JEAS, Vol. 31 No. 150 (2025) pp (142-154)
P-ISSN 2518-5764 - E-ISSN 2227-703X
DOI: https://doi.org/10.33095/045yqd76

Journal of Economics and Administrative Sciences

Analysis of the Role of Agricultural Investment Policies and Agricultural Lending in Developing Commodity Production of Rice Crops

Istibraq Mansour Falih * **Omar Hameed Majeed**
Department of Economics; College of Administration and Economics
University of Baghdad; Iraq.
***Corresponding author**

Received: 10/6/2025 **Accepted: 2/10/2025** **Published: 1/12/2025**

Abstract:
This study investigates the impact of agricultural investment policy—represented by agricultural loans and investment allocations—on rice crop production in Iraq over the period 2003–2023, employing the Autoregressive Distributed Lag (ARDL) model. Using time-series econometric analysis, the study confirms a short-term positive and statistically significant effect of financial support on rice output, while revealing statistically insignificant long-term effects. The presence of a cointegration relationship suggests long-term equilibrium between agricultural policy variables and rice production. However, the absence of causality in the Yamamoto-Toda test implies that structural and institutional inefficiencies may dilute the long-term impact of financial interventions. Practical implications of the study lie in guiding policymakers toward optimizing short-term agricultural investment strategies while simultaneously reforming institutional frameworks to enhance long-run outcomes. Emphasis is placed on the effective deployment of resources, improved monitoring mechanisms, and fostering innovation in agricultural practices. The results also underscore the importance of aligning credit mechanisms with production cycles to maximize returns. From a social perspective, the research highlights agriculture's critical role in enhancing food security and rural employment. It addresses the economic disparities caused by inefficient resource allocation and advocates for policies that promote Development of the agricultural sector, particularly in post-conflict regions like Iraq. The unique contribution of this study lies in its comprehensive econometric approach contextualized within Iraq's fragile economic structure. It provides a data-driven framework for understanding how targeted financial mechanisms can enhance agricultural productivity, offering insight for emerging economies aiming to balance investment efficiency with Economic development.

Keywords: Agricultural Sector, Agricultural Investment, Rice Crops.

1. Introduction:

Agricultural investment thrives in developed countries but lags in many developing and low-income countries (Hamad, 2023). Agricultural investments create jobs, attract foreign currency, generate tax revenue, and drive economic growth. They also transfer technology and improve food availability (Cochrane et al., 2024). The Food and Agriculture Organization (FAO) advocates for increased investment in agriculture to enhance production and alleviate hunger (Zhao & Chen, 2023).

Agricultural investment plays a crucial role in shaping food security outcomes. In countries such as the United States, advanced agricultural investments have led to increased productivity (Oditi, 2023). Achieving food security involves investing capital in plant- or animal-based agricultural projects to generate suitable returns for individuals or businesses, or to supply essential national food requirements (Nema & Al-Aqabi, 2018).

Agricultural investment is defined as integrating available production factors in agriculture to produce materials that meet consumer needs and obtain the best possible results (Ibraheem, 2020).

It also refers to spending on new agricultural capital goods, such as factories, machinery, equipment, land, roads, and houses, or adding to commodity stocks of agricultural raw materials (Mohammed, 2018). The sector supplies people with food, industries with raw materials, agricultural workers with jobs, and livestock with feed (Singh et al., 2022).

Research and development (R&D) investments in agriculture have long helped rice-growing nations boost or maintain production. Such investments help overcome domestic food insecurity and support economic development goals (Dikitanan et al., 2022). Developing nations produce 90% of the world's rice. Rice is essential for food security and provides livelihoods for over 157 million people worldwide. As a staple food for over half of the world's population, rice accounts for 20% of the global food supply. Annual production exceeds 514 million tons, grown on five continents (Vargas-Escobar et al., 2024; Tiwari et al., 2024). Rice production increased more than threefold after the introduction of high-yielding varieties during the Green Revolution of the late 1960s (Sarwar et al., 2022). If production increases accompany consumption increases, no problem arises (Sutardi et al., 2022). Increasing harvest and cropping indexes can further enhance rice production (Anshori et al., 2021). Agriculture’s potential to break the cycle of poverty and productivity decline depends heavily on financial support, emphasizing the critical role of credit for farm investment (Adewumi & Falola, 2024).

One type of agricultural financing and a significant source of funds for farmers is agricultural borrowing. Giving up current funds in return for future funds is called borrowing. Loans given to farmers and peasants help with crop production, harvesting, and livestock care. This is known as agricultural borrowing (Mohammed, 2018). Agricultural lending is a crucial aspect of the agricultural industry. The maturity date of the loan is often tied to the production cycle of the underlying crop or livestock. The loan is repaid with the sale of the associated crop or livestock (Pogach et al., 2024). Production and restock working and fixed capital are being impacted by the decline in financing; to guarantee full recovery, it is currently necessary to enhance state financing and bank crediting of agricultural businesses (Повод, 2024). It is impossible to overestimate the significance of credit in agricultural development. Credit increases farmers' access to resources by lowering financial barriers and enabling them to use inputs and other production components more efficiently. The traditional rationale for providing agricultural loans is that additional money can be utilized in the short term to increase a household's level of productive and physical capital (Abu, 2024).

