governance indicators. The analysis shows that GDPA is modestly and positively correlated with RL (R = 0.247) and GE (R = 0.115), suggesting some contribution of these dimensions. By contrast, the correlations between GDPA and RQ, as well as VA, are relatively weak, indicating a limited direct effect of these indicators on agricultural productivity. In addition to these associations, the matrix also highlights significant interdependence among the governance indicators themselves. For example, VA and RQ exhibit a strong positive correlation (R = 0.816), implying possible conceptual overlap or complementary effects between these two institutional dimensions. Such strong interrelationships raise the likelihood of multicollinearity, which may distort regression estimates if not properly addressed.

and the results are presented in Table 4. The VIF analysis provides a more rigorous assessment of multicollinearity, thereby ensuring the reliability and stability of subsequent econometric estimations.

Table 4: *variance inflation factor (VIF) for governance indicators.*

Variables	VIF	1/VIF
VA	3.76	0.266
RQ	3.26	0.307
GE	1.31	0.764
RL	1.14	0.874
PS	1.14	0.897
Mean VIF	2.116	

A diagnostic test for multicollinearity was carried out using both the correlation matrix (Table 3) and the VIF results (Table 4) to confirm the reliability of the regression estimates. All explanatory variables recorded VIF values below the conventional threshold of 5, indicating that multicollinearity is not a serious concern. The highest VIF was observed for VA at 3.76, followed by RQ at 3.26, indicating moderate association with other variables but remaining within acceptable limits. Other indicators, including GE, RL, and PS, showed low VIF values, with an overall average of 2.12. These findings confirm the independence of the governance indicators and justify their inclusion in the ARDL model, ensuring robust and unbiased coefficient estimates.

Unit root test

The ADF, PP, and KPSS methods were applied to examine the stationarity properties of the study variables GDPA, VA, PS, GE, RQ, RL, and CC. These methods determine whether each variable is stationary at levels, first difference or second difference. thereby establishing their order of integration. Identifying the order of integration is crucial for selecting a suitable econometric method and ensuring the validity of long-term estimations. The results of three stationarity tests, presented in Table 5 under different model specifications, at significance levels of 1%, 5%, and 10%, provide a comprehensive evaluation of the time-series properties of the variables. This step forms the foundation for the subsequent application of the ARDL model.

Table 5 shows that the null hypothesis (H_0: δ = 0), which assumes the existence of a unit root (i.e., the variable is non-stationary), can be rejected for GDPA and CC at the 1% significance level across all test specifications (intercept, trend and intercept, or none). The test statistics for these variables are lower than the critical values, confirming that they are stationary at level, i.e., integrated of order zero I(0). In contrast, the null hypothesis cannot be rejected for the remaining variables (VA, PS, GE, RQ, and RL) at level, suggesting that these series are non-stationary. However, when differenced once, all of them turn stationary under the same test conditions, indicating that they are integrated of order one, I (1).

Given the mixed integration orders of the variables, the ARDL model was selected for the analysis. One of the main strengths of the ARDL framework is

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Table 5: *Results of ADF, PP, and KPSS tests for stationarity of study variables.*

	ADF						P-P						KPSS				
	Level			1st difference			Level			1st difference			Level		1st difference		
	Intercept	Trend and intercept	None	Intercept	Trend and intercept	None	Intercept	Trend and intercept	None	Intercept	Trend and intercept	None	Intercept	Trend and intercept	Intercept	Trend and intercept	Decision
GDPA	-3.48*** (0.02)	-3.81** (0.04)	-0.15 (0.61)				-3.31** (0.048)	-3.49** (0.038)	-3.20** (0.04)				0.16***	0.07***			I(0)
VA	-2.14 (0.23)	-2.20 (0.45)	-1.56 (0.10)	-6.20*** (0.00)	-7.52*** (0.00)	-5.32*** (0.000)	-2.22 (0.204)	-2.20 (0.45)	-1.56 (0.10)	-5.7*** (0.000)	-6.62*** (0.000)	-5.14*** (0.000)	0.54	0.137	0.20***	0.05***	I(1)
PS	-2.14 (0.23)	-2.20 (0.46)	-0.18 (0.60)	-7.45*** (0.00)	-7.80*** (0.000)	-7.55*** (0.000)	-2.18 (0.21)	-2.31 (0.40)	-0.12 (0.62)	-7.0*** (0.000)	-7.52*** (0.000)	-7.10*** (0.000)	0.418	0.295	0.06***	0.06***	I(1)
GE	-2.10 (0.24)	-1.23 (0.87)	-1.34 (0.15)	-2.99** (0.04)	-3.52** (0.490)	-2.67*** (0.011)	-2.07 (0.25)	-1.32 (0.84)	-1.21 (0.19)	-3.04** (0.049)	-3.18** (0.039)	-3.09*** (0.004)	0.470	0.247	0.34**	0.07***	I(1)
RQ	-1.83 (0.35)	-1.65 (0.73)	-0.74 (0.38)	-5.36*** (0.00)	-6.001*** (0.000)	-5.26*** (0.000)	-1.83 (0.35)	-1.65 (0.73)	-0.74 (0.38)	-5.36*** (0.000)	-6.00*** (0.000)	-5.26*** (0.000)	0.819	0.341	0.12***	0.04***	I(1)
RL	-2.09 (0.24)	-2.03 (0.54)	-0.12 (0.71)	-5.16*** (0.00)	-5.10*** (0.003)	-5.33*** (0.000)	-2.09 (0.24)	-2.03 (0.54)	-0.12 (0.71)	-5.1*** (0.000)	-5.10*** (0.004)	-5.33*** (0.000)	0.27**	0.264		0.08***	I(1)
CC	-5.24*** (0.001)	-5.36*** (0.004)	-0.13 (0.62)				-3.05** (0.04)	-3.19** (0.04)	-0.12 (0.62)				0.09***	0.06***			I(0)

