Research on World Agricultural Economy
https://journals.nasspublishing.com/index.php/rwae

ARTICLE

The Impact of Economic Policies on Agricultural Sector Performance Indicators in Iraq for The Period 2004–2022

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ABSTRACT

The study aimed to measure the impact of macroeconomic policies on the performance indicators of the agricultural sector in Iraq for the period 2004–2022. The study used quarterly data amounting to 76 observations for each of (public spending, exchange rate, trade openness, agricultural bank credit) as independent variables, and agricultural output and agricultural exports as dependent variables. By relying on the autoregressive distributed lag model to achieve accurate results that reflect the impact of economic indicators on the Iraqi agricultural sector in the short and long term, and to understand the balances between the time series of the variables. The results showed a significant positive impact of public spending and agricultural bank credit on agricultural output, while the study found a negative impact of both the exchange rate and trade openness on agricultural output. There was a negative impact of public spending on agricultural exports and a positive impact of agricultural bank credit on agricultural exports. The study proved that neither the exchange rate nor trade openness had an impact on agricultural exports, which can be justified firstly by the weakness of the Iraqi agricultural sector, and secondly by the emergence of what is known as the Dutch disease.

Keywords: Agricultural GDP; Agricultural Exports; Public Expenditure; Exchange Rate; Economic Openness; Agricultural Credit

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ARTICLE INFO

Received: 29 April 2025 | Revised: 29 May 2025 | Accepted: 4 June 2025 | Published Online: 22 July 2025
DOI: https://doi.org/10.36956/rwae.v6i3.2077

CITATION

Fawaz, N.A., Al-Anezi, W., 2025. The Impact of Economic Policies on Agricultural Sector Performance Indicators in Iraq for The Period 2004–2022. Research on World Agricultural Economy. 6(3): 459–476. DOI: https://doi.org/10.36956/rwae.v6i3.2077

1. Introduction

In order to manage the economy and influence its macroeconomic variables and real sector, the authorities adopt a bunch of economic policies that work in coordination with each other to achieve the ultimate economic goals, which are price stability, economic growth and employment, and prevent conflicts in their work to achieve these goals. The agricultural sector is a very important real economic sector targeted by these economic policies, and both developed and developing countries are interested in its growth because of its great value in supporting the gross domestic production growth, providing food security, and achieving a surplus that supports the growth of export and a surplus in the trade balance, which improves the balance of payment situation and also works on the flow of foreign currency that improves the position of the local currency.

The agricultural sector has a special nature that differs from the other real economic sectors, this difference results from internal influences that affect the growth of this sector related to environmental condition, production inelasticity, price fluctuation because of the production is seasonal, in addition to external influences related to the macroeconomic variables that affect the performance and growth of this sector, which may be a factor in the growth or contraction of its performance [1]. The implementation of economic policies to achieve some goals result in some economic effects that may be undesirable on the agricultural sector, for example adopting deflationary policies to curb inflation rates may cause a contraction in the growth of agricultural production, on the other hand, this sector may be the target of these policies, especially in countries where the government is still undertaking the process of economic development due to the low role of the private sector, therefor the effect on agriculture will be desirable. The agricultural sector is a real income-generating activity and is an ideal alternative to get rid of the rentier economy, which generates internal economic shocks due to external shocks of this rentier resource. However, in the case of Iraq's economy, we find a decline in the relative importance of agriculture and its contribution in the gross domestic production, especially after 2003 due to various reasons including the decline In public investment rates in agricultural sector and trade openness which led to a significant decline in the local competition degree for imported goods, in addition to the decline in support and production for agricultural producers accompanies by the exacerbation of internal problems specific to the sector itself, including the salinity problem, water scarcity, the abundance of agricultural pests, the decline in production technology, the decline in invested capital in the sector, the other problems that have work together to decline the agricultural production and local dependence on imported goods.