Iraq’s economy, especially its industrial and agricultural sectors, remains highly vulnerable to shocks due to heavy reliance on oil (Pasten et al., 2020; Muhammad & Shaaibith, 2022).

Agricultural production in Iraq remains low due to various shocks and crises. This situation requires further study and treatment to mitigate negative impacts and maximize positive effects. Low investment levels are the main reason for this. The study examines the impact of agricultural investment policy and agricultural loans on the development of rice production in Iraq from 2003 to 2023.Natural investment policy and agricultural loans in achieving growth in Rice Crops in Iraq during the period 2003-2023 by measuring and analyzing rice production using the ARDL model and the (E-Views 13) program, in accordance with economic theory, and benefiting from its results.

2. Literature Review and Hypothesis Development:

The agricultural sector in Iraq has witnessed a remarkable transformation from a planned economy to a market economy since the 1980s. However, this transformation has not yet been successfully implemented due to insufficient planning and neglect (Mohammed, 2020). According to Mohammed (2018), the agricultural sector has a variety of funding options, including bank loans and self-financing.

To support rice crop production in Iraq from 1990 to 2016, Noori & Al-Hiyali (2019) considered factors such as population, inflation rate, import value, and insufficient production to meet demand. They analyzed the relationship between these independent variables and the dependent variable using econometric techniques, specifically cointegration and unit root tests to assess data stability. The Autoregressive Distributed Lag (ARDL) model estimated both long-term and short-term equilibrium relationships. Findings showed that population and rice crop support amounts were directly correlated.

According to a study by Leartlam et al. (2021), agricultural investment is important for raising farmers' incomes and production efficiency. The purpose of this essay is to examine the variables influencing investment in Vietnam and Thailand. TVSEP provides information on 2,414 households that grow rice in Vietnam and Thailand. According to the findings, 40% of Thai rice households, who have low wealth and a small, planted area, did not make any investments. Older farmers with a wealth of experience, raising educational standards, and increasing remittances are important factors that encourage investment in Vietnam.

The study by Bakari & El Weriemmi (2022) aims to investigate the impact of agricultural investment on France's economy. Annual data were gathered from 1978 to 2020 and estimated using the ARDL model to achieve our goal. According to empirical findings, agricultural investment enhances France's economic growth in both the short and long term.

A study by Abidin et al. (2022) in Malaysia examines the impact of labor, capital investment, and rural infrastructure on rice production. Data on these factors came from the World Bank and the Department of Statistics Malaysia. Unit roots were examined with the augmented Dickey-Fuller (ADF) test, while relationships among variables were analyzed using the autoregressive distributed lag (ARDL) model. Results indicated that Malaysian rice production was positively related to labor, capital investment, and rural infrastructure.

Turning to findings from Africa, the study by Workneh & Kumar (2023) aimed to assess the technical effectiveness of significant agricultural investments in Northwest Ethiopia. Additionally, it aims to understand how farm management practices and socioeconomic characteristics affect technical inefficiency. Better use of capital, labor, land, and seed inputs was found to have a positive (albeit proportionately lower) impact on grain output.

Focusing again on Iraq, a study conducted by Al-Jumaili & Abd (2023) aimed to measure the efficiency of agricultural investment and the value of agricultural output in Iraq. Multiple linear regression analysis was employed using the method of least squares (OLS). It was found that there was no statistically significant effect of investment efficiency on the value of agricultural output in Iraq, while the regression line equation shows that both the investment rate and the capital intensification coefficient have proven their statistical significance at the significance level (0.1%), in terms of their effect on the value of Iraqi agricultural production.