Note: The values in parentheses represent the p-values. The asterisks (*, **, ***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

its ability to handle variables that are a combination of I(0) and I(1), without requiring all series to be integrated at the same order. Moreover, the ARDL approach simultaneously estimates both short-term dynamics and long-run relationships, making it well-suited to the study's objective of evaluating the impact of governance indicators on Iraq's agricultural output over time. The Bounds Testing procedure, embedded within the ARDL methodology, further enhances its suitability by enabling robust testing of long-run equilibrium relationships without the need for strict pre-testing of stationarity. This feature makes it particularly appropriate for the quarterly time-series dataset employed in this study (2003Q1–2024Q4).

Estimation of the function using the (ARDL) model

After testing the stationarity of the study variables and determining their order of integration, it was found that GDPA and CC are stationary at the level. Meanwhile, the variables VA, PS, GE, RQ, and RL become stationary after taking their first differences across all test specifications (intercept, trend and intercept, and none). Since none of the variables became stationary at the second difference, and the dependent variable GDPA was already stationary at level, the ARDL approach was considered appropriate for this analysis. The estimate results obtained from the ARDL model are summarized in Table 6.

The results in Table 6 indicate that ARDL model is highly reliable, with the F-statistic of 8.871 that is significant at the 1% level, confirming the validity of the estimated relationships.

Table 6: *Results of the autoregressive distributed lag (ARDL) model.*

Variable	Coefficient	Std. error	t-Statistic	Prob.*
GDPA (-1)	0.166	0.139	1.186	0.274
VA	-5.609***	1.536	-3.651	0.008
VA(-1)	7.151**	2.919	2.449	0.044
PS	0.634***	0.112	5.633	0.000
PS(-1)	0.609***	0.071	8.511	0.000
GE	-0.251	0.728	-0.345	0.739
RQ	-2.042***	0.651	-3.136	0.016
RQ(-1)	-5.235*	2.529	-2.069	0.077
RL	0.647	0.887	0.729	0.489
RL(-1)	2.370*	1.090	2.174	0.066
CC	5.163***	1.342	3.847	0.006
C	13.088***	3.157	4.145	0.004
R-squared	0.933	Mean dependent var		6.404
Adjusted R-squared	0.827	S.D. dependent var		1.341
S.E. of regression	0.556	Akaike info criterion		1.930
Sum squared resid	2.168	Schwarz criterion		2.526
Log likelihood	-6.339	Hannan-Quinn criterion.		2.031
F-statistic	8.871	Durbin-Watson stat		2.003
Prob (F-statistic)	0.004			

Note: *,**,*** represent statistical significance at the 1%, 5%, 10% level respectively, for the corresponding coefficient.

The model also demonstrates strong explanatory power, as revealed by an R^2 value of 0.93. This shows that the governance indicators VA, PS, GE, RQ, RL, and CC collectively explain about 93% of the variation in Iraq's GDPA.

Governance indicators, as mentioned in Table 6, shows that collectively they exert a strong effect on variations in Iraq's GDPA. The model's high coefficient of determination (R^2 = 0.93) depicts that the included variables explain 93% of changes in agricultural produce. The F-statistic is also statistically significant, confirming joint relevance of the governance indicators. Among them, PS and CC display significant positive influence, strengthening the hypothesis that sound governance enhances agricultural performance. In contrast, RQ and VA present unexpected signs in the short term, which may indicate institutional inefficiencies or challenges in policy implementation. Overall, the strong influence of PS and CC highlights the importance of political stability and anti-corruption measures as major drivers of agricultural growth in Iraq on a sustainable basis.

Corruption often diverts important resources away from agricultural inputs and infrastructure, thus limiting productivity. Similarly, political instability interferes supply chains, depresses investment and discourages farmers' access to markets. The negative or non-significant effects of VA and RQ may reflect deep-rooted structural weaknesses. Although formal mechanisms for citizen participation and regulatory enforcement are in place, their inconsistent application highlights the gap between institutional frameworks and their practical implementation. Comparable trends have been reported in other fragile states, where governance indicators often produce mixed or contradictory effects on sectoral performance.

Autocorrelation and heteroscedasticity

Before examining the occurrence of long-term or short-term associations among study variables, it is important to conduct a series of preliminary analytical tests. The most important of these include.

Autocorrelation of residuals

Autocorrelation refers to the correlation between error terms across consecutive time periods, producing a non-zero correlation coefficient. Its occurrence violates a major assumption of the Ordinary Least Squares (OLS) method, as errors in one period may affect those in subsequent periods, resulting *in* inefficient and potentially biased assessments. In order to confirm the absence of autocorrelation in the study model, the Breusch-Godfrey LM test was used, and the results are presented in Table 7.