Successful economic policies are those that influence real sector and are not considered successful policies unless they have this influence. As a whole, they work to create an investment environment that attracts or repels real investment, and to achieve the desired growth of the agricultural sector, these policies must be activated and directed to create factors that encourage growth. Monetary policy is the most prominent policy that works through its channels to transfer the effects of its decisions to the real economy. The most important of these channels are the price, the exchange rate, and the interest rate channel, in addition to its tools that govern the banking performance and the money supply, thus directly and indirectly influencing the credit and the money supply, which directly affects the agricultural sector's performance [2]. There is a direct relationship between interest rates and the growth of agricultural output, as interest rates affect the capital cost thus the size of agricultural investment. High interest rates lead to a contraction in investment and vice versa, a high interest rate leads to a decline in money supply thus negatively affects the investment, The monetary policy indirectly affects market prices and the money supply [3]. Increasing the magnitude and facilities of credit through the credit channel acts as an incentive for the growth of the agricultural output and enhances its contribution in the gross domestic product and increase the agricultural export of primary crops and also the production of manufactured agricultural goods, thus enhancing the agricultural trade balance [4].

The exchange rate fluctuations affect prices and output inside the country and have an impact on the

magnitude of the exports and their returns and on imports. The exchange rate rise implies a decline in the exports magnitude due to the increase in their external cost and will work to increase the size of imports due to the decline in their prices domestically and vice versa if there is a decline in the currency value, this will increase exports and increase production incentives and decline in the magnitude of imports and thus the prices will rise. This mechanism has prompted many countries to use a policy of manipulating the exchange rate in order to stimulate exports. If there is a real production, the effect will be positive on the economy and agricultural output; however, in the case of a decline in output, the policy of reducing the exchange rate will not work to stimulate production, but rather the import of high-priced goods will increase, which means bringing inflation. The extent of exchange rate fluctuations' impact depends on size of adjustment made by economic policies towards the economic sectors in general and agriculture in particular. With the low size of public agricultural investment, the decline in production incentives, the unstable investment environment, the decline in government support and the decline in the size of agricultural lending, all of these factors will prevent any change in the output caused by the negative exchange rate fluctuations. This is very clear in Iraq's economy, even the government's measure to reduce the value of the local currency did not generate any desired economic impact on the output or on the balance of payments, due to the decline in size of the output, thus this policy resulted in high inflation rated for capital and consumer goods.

Inflation as an indicator of monetary policy is linked to both the interest rate and the exchange rate. Interest rate fluctuations affect the money supply and inflation rates, which in turn affect the size of agricultural output. Exchange rate also affects inflation, as local prices move in the opposite direction to it. A slight increase in prices or an acceptable inflation rate, as economists describe it, will be incentive for agricultural producers and an incentive to raise production rates, but the increase in the inflation rate will also be reflected in production costs, and with the decline in government support and the continues increase in prices, this will have a negative impact on agricultural production rates, and economic growth rate will decrease especially with the decline in production efficiency [5]. The coincidence of high inflation rates with trade openness will make the price of local goods relatively expensive, which will weaken their competitiveness abroad and inside the country, it will shift consumer preferences towards imported goods, this will exacerbate farmers' losses, thus reducing the supply of goods in coming production cycles, especially since the agricultural production decision depends on prices for a past period. This will ultimately mean a drop in the size of agricultural output and a larger deficit in the agricultural trade balance. Fiscal policy performs an influential role in the real economic sectors, although the success of its work is subject to controversy in economic literature due to the slowness of fiscal procedures, especially in the short term, with the strength of influence and correction in the long term. The process of managing and directing public revenues directly affects agricultural activity, especially when it is the largest beneficiary. Also, the decline in agricultural income excludes farmers from tax deductions, which provides income that can be reinvested in the agricultural sector [6]. Omodero and Ajetumobi believe that direct tax can develop the performance of the agricultural sector if applied effectively while avoiding misallocating the resources [7]. They believe that a large amount of direct taxes should be allocated to agricultural investment to provide food and create job opportunities. Economic theory sees taxes as a growth factor, but they should not exceed certain ceilings, whether income taxes or production taxes. Lemishko believes that taxes are a growth factor, especially for the agricultural sector, if the authorities adopt tax incentives for farmers, as is the case in the European Union [8]. Government expenditures have a high and clear impact on the agricultural sector, whether it is spending on agricultural infrastructure or in the field of support, subsidies and other facilities. Public expenditures will enhance the capacity of the agricultural sector, which will bring the government greater revenues resulting from the growth of agricultural income [9]. It will also improve the payment balance due to the increase in agricultural exports and the decline in imports, which will support the growth of other economic sectors and drive the wheel of economic growth.