Continuing with determinants in Iraq, a study by Khalaf Abdulah & Latif (2023) utilized the Autoregressive Distributed Lag (ARDL) methodology to analyze the effects of specific financial and economic determinants on agricultural investment in Iraq from 1990 to 2020. The purpose of this study was to determine the economic factors and their impact on investment in Iraq's agricultural sector. Econometrics and the time series analysis software EViews-12 were used to evaluate the data and estimate standard models. With the exception of the inflation rate, all determinants have a significant impact on agricultural investment, according to the results of the long-term relationship estimation in Ghana. Rice is a widely consumed staple that is essential to the livelihoods and sustenance of many people. The objective of this study was to determine how Ghanaian rice farmers perceive and utilize Climate-Smart Agricultural (CSA) technologies. In the research, 319 rice farmers from the Central Region were selected using a multistage sampling technique and a cross-sectional survey. According to the findings, rice farmers view CSA technologies favorably and link them to higher incomes and better yields (Fiawoo et al., 2024).4)The goal of the study by (Hamdi & Ahmed, 2024) was to examine the influence of government agricultural lending on local and agricultural products and to assess how much the Iraqi Agricultural Cooperative Bank improved its lending efficiency for agricultural purposes. Multiple regression analysis was used to examine the relationship between loan terms and their impact on agricultural GDP over time. The GDP of agriculture is the dependent variable. The findings supported the validity of the study hypothesis regarding the beneficial relationship between household and agricultural products as well as the influence of agricultural initiative. A study conducted by Abu (2024) investigated the impact of agricultural loans on agricultural productivity in Nigeria between 1992 and 2021. The research aimed to assess the roles of the prime lending rate, government agricultural spending, commercial bank loans to agriculture, and the money supply as independent variables, with agricultural GDP as the dependent variable. The data gathered during the study period was estimated using the ordinary least squares (OLS) method. The findings showed a strong correlation between Nigeria's agricultural output growth and commercial bank loans. Interest rates have no discernible impact on the growth of agricultural output in Nigeria, and a strong correlation exists between government spending on agriculture and the growth of agricultural output.

In summary, although research in Iraq is limited, existing studies collectively indicate that a national causality test demonstrates a positive relationship between agricultural investment policy and rice growth rates. Accordingly, the following hypotheses guide the current investigation and align with previous findings on rice production and agricultural investment:

There is a positive relationship between agricultural investment policy, agricultural loans, and the development of rice crops for the period from 2003 to 2023.

3. Research Methodology:

In addition to a series of tests that would support the findings of scientific research, the standard model description stage is one of the important phases through which the analytical side's findings can be validated using the most precise standard methods. To arrive at conclusions that allow us to validate or refute the hypothesis, it is also feasible to ascertain the direction of economic relations between the variables under study based on economic theory, using standard results. The relationship between the agricultural investment variable and commodity production (rice) in Iraq was examined using the Autoregressive Distributed Lag (ARDL) model, which was constructed to estimate the relationship after the stationarity tests revealed that all of the data were stationary in the first difference.

The researcher used both the inductive approach based on theoretical foundations by using the descriptive analysis method and all data, parameters, and measurement tools, as well as the deductive approach that relies on analysis to reach the results by moving from the general principle to the specific principle to accomplish the research objectives and demonstrate the validity of his hypothesis (E-views 13). Figure 1 provides an explanation and expression of the sort of relationship between the research variables.

In this study, we define the Rice Crops index (R) as the variable representing the production of plant commodities, serving as the dependent variable. The investment allocations to the agricultural sector (AS) refer to the total funds dedicated to agriculture, while agricultural loans (AL) refer to the financial credits provided for agricultural development. Both AS and AL are independent, or explanatory, variables representing the agricultural investment policy. The model can be formulated as follows:

$$\boldsymbol{R = f\ (AS\ , AL)}$$

In a regression model, the model can be written as follows:

$$R = \ \beta 0 + \ \beta 1\ \mathrm{AS} + \ \beta 2\ \mathrm{AL} + \ \mu t \ldots (1)$$

Where:

β0 is the constant.

β1, β2 are the parameters to be estimated.

μt is the random error term.