Table 7: *Breusch-godfrey LM test results for the study model.*

F-statistic	**1.015**	**Prob. F(1,6)**	**0.35**
Obs*R-squared	2.750	Prob. Chi-Square(1)	0.10

Table 7 confirms that the model does not suffer from autocorrelation. The F-statistic of 1.015 fails to reject the null hypothesis of serial correlation, showing that the error terms are uncorrelated over time.

Heteroskedasticity test: ARCH

Heteroskedasticity occurs when the variance of the residuals varies across observations, which reduces the efficiency of estimates and weakens the accuracy of statistical inferences, although the estimates remain unbiased. To address this concern, the Breusch-Pagan-Godfrey test was performed. The results in Table 8 report an F-statistic of 0.465 with a related p-value; F (11, 7) = 0.877. Since the probability value is much higher than the 5% threshold, the null hypothesis of constant variance is not rejected. This result is confirmed as the residuals appear symmetric, which ensures the strength and reliability of the explanatory variables of the model.

Table 8: *Diagnostic results of the heteroskedasticity test.*

Heteroskedasticity test: Breusch-pagan-godfrey			
F-statistic	0.465	Prob. F(11,7)	0.877
Obs*R-squared	8.02	Prob. Chi-Square(11)	0.712
Scaled explained SS	1.912	Prob. Chi-Square(11)	0.999

Bounds test for detecting co-integration

After confirming that autocorrelation and heteroskedasticity are not present in the model, the subsequent step involves examining the existence of co-integration among the variables under consideration. To achieve this, the Bounds testing approach is employed, as illustrated in the following equation.

Normal test of the random errors

The Jarque-Bera test results, explained in Figure 2,

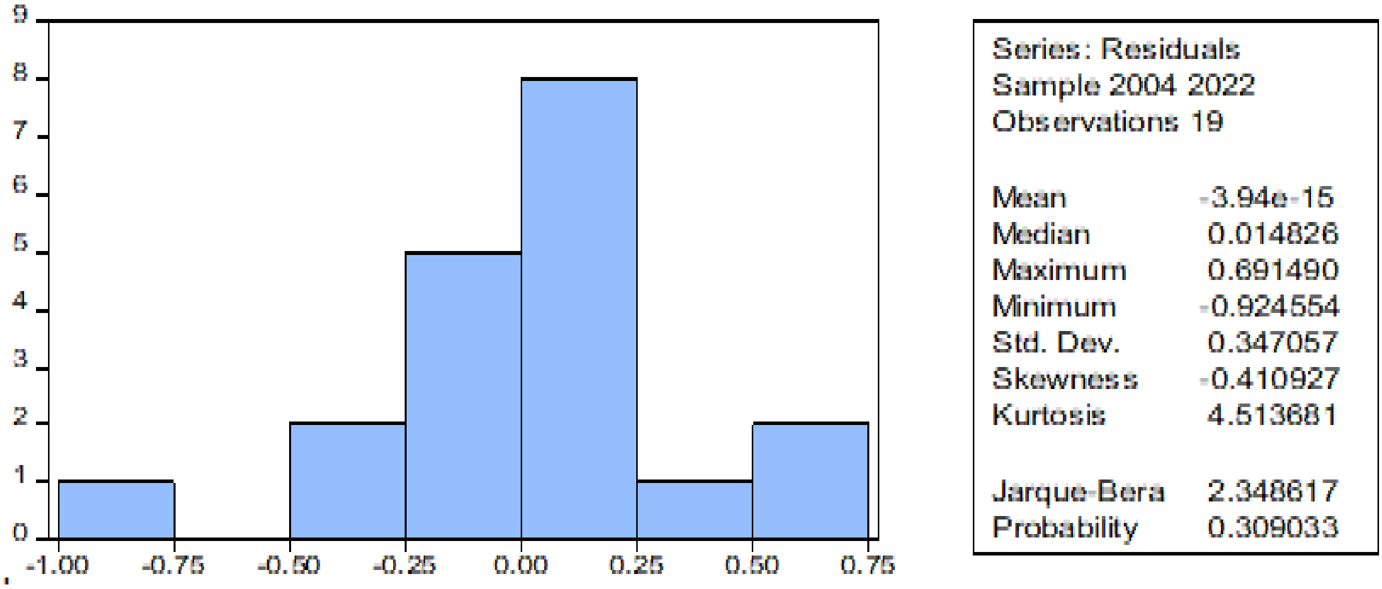

Figure 2: *Normal distribution of model errors.*

$$\Delta GDPA_t = \alpha + \sum_{i=0}^{p} \varphi_i VA_{t-i} + \sum_{i=0}^{n} \beta_i \Delta PS_{t-i} + \sum_{i}^{m} \delta_i \Delta GE_{t-i} + \sum_{i=0}^{q} \xi_i \Delta RQ_{t-i} + \sum_{i=0}^{r} \varrho \Delta RL_{t-i} + \sum_{i=0}^{v} \gamma \Delta CC_{t-i} + \varepsilon_t$$

show that the null hypothesis of normally distributed residuals cannot be rejected, confirming that the error terms follow an approximately normal distribution.