Some believe that expanding government expenditures is undesirable because it generates inflationary pressures, and thus this expansion will be followed by contractionary measures with undesirable effects on economic activity. Therefore, in order to enhance growth, a contractionary policy can be followed towards unproductive expenditures and the contraction should be excluded from spending in aspects of the real economy, including the agricultural sector. This is the best measure for the case of developing countries in which the government adopts the development of economic sectors without or with the weakness of the private sector in this area. By following the government expenditures in the agricultural sector in Iraq, we can find a decline in the investment expenditure rate in the agricultural sector [10]. This is because of the neglect of development plans on one hand, and to the reliance on oil revenues as it is the largest component of national income, in addition to the failure of initiatives, including the agricultural initiative that was launched in 2008, due to weak administrative and financial oversight and the spread of corruption. Public expenditures in the agricultural sector have faced controversy in development literature. Some development models have found that growth begins in the manufacturing sector, while others have found that growth originates in the agricultural sector. Therefore, studies have found that the experiences of Asian countries in agricultural growth have proven successful and reduced poverty rates, unlike studies that have focused on African countries, which have adopted the approach of manufacturing sector growth, declining agricultural investment, and increasing taxes [11]. Mogues et al. believe that the most important justification for government investment in the agricultural sector is the failure of market mechanisms [12]. This failure is related to the incomplete market in the field of agricultural technology and social inequality. Goods and services are directed against the benefit of workers and residents in the countryside; therefore, directing investment to them will reduce this inequality [13].

Trade policy, with its variables, plays an influential role in the economy as a whole, and on the agricultural activity in particular. In general, the export process represents economic growth factor that supports sustainable growth, works on the flow of foreign currency, and supports the sectoral interconnection of the economic sectors that will grow side by side, which enhances exports [14]. Exports and their revenues are linked to the size of production and the exchange rate. There is a positive relationship between the size of exports and the size of agricultural output, while their relationship with the exchange rate is inversely negative [15]. The size of imports depends on the relative price differences generated by exchange rates and on the size of the GDP. We find that exchange rate fluctuations lose their importance when there is no production or the size of production is very low; thus, imports become an inevitable necessity even if exchange rates decline. That means an increase in the prices of imported goods, which will result in inflation inside. The trade policy deliberately uses a set of tools that basically regulate the flow of goods and services, and collect revenues for the government as an additional factor.

From the general view of the Iraqi trade balance and the agricultural trade balance especially, we find that the deficit is a permanent feature of them (excluding oil exports from the trade balance). This does not include the import of capital goods as a production requirement, but rather goes beyond it to consumer goods competing with the local product. This requires a review of the restrictions imposed on the flow of goods and a review of incentives for agricultural production. Foreign trade is not a curse for all countries. International experiences, especially in industrialized countries, have proven that trade openness supports commodity specialization and diversification of consumer options, thus economic prosperity and it also supports competition and improving local production. However, trade openness imposes many restrictions, especially in developing countries, which still depend on raw materials for their exports, which lose their importance in trade with the presence of the alternatives industrial, which means that the rates of the exchange are not in favor of developing countries. Trade openness is not limited to exports and imports, but foreign direct investment enters as a supporter of gross domestic product growth or vice versa, depending on the nature of this investment and the sector to which it flows. In developing countries, there are many restrictions that

govern the flow of foreign investment, including political stability and the spread of corruption, which are factors that repel it [16]. Tian et al. state in a study on foreign direct investment flows to China that foreign direct investments double GDP growth, especially when they bring in modern technology that enhances production in both quantity and quality [17]. Economic growth in general depends on the strategy of these investments, their return, and the sectors that benefit from them. Economists believe that the existence of a problem depends on the degree of trade openness and the type and quantity of imported goods. Importing production goods does not constitute a problem; it generates a long-term production growth that will work to enhance exports in the future and improve the balance of payments.