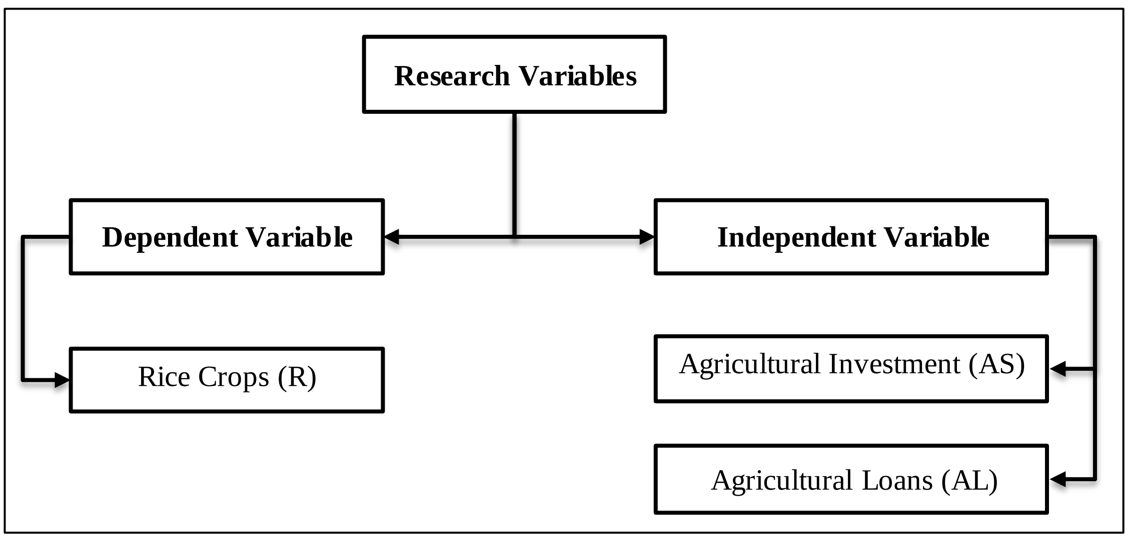

Figure 1 : Hypothetical research plan

Source : Prepared by the researchers

We use a five-step estimation process to examine the relationship between agricultural investment and rice yield. In the first step, we extract the initial results of the autoregressive distributed lag (ARDL) model. In the second step, we reproduce the results of the bounds test. In the fourth step, we find the results of the short- and long-term ARDL coefficient estimates and the error correction coefficient. In the fourth step, we reproduce the results of the long-term ARDL coefficient estimates. In the fifth step, we verify that the model does not suffer from Econometrics problems.

4. Results:

This section presents empirical evidence for the study, including the unit root test results obtained using the Phillips-Perron (PP) test and the findings from the cointegration model between the dependent and independent variables. We verified the unit root to confirm that no variable achieved stationarity at the second difference or at an order of integration of two. We employed the Phillips-Perron (PP) test to determine the stationarity of the variables. The test results appear on the table below:

Table 1: Results of the Phelps-Perron Test

Variable name	At the 5% level of the critical value (probability value)			At the first 5% difference, the critical value (probability value)		
	Fixed limit only	Fixed limit and general direction	No fixed limit and no general direction	Fixed limit only	Fixed limit and general direction	No fixed limit and no general direction
R	0.0311	0.1263	0.1381	0.1263	0.0023	0.0000
AL	0.4675	0.3872	0.2294	0.0283	0.0617	0.0016
AS	0.4337	0.7137	0.2542	0.0144	0.0513	0.0008

Source: 1. Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics E-views 13 program outputs.

Table (1) shows that all variables have probability values greater than 5% at level I (0), with the exception of the red meat production variable RM, which was stationary at the initial level I (0). This indicates that the other variables are not stationary at the level, but their probability value decreased to less than 5% after taking their first difference, which is required to prevent false regression. This confirms that the variables became stationary at the first difference, indicating that they are integrated of the first degree I (1)

4.1 Preliminary results of the autoregressive distributed lag (ARDL) model:

After all the variables appear to be stationary with the first difference I (1) according to Table (1), we proceed with the cointegration analysis to discover the long-run relationship between the variables.

Table 2: Initial estimation results for model R

R-squared	0.627992	Akaike info criterion	26.73963
Adjusted R-squared	0.404787	Schwarz criterion	27.08272
F-statistic	2.813520	Hannan-Quinn criter.	26.77374
Prob(F-statistic)	0.051642	Durbin-Watson stat	2.615521

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

Based on the table (2), the statistical results of the initial estimation of model (R) are shown in the following form:

The dependent variable, rice crop, changed 62% because of changes in the independent variables, namely agricultural loans, and investment allocations to the agricultural sector, according to the coefficient of determination (R-squared), which was 0.62799.

With a significance level of (0.051642) and an F-statistic of (2.813520), the model is completely regarded as significant and less than 5%.

Given that it falls within the 1.5–4 Durbin-Watson range, the model is free of autocorrelation, according to the Durbin-Watson stat value of (2.615521).

The Akaike info criterion, which had the lowest value of all the criteria at (26.73963), is the best criterion for assessing the relationship between variables in the model (R).

The results the model will rely on will be authentic and not fabricated, and it is not affected by the spurious regression issue. The short- and long-term relationship between the independent variables (loans and investment allocations to the agricultural sector) and the dependent variable (rice crop) will therefore be measured after cointegration.

4.2 Bound test results:

The first test to assess the long-term relationship is the cointegration test, which is regarded as a prerequisite for it. By comparing the F-statistics with the lower and upper limits, this test is dependent on the boundaries established by Basran. The presence of cointegration is indicated if the F-statistic value is found to be higher than the upper limit. On the other hand, cointegration is absent if the F-statistic value is found to be less than the lower limit. The following table illustrates these findings:

Table 3: Results of the cointegration test for model (R)

Null Hypothesis: No levels relationship		
F-Bounds Test		
Value		Test Statistic
5.860781		F-statistic
2		K
I (1)	I (0)	Signif.
4.23	3.22	10%
3.45	3.45	5%
4.00	4.44	2.5%
6	5.12	1%

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

The results of the joint integration test for the model (R) are displayed in the table above. At a significant level of 5%, the value of (F-statistic = 5.860781) is higher than the upper limit of parameter I (1), which reached (3.87). This finding thus suggests that there is a joint integration relationship between the dependent variable (rice crop commodity production) and the independent variables (loans and investment allocations to the agricultural sector). Considering this, we reject the null hypothesis and accept the alternative hypothesis, which suggests a joint integration relationship between the two variables. This suggests that rice crop production and the variables influencing agricultural investment policy are both trending toward long-term equilibrium. We will interpret the results of the long-term parameters to determine the nature of the relationship—whether positive or negative—between them.