The following hypotheses will be tested:

$$H_0: \tau_1 = \tau_2 = \tau_3 = \tau_4 = \tau_5 = \tau_6 = \tau_7 = 0$$

$$H_0: \tau_1 \neq \tau_2 \neq \tau_3 \neq \tau_4 \neq \tau_5 \neq \tau_6 \neq \tau_7 \neq 0$$

Table 9 shows that the calculated value of 9.255 exceeds the critical upper bound value of 4.43 at the 1% significance level. This indicates that the null hypothesis, which suggests the absence of co-integration, is rejected. Across the examined variables, *the null hypothesis is rejected*. Consequently, a long-term stable equilibrium relationship *exists* between GDPA and the governance indicators (VA, PS, GE, RQ, RL, and CC).

ARDL Model estimation for long-run relationship

After confirming the presence of a stable long-term equilibrium between GDPA and VA, PS, GE, RQ, RL, and CC, the ARDL framework was employed to estimate the parameters for both long-term dynamics and short-term adjustments, including the error correction mechanism. Table 10 reports the estimated coefficients for the long-term relationship.

Table 9: *Co-integration test results using the bounds test.*

F-Bounds Test	Null Hypothesis: No level relationship			
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	9.255	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.50%	2.75	3.99
		1%	3.15	4.43

Table 10: *Estimated coefficients of long-run parameter.*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VA	1.848	3.688	0.501	0.632
PS	1.491***	0.354	4.212	0.004
GE	-0.302	0.839	-0.359	0.729
RQ	-8.723***	1.786	-4.883	0.001
RL	3.616	2.051	1.763	0.121
CC	6.189***	2.196	2.818	0.026
Note:*** represents statistical significance at the 10% level.				

Results for the long-term coefficients of the ARDL model are presented in Table 10, depicting that among the six governance indicators, only PS, CC,

$$\Delta GDPA_t = \alpha + \sum_{i=0}^{n} \beta_i VA_{t-i} + \sum_{i=0}^{q} \delta_i \Delta PS_{t-i} + \sum_{i}^{m} \phi_i \Delta GE_{t-i} + \sum_{i=0}^{P} \varphi \Delta RQ_{t-i} + \sum_{i=0}^{s} \varrho \Delta RL_{t-i} + \sum_{i=0}^{v} \gamma \Delta CC_{t-i} + \psi ECT_{t-i} + \varepsilon_t$$

and RQ have statistically significant effects on Iraq's agricultural productivity over the study period. PS has a positive and significant coefficient of 1.491, indicating that a one-unit increase in PS is associated with a 1.491 unit improvement in GDPA. This result highlights the significance of a secure political environment in minimizing uncertainty and fostering investment and productivity in the agricultural sector. Similarly, CC demonstrates a strong positive effect, with a one-unit improvement in anti-corruption measures contributing to a 6.19-unit increase in agricultural output, underscoring the role of transparent and accountable institutions in promoting efficient resource allocation. In contrast, RQ displays a significant negative relationship of -8.723, implying that existing regulatory frameworks may impose barriers or inefficiencies that constrain sectoral growth, possibly due to bureaucratic complexity or inconsistent enforcement. The remaining indicators VA, GE, and RL show statistically insignificant coefficients, suggesting that their long-term influence on GDPA is either minimal or operates indirectly through other governance channels not fully captured by the model.

Error correction term and estimation of short -run coefficient

The short-term dynamics between Iraq's GDPA and the governance indicators (VA, PS, GE, RQ, RL, and CC) were observed using the Error Correction Model (ECM). This system analyzes both the immediate effects of changes in governance on agricultural productivity and the rate at which short-term imbalances are corrected toward the long-term equilibrium. The ECM specification makes it possible to assess the direction and magnitude of the short-term association, and determine the adjustment speed through the error correction term.

The term (ECT) presented in Table 11 indicates the expected negative sign and is statistically significant at the 1% level. The results for Iraq's GDPA and governance confirm a stable long-term co-integration between GDPA and the governance indicators (VA, PS, GE, RQ, and CC). The estimated coefficient of -0.83 shows that about 83% of short-term *imbalances* in GDPA are corrected within the same period. This relatively high adjustment speed emphasizes the performance of the mechanism and suggests that deviations from a long-term equilibrium are largely restored within a year.

Table 11: *Results of short- run parameter and error correction term*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VA)	-5.610***	1.536	-3.652	0.008
D(PS)	0.635***	0.113	5.633	0.001
D(GE)	-0.252	0.728	-0.346	0.740
D(RQ)	-2.042***	0.651	-3.136	0.017
D(RL)	0.647	0.887	0.729	0.490
D(CC)	5.164***	1.342	3.847	0.006
CointEq(-1)	-0.834***	0.140	-5.973	0.001

Note: *** represents statistical significance at the 10% level.

Table 11 provides the short-term assessments from the ARDL framework, together with the ECT. The findings prove that CC and PS share a positive and significant relationship with Iraq's GDPA in the short-term. Specifically, a one-unit enhancement in CC is associated with a 5.16-unit increase in GDPA, while a one-unit increase in PS corresponds to a 0.635-unit gain. These results highlight *the* significance of transparent institutions and PS in creating conditions that support agricultural growth. In contrast, RQ and VA exert significant negative short-term influences, which may reflect irregularities in regulatory enforcement and weak participatory mechanisms that limit the performance of governance in practice. The coefficients for GE and RL are statistically non-significant, indicating that their influence may operate through long-term institutional strengthening rather than immediate short-term impacts. The ECT is negative and highly significant (–0.834, $p < 0.01$), confirming the presence of a stable long-run equilibrium. Its magnitude indicates that approximately 83% of short-term deviations from equilibrium are corrected within a single quarter, pointing to a rapid adjustment process. Taken together, these findings reinforce the evidence that improvements in governance, particularly through minimizing corruption and ensuring PS, are central to enhancing the performance of Iraq's agricultural sector.