Therefore, economic policies directly and indirectly affect agricultural output through their economic variables. It is necessary to estimate the impact of these policy variables in order to identify the most important obstacles that prevent the growth of agricultural output and to direct these variables to achieve the required growth.

The study adopted an inductive method, which included collecting data on economic policy variables and agricultural sector indicators. The hypotheses were then tested using econometric methods to verify their validity. The results were then analyzed, and the type and magnitude of the relationship between the variables under study were deduced, proving the research hypothesis.

After the introduction, which represents the first section, the paper was divided into sections: the second section includes a literature review; the third section includes materials and methods; the fourth section presents the results and discussion; and the fifth section presents the conclusions.

2. Literature Review

We can present some papers from the literature review: Omodero & Ajetumobi investigated direct taxes impact on agricultural investment in Nigeria [7], using an extended time series 2012–2021 for both direct taxes and agricultural expenditures, results of the multiple regression analysis showed that direct taxes have a small impact on financing the agricultural sector and called for greater directing of tax revenues towards the Nigerian agricultural sector. Asaleye et al. studied monetary policy transmission channels impact on the agricultural sector permeance in Nigeria using the standard **VAR** model and the **DOLS** model [18]. They identified the credit channels, interest rate and exchange rate as independent variables affecting agricultural output, agricultural employment and agricultural exports. The results showed a positive relationship between the production size and money supply, while it is negative between the interest rate and production. It also showed that the exchange rate is inversely related to the size of agricultural exports. Ogbuabor et al. investigated the impact of monetary policy shocks on the Nigerian agricultural sector for the years 1981 to 2019 using the VAR technique for each of the money supply, monetary policy price, interbank interest rate and exchange rate [19]. It's concluded that the agricultural sector responds directly to the shocks through the interest rate and credit channel, while the policy price and exchange rate channels respond in the long term. Therefore, the study recommends developing the monetary policy tools in order to develop the agricultural sector.Oluwaseun, Solomon & Yusuf sought to analyze the fiscal policy impact on agricultural sector productivity in Nigeria for the years 1980–2017 [20], by using Johansen's cointegration methodology and VEC, the results showed that public agricultural capital expenditure has a positive impact on agricultural production, while personal income taxes have a negative impact on it, this prompted them to recommend increasing the allocation for agricultural capital expenditure as an allocation from the federal budget and encouraging an expansionary fiscal policy that works to raise income and thus increase agricultural investment. Adongo et al. examined monetary policy impact on the agricultural gross domestic in Kenya for 1981 to 2019 [21], using the OLS model, the impact of each of discount rate, exchange rate and money supply, on agricultural output was tested and the results showed that exchange rate had a negative impact on output while money supply had appositive effect. The researchers recommended increasing the allocations for agriculture in the government budget and maintain-