4.3 Results of estimating short-term and long-term ARDL coefficients and error correction coefficients.

The error correction coefficient expresses the possibility of correcting short-term imbalances and reestablishing balance over time. Its requirements include being negative, significant, and having a parameter smaller than one. The table below displays the short-term results (R) and the error correction coefficient:

Table 4: Error correction factor and short-term results for the R model

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AL)	1.483968	0.350289	4.236411	0.0017
D(AS)	1.212272	0.306911	3.949916	0.0027
D(AS (-1))	0.575796	0.236067	2.439127	0.0349
Coint Eq (-1) *	-2.666979	0.483104	-5.520513	0.0003

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

The outcomes of the short-term dynamic coefficients linked to the long-term relationships derived from the ECM equation are displayed in Table 4. Since they show how the long-term equilibrium in the dynamic model has been adjusted, the error correction terms in the cointegration models are important. The short-term deviations from the agricultural policy to the production of the rice crop quickly adjust towards the long-term equilibrium, as indicated by the error correction term coefficients reaching (-2.6).

All short-term coefficients are significant and positive, as shown in the table above, indicating that increasing agricultural loans and investment allocations will boost rice production soon. This outcome is logical because the availability of agricultural necessities, such as seeds, fertilizer, and water sprinklers, along with government and banking support, positively impacts crop growth.

4.4 Long-term ARDL coefficient estimation results:

The following table displays the long-run ARDL coefficient results following the confirmation of a long-term cointegration relationship between independent and dependent variables by the results of the bounds test.

Table 5: Long-term results of the R model

Cointegration equation EC = R - (0.0001*AL -0.0131*AS + 273199.8383)				
Long Run Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
AL	6.295600	0.000113	0.557758	0.5893
AS	-0.013123	0.025810	-0.508454	0.6222
R	273199.8	21703.32	12.58793	0.0000

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

The long-term coefficient estimation using the ARDL model was displayed in Table (5). The findings showed that the independent variable's probability values exceeded 5%, indicating that the independent variables' coefficients had no long-term significance on the dependent variable's coefficient. This implies that rice production will eventually rise in proportion to the amount of investment allocated to the agricultural sector.

4.5 Standard Problem Results (Model Quality):

It is necessary to make sure that the study model is free from autocorrelation issues and that its residuals are normally distributed to guarantee its validity. Both structural and variance stability must also be present in the model. The following illustrates the outcomes:

Table 6: Standard Problem Results (Model Quality)

Serial correlation test results			
0.2918	Prob. F (1,15)	1.193833	F-statistic
0.2246	Prob. Chi-Square (1)	1.474429	Obs*R-squared
Heteroskedasticity test results			
0.1263	Prob. F (1,17)	2.584459	F-statistic
0.1133	Prob. Chi-Square (1)	2.507331	Obs*R-squared

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

Based on their probability value, the above table demonstrates that all diagnostic tests were error-free. Since the probability of chi-square for autocorrelation reached (1.4744), which is greater than 5%, it is demonstrated that there is no autocorrelation (serial correlation) problem. As a result, we accept the alternative hypothesis, which claims that the model does not include the autocorrelation problem. Given that the probability of chi-square for homoscedasticity reached (2.507), which is greater than 5%, it is also demonstrated that the model is free from the problem of heteroscedasticity (ARCH). Accordingly, we accept the alternative hypothesis, which holds that the model does not include the problem of heteroscedasticity.

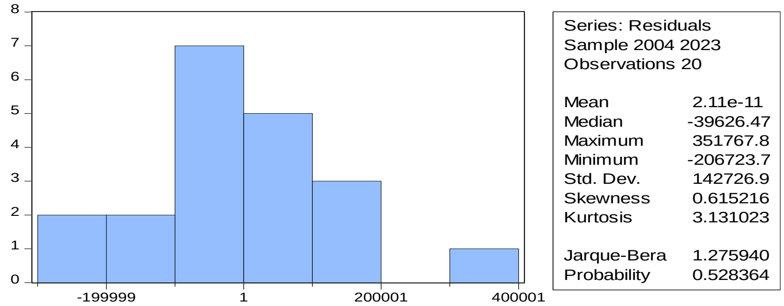

Figure 2 : Results of the normal distribution test for residuals

Source: E-views 13 program outputs.

Since the probability (Jarque-Bera) reached (1.275940), which is greater than 5%, it is evident from the table and figure above that there is no issue with the normal distribution of the model's residuals. Accordingly, we accept the alternative hypothesis, which holds that the model does not include the issue of the residuals' normal distribution.