The empirical results of this study extend the existing literature on governance and agricultural performance. The positive and statistically significant influences of CC and PS on Iraq's GDPA, in both the short- and long-term horizons, are aligned with evidence from Nigeria, Vietnam, and MENA countries (Nguyen *et al*., 2019; Al-Khatib and Benhaddou, 2022), highlighting their critical role in fostering agricultural growth. Conversely, RQ shows a negative long-term effect, and VA has a negative short-run effect in Iraq, suggesting that institutional challenges, implementation gaps, and weak farmer engagement may hinder their effectiveness. GE and RQ were statistically insignificant, in contrast to findings by Ariabod *et al*., 2024 and Gelgo *et al*., 2023, indicating that their influence in Iraq may be indirect or require a longer time frame to materialize.

Diagnostic test

After estimating both the long- and short-term models, stability diagnostics are needed to confirm the consistency of parameters and to check for possible structural shifts in the data. Tests such as CUSUM and CUSUMSQ are commonly applied to determine whether model coefficients remain stable throughout the study period.

- Cumulative Sum Test (CUSUM))
- Cumulative Sum of Squared Test (CUSUMSQ)

The stability of the measured ARDL Error Correction Model was assessed using the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests, commonly employed to detect structural changes in econometric models. These methods evaluate whether recursive residuals remain within critical bounds at the 5% significance level. Exceeding these bounds would indicate instability in the estimated coefficients, suggesting that the long- or short-term associations may not be consistently maintained over the study period. As shown in Figure 3, the CUSUM and CUSUMSQ statistics remain within the 5% significance limits throughout the study period, offering strong evidence of structural stability in the ARDL model. This indicates that measured parameters are statistically reliable and resilient to potential shocks or structural changes in the data. Such stability strengthens the credibility of both long-term and short-term estimates derived from the model. Furthermore, the occurrence of a negative and statistically significant error correction term (ECT) supports these results by demonstrating that deviations from long-term equilibrium are corrected at a reasonable adjustment speed. Overall, these results confirm the robustness of the ARDL framework in calculating dynamic interactions between governance indicators and Iraq's agricultural GDP, ensuring that calculated relationships remain consistent over the study period.