ing the exchange rate stability to support the agricultural sector's growth. Iliyasu was interested in knowing the exchange rate and agricultural output relationship in Nigeria from 1999 to 2016 [22]. The results clarify a positive relationship between the variables. It is recommended to take advantage of the decline in exchange rates, which makes agricultural exports relatively cheaper, leading to the growth of exports, and also activating the agricultural sector in order to raise the level of income and avoid imported inflation. Salim & Ahmed sought to know monetary policy impact on the agricultural GDP from 1990 to 2014 [23]. Using VECM, the results clarified a positive impact of both money supply and inflation on agricultural output. In the short term, there was no significance for the rest of the variables, such as the exchange rate and interest rate but in the long term, the interest rate is inversely related to the agricultural output. They recommended adopting an expansionary policy that includes price control and agricultural credit expansion. Oladipo et al.'s paper aimed to examine the impact of tax revenues on the agricultural performance in Nigeria [24]. With the decline in the size of the agricultural and the rentier economy, there is a need to diversify sources of income and direct the tax revenues towards the development of the agricultural sector. The impact of each of tax revenues, the size of agricultural labor and agricultural capital on the agricultural output was studied. Using join integration methodology and the error correction mode, it appeared that the relationship between tax revenues and production size is positive. Therefore, developing agricultural output will work to increase employment and income and increase and diversify exports. Wagan et al. studied monetary policy impact on employment, agricultural growth and food inflation from 1995 to 2016 using the VAR model in both India and Pakistan [25]. The results showed that restrictive monetary policy reduced food price inflation and agricultural production, and it also increased rural unemployment and interest rates in both countries in the short and long term. shevchuk & Kopych studied the fiscal policy effects on the agricultural and industrial sectors output in Ukraine from 2002 to 2016 [26], using the VAR technique; the results showed a positive impact of government expenditure on both sectors, while increasing government revenues will expand the industrial sector only. Chandio et al. sought to know the government expenditure impact on the agricultural sector and economic growth in Pakistan for the years 1983–2011 [27]. Using the OLS model and Johansen's cointegration, the results showed a positive government expenditure effect on agricultural output, which is a long-term effect. Despite this, the agricultural sector still suffers from weak financing, marketing and various problems, which prompted the researchers to direct the need to increase government agricultural expenditure. Aroriode & Ogunbadejo seek to know the macroeconomic policies' impact on the growth of the agricultural sector in Nigeria from 1970 to 2010 [28]. Using OLS estimators, the results showed that GDP, agricultural loans and exchange rates have a positive impact on agricultural growth, and that agricultural output is inversely related to money supply; it also showed that interest rate has a positive and weak impact. Djokoto examined the trade openness relationship with agricultural sector performance in Ghana from 1995 to 2009, using ARDL model [29]. The results showed that trade openness and foreign direct investment had a negative impact on Ghanaian agricultural sector performance; this requires looking at the type of foreign direct investment and reconsidering the trade liberalization policy and providing support to the agricultural sector to improve its performance. Achsani et al. seek to know the fiscal policy impact on the agricultural sector of the cities of South Sulawesi in Malaysia [30], using the Panel data for the years 2004–2009. The study showed that government capital agricultural expenditure acts as an incentive for the growth of the regional agricultural GDP, and the non-agricultural capital spending acts as an incentive for the regional GDP and will play its role in stimulating private investment, which will reduce unemployment rates, as the increase in the size of the output will work to absorb the labor. Obayelu & Salau were interested in knowing the agricultural production response to the currency exchange rate changes and the general price level for 37 years in Nigeria [31]. Using the join integration test and VEC, the results showed that the decline in the currency exchange rate increases agricultural production, and this increase in production is the result of the increase in income generated from agricultural exports due to the

decline in exchange rate.

3. Materials and Methods

3.1. Data

We used a time series data extending from the year 2004 to 2022 for each the dependent variables which are agricultural GDP (Y1) and agricultural exports (Y2), and the independent variables which are public expenditure (X1), exchange rate (X2), economic openness (X3) and agricultural credit (X4), by converting the data from the annual to quarterly data. All the data was collected from the annual bulletins of the Central Bank of Iraq.

3.2. Empirical Model

The autoregressive distributed lag (ARDL) model was used to show the extent of the impact of the independent variables on the dependent variables for the period 2004–2022, using the econometrics program (EVIEWS) and by conducting the unit root tests for the time series. **Tables 1** and **2** show the results using the expanded Dicky-Fuller (ADF) test and Phillips-Perron (PP) test for the variables.

Table 1. Unit Root Tests (ADF Test).