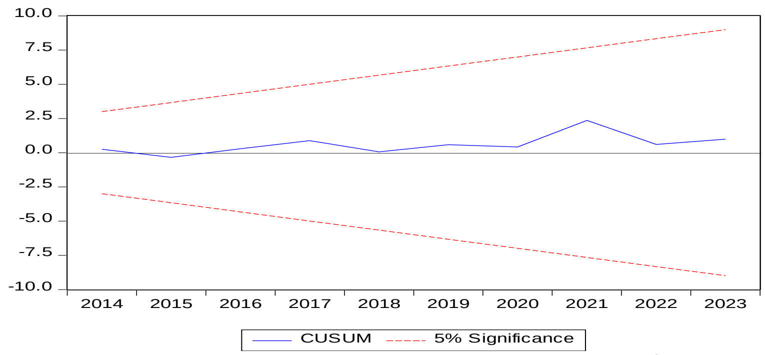

Figure 3 : Stability test results according to the CUSUM formula

Source: E-views 13 program outputs.

Structural Stability Tests: The model was stable, indicating that it possessed structural stability, according to the above figure, which is related to the structural stability test (CUSUM). At a 5% significance level, the cumulative sum of residuals (red line) fell between the two critical lines' safe zone (blue) and the confidence limits. Since the null hypothesis shows that the structural regression coefficients are stable, we accept it, proving that the model is structurally stable over the long term.

The CUSUM curve's stability and the accuracy of the long-term estimates of the structural parameters of the estimated econometric model are confirmed by the results of Figure (3), which show that it falls between two limits of the 5% confidence interval.

4.6 Yamamoto Toda-causality test results:

Prior to presenting the Yamamoto Toda test results, we will use actual data rather than converting it to the natural logarithm because the latter deprives the data of its authenticity, particularly when it comes to the Iraqi economy. Due to reliance on the oil industry and serious deficiencies in the agriculture, industry, and services sectors in the GDP formation process, this is impacted by both internal and external changes. For all researchers and specialists, this is an obvious fact.

We will apply Yamamoto Toda's test to ascertain the direction of the causal relationship (who causes whom) between agricultural policy and rice commodity production. We need to figure out the ideal lag time for the estimated model before displaying the test results. Next, using the causal equation, we ascertain the model variables' maximum level of stillness.

Table 7: Determining the optimal lag period for the estimated model R.

HQ	SC	AIC	FPE	LR	Log L	Lag
97.19000	97.31020	97.16084	3.161238	NA	-968.6084	0
96.55998	97.04079	96.44336	1.570138	25.87973	-952.4336	1

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

From the table above, it is noted that the optimal lag degree for the standard study variables is (1) based on the spread that is included in the values of (AIC, FPE, LR, HQ, SC). Hence, the highest stationarity degree d_{max} for the time series of the variables through unit root tests, which was previously determined at I (1). Then, the VAR(k+d_{max}) model is estimated.

Table 8: Results of the Y T causality test for model R

Dependent variable: R			
Prob.	df	Chi-sq	Excluded
0.6299	2	0.924388	AL
0.8941	2	0.223890	AS
0.8920	4	1.114029	All
Dependent variable: AL			
0.2612	2	2.684987	R
0.3453	2	2.126539	AS
0.2961	4	4.915503	All
Dependent variable: AS			
0.5449	2	1.214234	R
0.6976	2	0.720136	AL
0.8251	4	1.508800	All

Source: Central Organization for Statistics and Information of Iraq - Directorates of Agricultural Statistics, E-views 13 program outputs.

Following the estimation of the causality test, it can be observed from the above table that there is no causal relationship between the long-term production of rice and the indicators of agricultural investment policy, which are represented by loans and investment allocations to the agricultural sector. Even though there is a long-term equilibrium relationship between them, the probability values are not significant, which is consistent with the boundary test results about the effects' long-term insignificance.

5. Discussion of Results:

The study's empirical findings offer significant insights into the relationship between agricultural policy—represented by agricultural loans and investment allocations—and rice crop production in Iraq. The results begin by establishing the stationarity of the variables using the Phillips-Perron (PP) test, which revealed that all variables became stationary at the first difference, confirming their suitability for ARDL modeling. This was essential for avoiding spurious regression, reinforcing the robustness of the model.

The preliminary ARDL model results showed that the independent variables explained about 62% of the variation in rice crop production. The R-squared value was 0.62799. The F-statistics were significant at the 5% level, confirming the model's overall relevance. The Durbin-Watson statistic of 2.615521 indicated that the model is free from autocorrelation. This supports the reliability of the time series estimates.

The bounds test results confirmed a long-run cointegration relationship between rice production and the independent variables. The F-statistics of 5.860781 exceeded the upper bound at the 5% significance level. This means the null hypothesis was rejected, indicating a stable long-term equilibrium between agricultural policy inputs and output.

Short-term coefficient estimates gave further clarity. All short-term coefficients were positive and statistically significant. This indicates that increases in agricultural loans and investment allocations result in immediate increases in rice production. These results underscore the importance of short-term financial support for agriculture, particularly in areas such as seed availability, fertilizers, and water supply. The error correction term was -2.666979, significant and negative. This satisfied the conditions for model stability and confirmed that short-term deviations are corrected toward long-term equilibrium.