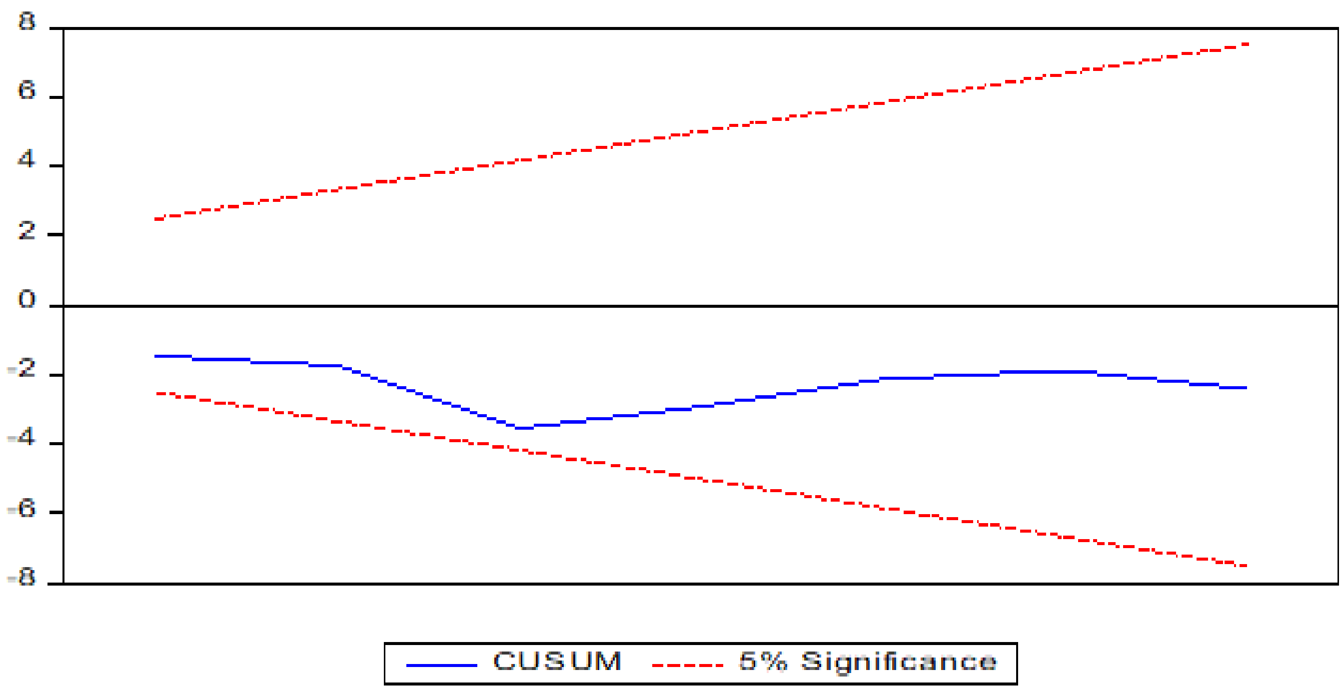

Figure 3: *CUSUM Test for structural stability of ardl model parameters.*

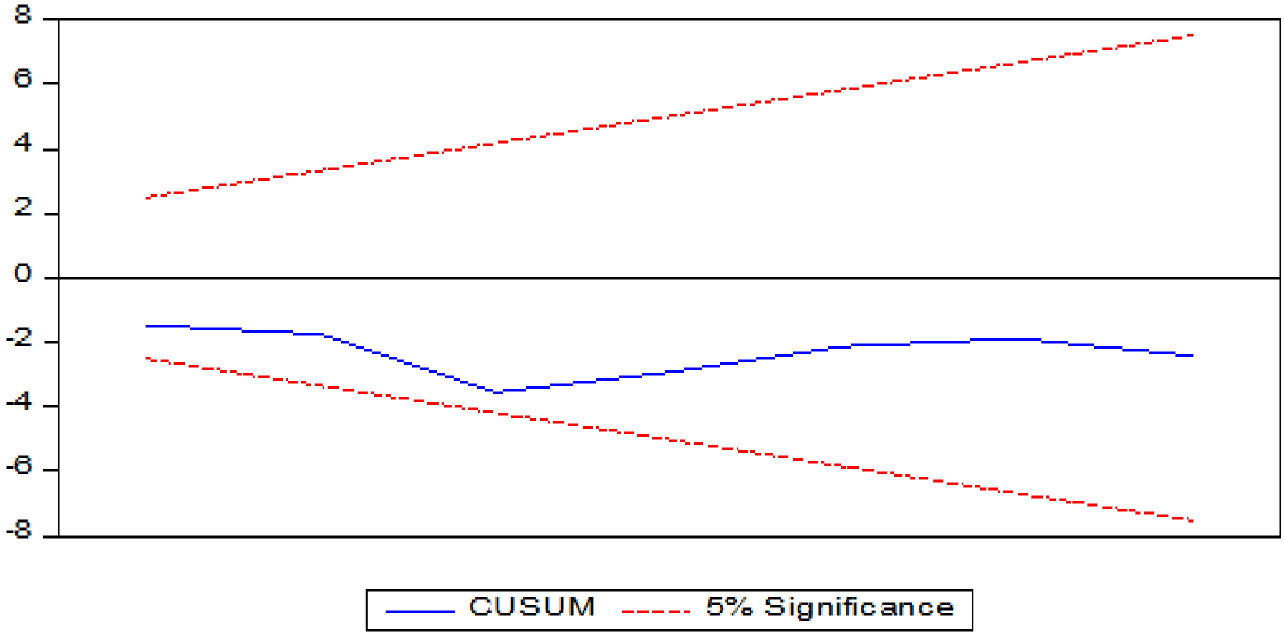

Figure 4: *CUSUMSQ Test for structural stability of ardl model parameters.*

Conclusions and Recommendations

This study examines how governance quality affects Iraq's agricultural productivity in both the short- and long-term, covering the period from 2003Q1 to 2024Q4, using the ARDL model. The analysis emphasizes six principal governance dimensions: Voice and Accountability (VA), Political Stability and Absence of Violence (PS), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption (CC), to determine the influence of institutional factors on a sector that remains essential for promoting inclusive growth and ensuring food security in a fragile socio-political environment like Iraq. The analysis depicts a stable long-term association between Iraq's GDPA and governance indicators, strengthened by a significantly negative error correction term of -0.83. PS and CC show consistent positive effects, highlighting their key role in boosting agricultural productivity, while RQ and VA reflect institutional weaknesses and limited citizen engagement. Policy priorities include strengthening anti-corruption strategies in agricultural programs, maintaining political stability to support production and investment, and enhancing participatory governance through farmer cooperatives and local councils. Limitations of this study include the reliance on aggregate governance measures and single-country data, which may constrain generalizability. Future research could use sector-specific indicators, include other fragile states, and apply advanced econometric methods to better understand the governance–agriculture link. Overall, improving governance by tackling corruption, ensuring stability, and fostering inclusivity is essential for unlocking Iraq's agricultural potential, promoting food security, and supporting long- term rural resilience.

Acknowledgements

The authors gratefully acknowledge the support of the College of Agriculture, University of Al-Qadisiyah, Iraq, for providing institutional and technical assistance during this research. Special thanks are extended to the Central Statistical Organization of Iraq for access to data resources.

Novelty Statement

This study uniquely integrates six World Bank governance indicators with agricultural productivity in Iraq (2003Q1–2024Q4) using an ARDL model. It reveals that control of corruption and political stability are the most decisive factors driving long-term agricultural growth in fragile-state contexts.

Author's Contribution

Hayder Abbas Drebee: Conceptualization, data analysis,Econometric modeling and manuscript writing.
Amjed Azeae Abd: Results interpretation and data collection.
Mohammed Kareem Abd Ali: Literature review.

Ali Sabah Alhasan: Editing, formatting, and final manuscript revision.

Generative AI or AI assisted technology statement

No generative AI or AI-assisted technologies were used to create this manuscript.