UNIT ROOT TEST TABLE (ADF)							
At Level							
		Y1	Y2	X1	X2	X3	X4
With Constant	t-Statistic	–2.0383	–2.3779	–1.8151	–2.3785	–2.8887	–2.0138
	Prob.	0.2702	0.1514	0.3704	0.1512	0.0517	0.2804
		n0	n0	n0	n0	*	n0
With Constant & Trend	t-Statistic	–1.6282	–3.1851	–2.4885	–2.1878	–1.721	–2.8528
	Prob.	0.7717	0.0954	0.3328	0.489	0.7317	0.1838
		n0	*	n0	n0	n0	n0
Without Constant & Trend	t-Statistic	–0.4974	–0.3964	1.3942	–0.2847	–0.7427	0.9735
	Prob.	0.4973	0.5376	0.9581	0.5801	0.3913	0.9112
		n0	n0	n0	n0	n0	n0
At First Difference							
		d(Y1)	d(Y2)	d(X1)	d(X2)	d(X3)	d(X4)
With Constant	t-Statistic	–1.8805	–6.3473	–3.2296	–3.9267	–4.3946	–4.1612
	Prob.	0.3395	0	0.0224	0.003	0.0007	0.0014
		n0	***	**	***	***	***
With Constant & Trend	t-Statistic	–3.5132	–6.3692	–3.261	–5.0777	–5.0716	–4.1279
	Prob.	0.046	0	0.0814	0.0005	0.0005	0.0089
		**	***	*	***	***	***
Without Constant & Trend	t-Statistic	–2.0299	–6.3954	–2.8833	–3.9544	–4.412	–4.0341
	Prob.	0.0413	0	0.0045	0.0001	0	0.0001
		**	***	***	***	***	***

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

Table 2. Unit Root Tests (PP Test).

UNIT ROOT TEST TABLE (PP)							
At Level							
		Y1	Y2	X1	X2	X3	X4
With Constant	t-Statistic	–2.6771	–1.991	–1.3244	–1.6568	–3.1781	–1.7355
	Prob.	0.0828	0.2902	0.6143	0.4488	0.0252	0.4095
		*	n0	n0	n0	**	n0
With Constant & Trend	t-Statistic	–1.6594	–2.6428	–2.0492	–1.2328	–2.0769	–2.2906
	Prob.	0.7594	0.2632	0.565	0.8961	0.5498	0.4336
		n0	n0	n0	n0	n0	n0
Without Constant & Trend	t-Statistic	0.4693	–0.3945	1.3286	–0.1026	–0.9792	1.2853
	Prob.	0.8138	0.5385	0.9526	0.6451	0.2905	0.9486
		n0	n0	n0	n0	n0	n0
At First Difference							
		d(Y1)	d(Y2)	d(X1)	d(X2)	d(X3)	d(X4)
With Constant	t-Statistic	–3.231	–5.0839	–4.6984	–4.0098	–3.6788	–4.2236
	Prob.	0.0221	0.0001	0.0002	0.0023	0.0064	0.0012
		**	***	***	***	***	***
With Constant & Trend	t-Statistic	–3.6193	–5.0964	–4.6657	–4.117	–4.1662	–4.1893
	Prob.	0.0349	0.0004	0.0017	0.0092	0.008	0.0074
		**	***	***	***	***	***
Without Constant & Trend	t-Statistic	–3.3358	–5.1297	–4.5458	–4.0379	–3.729	–4.0875
	Prob.	0.0011	0	0	0.0001	0.0003	0.0001
		***	***	***	***	***	***

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

The Autoregressive Distributed Lag (ARDL) model methodology was introduced by Pesaran et al. in 2001 [32]. This methodology combines the autoregressive model and the distributed lag model into a single model. Here, the time series are characterized by their lag values, the current values of the independent variables, and their time lag.

The ARDL methodology has several advantages, the most important of which are [33]:

1- The ARDL model avoids the problem of varying levels of stability of the time series under study. It does not require the variables to be stable at a single level; the series can be stable at their original level or at the initial level.

2- The problem of small samples can be avoided by applying ARDL.

3- The short-term and long-term relationships can be estimated in the same model, and the magnitude of the effect of each independent variable on the dependent variable can also be determined.