In contrast, the long-term ARDL results showed a nuanced picture. A cointegration relationship exists; however, the individual long-run coefficients were statistically insignificant. While short-term agricultural investment yields clear gains, these effects may fade over time—due to inefficiencies, diminishing returns, or misallocation of resources.

Model diagnostics confirmed the model's robustness. There were no issues with serial correlation, heteroscedasticity, or residual normality. The CUSUM test also demonstrated structural stability over time, increasing confidence in its predictive power.

The Yamamoto-Toda causality test results did not indicate a causal relationship between agricultural loans, investment allocations, and rice crop production. Even with long-term equilibrium, the lack of causality means other factors may influence the observed relationships. Examples include technological adoption, climate variability, institutional inefficiencies, or market distortions.

In conclusion, the findings indicate that short-term agricultural investment has a significant impact on rice production. However, these gains may not be sustained in the long term. Policymakers must prioritize funding and improve structural and institutional support for resource use. Further research should focus on governance, innovation, and market access to enhance agricultural sustainability.

6. Conclusion:

This study examined the relationship between agricultural policy, as measured by agricultural loans and investment allocations, and rice crop production in Iraq, using the ARDL approach over the period 1990–2020. The analysis yielded several important conclusions. Firstly, the stationarity of variables was confirmed at the first difference, allowing for the application of the ARDL model and ensuring robustness against spurious regressions.

The findings showed a statistically significant short-term impact of agricultural loans and investment allocations on rice production. The short-term effects are substantial. Increased financial support directly enhances production outcomes. A significant and negative error correction term further confirms that any short-term imbalances adjust toward the long-run equilibrium. This enhances the model's reliability.

However, the study also revealed that, despite a confirmed long-run cointegration relationship, the individual coefficients of the agricultural policy variables were statistically insignificant. This suggests that long-term gains from investment may be limited or obscured by structural inefficiencies, diminishing returns, or challenges in deploying and effectively utilizing such investments over time.

Diagnostic tests also confirmed the robustness of the model. There were no signs of autocorrelation, heteroscedasticity, or non-normality of residuals. The model's structural stability was validated by the CUSUM test. However, the Yamamoto-Toda test found no causal relationship. This suggests that other contextual factors may have a greater influence on rice production than financial variables alone.

In summary, short-term investment in agriculture brings tangible benefits. However, sustainable long-term outcomes require integrated strategies. These should address structural and institutional challenges alongside financial support.

Authors Declaration:
- We Hereby Confirm That All the Figures and Tables in The Manuscript Are Mine and Ours. Besides, The Figures and Images, which are Not Mine, Have Been Permitted for Republication and Attached to The Manuscript.
- Ethical Clearance: The Research Was Approved by The Local Ethical Committee of The University.

References:

Abidin, I. S. Z., Haseeb, M., Islam, R., & Chiat, L. W. (2022). The role of rural infrastructure, labour, and capital investment on the rice production in Malaysia. *AgBioForum*, *24*(1), 50–58.

Abu, N. I. (2024). The Effects of Commercial Banks Lending on Agricultural Productivity in Nigeria: An Empirical Analysis. *African Banking and Finance Review Journal*, *8*(8), 47–56.

Adewumi, I. D., & Falola, A. (2024). Use of Agricultural Bank Loan in Rice Production among Small-Scale Farmers in Bida Local Government Area in Niger State. *Adeleke University Journal of Engineering and Technology*, *7*(1), 53–58.

Al-Jumaili, J. S. A., & Abd, H. A. (2023). Measuring and analyzing the overall impact of agricultural investment efficiency standards on the value of agricultural output in Iraq for the period (1990-2020). *Tikrit Journal of Administrative and Economic Sciences*, *19*(63 part 1).

Anshori, A., Riyanto, D., & Widodo, S. (2021). The increase of rice cropping index supported by river dam irrigation in dry land. *IOP Conference Series: Earth and Environmental Science*, *653*(1), 012074.

Bakari, S., & El Weriemmi, M. (2022). Exploring the impact of agricultural investment on economic growth in France. *Munich Personal RePEc Archive*.

Cochrane, L., Li, E. P. H., Dejene, M., & Husain, M. M. (2024). Why foreign agricultural investment fails? Five lessons from Ethiopia. *Journal of International Development*, *36*(1), 541–558.

Dikitanan, R. C., Pede, V. O., Rejesus, R. M., Bhandari, H., Alam, G. M. M., & Andrade, R. S. (2022). Assessing returns to research investments in rice varietal development: Evidence from the Philippines and Bangladesh. *Global Food Security*, *33*, 100646.