Conflict of interest

The authors have no conflict of interest.

References:

Ali, K. and M. Hussain. 2021. Governance Indicators and Food Security in Developing Countries. Food Policy., 99: 101982. https://doi.org/10.1016/j.foodpol.2020.101982.

Al-Juthery, H.W., J.T. Al-Fadhly, E.A.H.M. Ali and R.A.H.G. Al-Taee. 2019. Role of Some Nanofertilizers and Atonik in Maximizing Production of Hydroponically-Grown Barley Fodder. Int. J. Agric. Stat. Sci., 15: 565–570.

Al-Khatib, S. and H. Benhaddou. 2022. Political Stability and Agricultural Development: A Panel Study of MENA Countries. Middle East Dev. J., 14(2): 145–164. https://doi.org/10.1080/17938120.2022.2083095.

Alwi, L.O., R.M. Iswandi, A. Gafaruddin, L.O.K. Arif, L.O.A. Dedu, M. Abadi and L.O.M. Munadi. 2025. The Effectiveness of Institutional Governance in Controlling Agricultural and Plantation Land Conversion in Kendari City, Southeast Sulawesi, Indonesia. Sar. J. Agric., 41(2): 684–699. https://doi.org/10.17582/journal.sja/2025/41.2.684.69.

Ariabod, A., R. Moghaddasi, Y. Zeraatkish and A.M. Nejad. 2024. Governance and Agricultural Growth: Evidence from Selected Developing Countries. Econ. J. Emerg. Mark., 11(1). https://doi.org/10.20885/ejem.vol11.iss1.art7.

Bayyurt, N., Z.Serin, F. Arıkan. 2015. Good Governance and Agricultural Efficiency. J. Soc. Develop. Sci., Vol. 6, No. 1: 14-23.

Bekpayeva, Z., N. Nikiforova, S. Zhanbyrbayeva and L. Zhakypbek. 2025. Corporate Governance in Agricultural Holdings: Ensuring Transparency and Efficiency in Management Decisions. Sci. Horizon., 28(3).

Bitzar, V., W. Bertus and P. de Steenhuijsen. 2016. The Governance of Agricultural Extension Systems. KIT Work. Paper. https://doi.org/10.1016/j.foodpol.2008.06.003.

Central Statistical Organization, Iraqi Ministry of Planning. 2024.

Drebee, H.A. and N.A.A. Razak. 2022. Impact of Oil Price Fluctuations on Economic Growth, Financial Development, and Exchange Rate in Iraq: Econometric Approach. Ind. Eng. Manag. Syst., 21(1): 110–118.

Drebee, H.A., N.A.A. Razak and R.T. Shaybth. 2022. Understanding the Causes of the Decline in the Iraqi Agricultural Sector's Contribution to the GDP. In IOP Conf. Ser: Earth Environ. Sci., V. 1060, No. 1: p. 012146. IOP Publishing. https://doi.org/10.1088/1755-1315/1060/1/012146

Drebee, H.A., N.A.A. Razak and M.Z.A. Karim. 2014. Is There an Overlapping Market Between National Car Producers in Malaysia? J. Ekon. Malaysia., 48(1): 75–85.

Engle, R.F. and C.W. Granger. 1987. Cointegration and Error-Correction Representation, Estimation and Testing. Econom., 55: 251–276.

Gelgo, B., A. Gemechu and A. Bedemo. 2023. The Effect of Institutional Quality on Agricultural Value Added in East Africa. Heliyon., 9(10): e20964. https://doi.org/10.1016/j.heliyon.2023.e20964.

Gidiglo, F.K., F.Y. Srofenyoh, K.A.A.-O. Agyei-Henaku, C. Badu-Prah, A. Agyeiwaa-Afrane and J.G. Djokoto. 2024. Aid, Domestic Governance, and Agricultural Growth in Developing Countries. Agris Online Pap. Econ. Inform., 16(1): 35–47. https://doi.org/10.7160/aol.2024.160104.

Globerman, S. and D. Shapiro. 2002. Global Foreign Direct Investment Flows: The Role of Governance Infrastructure. World Dev., 11: 1899–1919.

Hamid, M.Q. 2025. Response of physical properties of sandy soil treated with different levels of natural soil conditioners zeolite and perlite. Sar. J. Agric., 41(2): 591-599. https://dx.doi.org/10.17582/journal.sja/2025/41.2.591.599

Hamid, M.Q., E.H. Abd, Z.K. Al-Salihi, R.J. Muhammed and D.F. Hassan. 2025. Effect of organic conditioners on the physical properties of sandy soil under drip irrigation conditions. Sar. J. Agric., 41(3): 1133-1142. https://dx.doi.org/10.17582/journal.sja/2025/41.3.1133.1142