4- The estimators resulting from this model are characterized by impartiality and efficiency

To apply the ARDL methodology, several practical steps must be followed. The first of these steps is: Time series stationarity testing is performed to ensure that all variables are stationary at their original or first level, and that none of the variables are stationary at the second level. This is done using several tests, including the augmented Dickey-Fuller (ADF) test and the Phillips-Perron test. The second step is to select the optimal lag period, which is the period that yields the lowest value for the criterion used to determine it, such as the Akaike or Schwarz criterion. Then, the Boundary Test of

the relationship between the variables is used to ensure the existence of a long-run equilibrium relationship between the research variables. The null hypothesis (H0) is chosen if there is no cointegration between the variables, when the calculated F value is less than its table value. The alternative hypothesis (H1) is chosen if there is cointegration between the variables, meaning that the calculated F value is greater than its table value. We then estimate the parameters of the ARDL model for the short and long runs, as well as the error correction parameter (VECM) [32].

$$Long\text{ - }run\ relationship\ Yt = ao + a1X1t + a2x2t + Vt \quad (1)$$

$$residual\ series\ Zt : Zt = yt - \hat{a}0 - \hat{a}1 \times 1t - \hat{a}2 \times 2t \quad (2)$$

Short-run relationship [Restricted Error Correction Model (RECM)]

$$\Delta yt = \beta o + \sum_{i=1}^{p} \beta i \Delta yt - i + \sum_{j=0}^{q1} yj \Delta x1t - j + \sum_{k=0}^{q2} \sigma k \Delta x2t - k + \pi zt - 1 + \varepsilon t \quad (3)$$

From **Tables 1** and **2** it is clear that the time series are not stationary at the original level, which means accepting the null hypothesis(H0) and rejecting the alternative hypothesis(H1) which states that the time series are stationary at their original level.

4. Results and Discussion

4.1. Relationship Between Agricultural GDP and Independent Variables

4.1.1. Initial Estimation Using (ARDL) Model

Table 3 clearly presents the results of the initial estimation for the relationship between agricultural GDP (Y1) and each of the public expenditure (X1), exchange rate (X2), trade openness (X3) and agricultural credit X4.

Table 3. ARDL Initial Estimation.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Y1(–1)	1.509217	0.12052	12.52253	0
Y1(–2)	–0.55696	0.178007	–3.12884	0.003
X1	0.454966	0.094558	4.811497	0
X1(–1)	–0.67149	0.175444	–3.82734	0.0004
X1(–2)	0.240318	0.158192	1.51916	0.1354
X2	–0.29455	0.081131	–3.63056	0.0007
X3	–0.54526	0.18416	–2.96082	0.0048
X3(–1)	0.570593	0.304111	1.876265	0.0668
X3(–2)	–0.05756	0.292993	–0.19645	0.8451
X4	0.034407	0.019464	1.767739	0.0836
C	1.0984	0.263423	4.169727	0.0001
R-squared	0.992832	Mean dependent var		6.919723
Adjusted R squared	0.989477	S.D. dependent var		0.129271
S.E. of regression	0.013261	Akaike info criterion		–5.54916
Sum squared resid	0.008265	Schwarz criterion		–4.81037
Log likelihood	217.2207	Hannan-Quinn criter.		–5.25571
F-statistic	295.9001	Durbin-Watson stat		2.277488
Prob(F-statistic)	0			

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

Table 3 shows the results of the initial estimation for the impact of public expenditure (X1), exchange rate (X2), trade openness (X3), and agricultural credit (X4) on agricultural GDP (Y1). It was found that all the economic variables above have a clear impact on agricultural production, in addition to the impact of agricultural production in previous periods on agricultural production in the current year.

It is clear that the determination coefficient reached 99% and that the corrected determination coefficient reached 98%, which means a high explanatory power for the model, i.e. the independent variables explain (99%) of the changes that occur in agricultural gross domestic product.