Fiawoo, H. D., Tham-Agyekum, E. K., Ankuyi, F., Osei, C., & Bakang, J. A. (2024). Rice farmers' adoption of climate-smart agricultural technologies and its effects on yield and income: empirical insights from Ghana. *SVU-International Journal of Agricultural Sciences*, *6*(1), 120–137.

Hamad, R. K. (2023). The Contemporary Agricultural Investment and Innovation (Challenges & Opportunities). *Iraqi Journal for Economic Sciences*, *21*(76).

Hamdi, N. M., & Ahmed, A. F. (2024). An economic analysis of the impact of government lending agricultural and the agricultural initiative on the agricultural domestic product in Iraq for the period (1990-2020). *Anbar Journal of Agricultural Sciences*, *22*(1), 665–679.

Ibraheem, A. A. (2020). Agricultural investment and its role in the rural development of Sudan For the period 2012-2017. *AL-Anbar University Journal of Economic and Administration Sciences*, *12*(30).

Khalaf Abdulah, L. I., & Latif, B. F. (2023). Estimation and Analysis of the Agricultural Investment Model in Iraq (1990-2020) using the Autoregressive Distributed Lag Methodology. *Journal of Kirkuk University for Agricultural Sciences*, *14*(3).

Leartlam, C., Praneetvatakul, S., & Bunyasiri, I. (2021). Investment of rice farming households in Thailand and Vietnam. *Kasetsart Journal of Social Sciences*, *42*(1), 1–8.

Mohammed, O. (2018). Agricultural loans and Agricultural Investment in Iraq. Journal of Economics and Administrative Sciences, 24(106). https://doi.org/10.33095/jeas.v24i106.26

Mohammed, O. H. (2020). The possibility of achieving sustainable agricultural development in Iraq. Journal of Economics and Administrative Sciences, 26(121), 369-382. https://doi.org/10.33095/jeas.v26i121.1981

Muhammad, M. A., & Shaaibith, S. J. (2022). Oil shocks and their impact on the money supply in Iraq for the period 2004-2020. *AL-Qadisiyah Journal for Administrative and Economic Sciences*, *24*(2), 339–347.

Nema, S., & Al-Aqabi, D. (2018). The requirements of agricultural investment in Iraq in light of his accession Of the World Trade Organization. Journal of Economics and Administrative Sciences, 24(106), 272. https://doi.org/10.33095/jeas.v24i106.24

Noori, N. S., & Al-Hiyali, A. D. K. (2019). An economic analysis of determinants of wheat production support in Iraq for the period 1990-2016. *Iraqi Journal of Agricultural Sciences*, *50*(4).

Oditi, J. (2023). Agricultural Investment and Food Security. *Journal of Poverty, Investment and Development*, *8*(3), 23–33.

Pasten, E., Schoenle, R., & Weber, M. (2020). The propagation of monetary policy shocks in a heterogeneous production economy. *Journal of Monetary Economics*, *116*, 1–22.

Pogach, J., Polson, C., & Heil, M. (2024). Agricultural Lending, Insurance, and Implications of Climate Change. *FDIC Center for Financial Research Paper*, *2024–05*.

Sarwar, N., Ahmad, S., Khan, M. A., & Hasanuzzaman, M. (2022). World rice production: An overview. *Modern Techniques of Rice Crop Production*, 3–12.

SINGH, A. K., KUMAR, S., & JYOTI, B. (2022). Influence of climate change on agricultural sustainability in India: A state-wise panel data analysis. *Asian Journal of Agriculture*, *6*(1).

Sutardi, c, Apriyana, Y., Rejekiningrum, P., Alifia, A. D., Ramadhani, F., Darwis, V., Setyowati, N., Setyono, D. E. D., Gunawan, & Malik, A. (2022). The transformation of rice crop technology in indonesia: Innovation and sustainable food security. *Agronomy*, *13*(1), 1.

Tiwari, V., Tulbure, M. G., Caineta, J., Gaines, M. D., Perin, V., Kamal, M., Krupnik, T. J., Aziz, M. A., & Islam, A. F. M. T. (2024). Automated in-season rice crop mapping using Sentinel time-series data and Google Earth Engine: A case study in climate-risk prone Bangladesh. *Journal of Environmental Management*, *351*, 119615.

Vargas-Escobar, P., Flórez-Acosta, O., & Corrales-García, L. L. (2024). Renewing the potential of rice crop residues as value-added products in the cosmetics industry. *Heliyon*, *10*(7).

Workneh, W. M., & Kumar, R. (2023). The technical efficiency of large-scale agricultural investment in Northwest Ethiopia: A stochastic frontier approach. *Heliyon*, *9*(9).

Zhao, Y., & Chen, Y. (2023). Global patterns of agricultural investment and food security: Evidence from the fDi markets database. *Foods*, *12*(9), 1827.

Повод, Т. М. (2024). Features of Bank Lending of Agricultural Enterprises in Modern Conditions. *Таврійський Науковий Вісник. Серія: Економіка*, *20*, 142–146.