Herrendorf, B. and T. Schoellman. 2015. Why is Measured Productivity So Low in Agriculture? Rev. Econ. Dyn., 18(4): 1003–1022.
Hoger Shalli, D. 2024. The Role of Agricultural Production on the Economy of the Kurdistan Region. In Resource Management Performance: A Sectoral Analysis in the Post-Conflict Kurdistan Region of Iraq. Spring. 381–415. https://doi.org/10.1007/978-981-97-7725-9_13.
Hundi, H.K., M.Q. Hamid and A.A.M. Noori. 2025. Role of Ochrobactrum Bacteria and Organic Matter in Plant Growth and the Content of N, P, and K Under Soil Salinity Stress. J. Environ. Earth Sci., 7(5): 130–139. https://doi.org/10.30564/jees.v7i5.8777
Janssen, M. and H. Van der Voort. 2016. Adaptive Governance: Towards a Stable, Accountable and Responsive Government. Gov. Inf. Q., 33: 1–5.
Kattel, D. 2024**.** Empirical evidence transformation into local agro-governance pathways for enhanced agro-productivity in rural mid-hills of Nepal. Indust. Policy, 4(1)l: 11–22. https://doi.org/10.61192/indpol.1478320.
Kaufmann, D. and A. Kraay. 2002. Growth Without Governance. Econom., 3(1): 169–229.
Kaufmann, D., A. Kraay and M. Mastruzzi. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. Hague J. Rule Law., 3(2): 220–246.
Khaleghifar, M., V. Qassemi, R. Hemati and S. Farahmand. 2015. Investigating the Effect of Good Governance on Entrepreneur's Economic Activity (in Hamadan Province). Int. J. Basic Sci. Appl. Res., 4(9): 542–553.
Kumar, V. and B. Adeyemi. 2024. Digital Governance and Agricultural Transformation in the Global South. Inf. Technol. Dev., 30(1): 55–73. https://doi.org/10.1080/02681102.2024.2001234.
Kwiatkowski, D., P.C.B. Phillips, P. Schmidt and Y. Shin. 1992. Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root? J. Econom., 54(1–3): 159–178.
Lee, D. and S. Park. 2022. Institutions, Governance, and Sustainable Agricultural Practices in Asia. J. Clean. Prod., 333: 130138. https://doi.org/10.1016/j.jclepro.2021.130138.
Lio, M. and M.C. Liu. 2008. Governance and agricultural productivity: A cross-national analysis. Food Policy, 33(6): 504-512.
Mirishli, S. 2025. The Role of Legal Frameworks in Shaping Ethical Artificial Intelligence Use in Corporate Governance. arXiv Preprint arXiv: 2503.14540. https://arxiv.org/abs/2503.14540.
Mohammadzadeh, Y., S. Hekmati and A. Sharifi. 2016. The Effect of Government Size on Good Governance and Economic Performance in Selected Countries. Res. Pap. Econ. Growth Dev., 7(26): 7–112.
National Association of Corporate Directors (NACD). 2025. Governance Outlook.
Nguyen, H.T., L.T. Nguyen and T.H. Pham. 2019. Governance Quality and Agricultural Growth in Vietnam: Evidence from Panel Data. Asia Econ. J., 33(1): 55–78.
Nguyen, T. and R. Lopez. 2021. How Regulatory Quality Shapes Agricultural Innovation: Evidence from Emerging Economies. Technol. Forecast. Soc. Chan., 166: 120644. https://doi.org/10.1016/j.techfore.2021.120644.
z. Governance and Agricultural Productivity in Nigeria: An Empirical Investigation. J. Agric. Econ., 71(3): 500–512.
Pere, E. 2015. The Impact of Good Governance in the Economic Development of Western Balkan Countries. Eur. J. Gov. Econ., 14(1): 25–45.
Pesaran, M.H. 1997. The Role of Economic Theory in Modelling the Long Run. Econ. J., 107: 178–191.
Pesaran, M.H., Y. Shin and R.J. Smith. 1996. Testing for the Existence of a Long-Run Relationship. DAE Work. Paper. Amalgamat. Ser., No. 9622: Univ. Cambridge.
Petrov, D. 2025. Agro Governance and Agricultural Productivity: An Empirical Analysis of Governance Indicators and Farm Performance. E. J. VFU., 23: 647–656. https://doi.org/10.53606/evfu.23.647-656.
Salim, A., H. Raheem and A. Al-Mahmoud. 2021. Agriculture in Iraq. Iraq Econom. Develop. Spring: 123–145. https://doi.org/10.1007/978-3-031-71356-9_6.
Sebudubudu, D. 2010. The Impact of Good Governance on Development and Poverty in Africa Botswana: A Relatively Successful African Initiative. Afr. J. Political Sci. Int. Relat., 4(7): 249–262.

Shahad, R.F. and M.H. Mohammed. 2025. Impact of Bentonite and Humic Acid on the Growth and Flowering of Catharanthus roseus L. in Sandy Soil. J. Environ. Earth Sci., 7(1): 157–166. https://doi.org/10.30564/jees.v7i1.7368.

Shahad, R.F., A.M. Abdullah and S.K. Essa. 2021. Studying the Effect of Agriculturally Exploited Soils on the Transformation of Mica Minerals Using Infrared Spectroscopy (IR). Malays. J. Chem., 23(4): 144–153. DOI: https://doi.org/10.55373/MJCHEM.V23I4.1199.

Stead, D. 2015. What Does the Quality of Governance Imply for Urban Prosperity? Habitat Int., 45: 64–69.

UNESCAP. 2014. What is Good Governance?. http://www.unescap.org/sites/default/files/good-governance.pdf.

Zhang, Y. and H. Ibrahim. 2023. The Role of Corruption Control in Enhancing Agricultural Investments: Cross-Country Analysis. J. Dev. Eff., 15(1): 1–19. https://doi.org/10.1080/19439342.2023.1001234