4.1.2. Optimal Lag Period

From **Figure 1**, it is clear that the model was chosen according to the (ARDL) methodology is of rank (6,6,0,6,0) for the variables Y1, X1, X2, X3, X4, respectively, and the optimal lag period is chosen gives the lowest value for the criteria used.

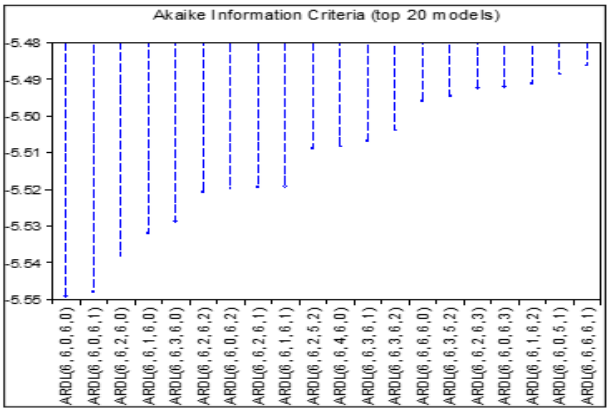

Figure 1. The Optimal Lag Period Using Akaike.

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

4.1.3. Bound Test

To test the existence of a long-term relationship between the independent variables and agricultural GDP, (F) statistic is calculated, and **Table 4** shows that the calculated (F) value is equal to (3.569865), which is greater than the critical (F) at the (5%) level, and thus we reject the H0 and accept H1 hypothesis, which means the existence of a joint integration relationship between the variables.

Table 4. Bound Test.

Test Statistic	Value	K
F-statistic	3.569865	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.50%	3.25	4.49
1%	3.74	5.06

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

4.1.4. The Short-Term and Long-Term Parameters Estimation

The results of **Table 5** indicate the existence of long-term cointegration between agricultural GDP and

the independent variables affecting it. The error correction coefficient (–0.1) was negative and statistically significant. The imbalance in the short term is due to the long-term equilibrium by 0.1 of a time. The short- and long-term results show a positive and significant relationship between the agricultural GDP variable and public expediter, while the relationship with the exchange rate was found to be negative. There was also a negative relationship between the dependent variable and economic openness, while the relationship between agricultural production and agricultural credit was found to be significant and positive. Furthermore, the negative relationship is due to the fact that the exchange rate was changed for other purposes, perhaps political rather than economic. Furthermore, the negative impact of economic openness on agricultural production was due to the lifting of protectionism on agricultural products in Iraq, which are characterized by their inability to compete with the same imported products, which led to the exit of local projects from the market and their cessation of production.

Table 5. Short-term and Long-term Parameters.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y1(–1))	0.689123	0.108017	6.379741	0
D(X1)	0.454966	0.094558	4.811497	0
D(X1(–1))	–0.24032	0.158192	–1.51916	0.1354
D(X2)	–0.29455	0.081131	–3.63056	0.0007
D(X3)	–0.54526	0.18416	–2.96082	0.0048
D(X3(–1))	0.057557	0.292993	0.196445	0.8451
D(X4)	0.034407	0.019464	1.767739	0.0836
CointEq(–1)	–0.17991	0.057173	–3.14668	0.0029
$\text{Cointeq} = Y1 - (0.5543 * X1 - 1.6373 * X2 - 0.0196 * X3 + 0.1912 * X4 + 6.1054$				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	0.554339	0.117686	4.710341	0
X2	–1.63726	0.364416	–4.49282	0
X3	–0.01963	0.249036	–0.07884	0.9375
X4	0.191249	0.108359	1.764953	0.0841
C	6.105412	1.380818	4.42159	0.0001

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

We also test the standard model quality using (ARCH) and the results clearly indicate that there isn't heterogeneity problem of variance, and the calculated (F) value reached (0.099927) at the probability level (0.7529) which was not significant at the level (5%). Also, with the use of (LM) tests, the results of the calculated (F) reached (1.337191) at the probability level (0.2717), which was not significant at the level (5%).

4.2. Relationship Between Agricultural Exports and Independent Variables

4.2.1. Initial Estimation Using the ARDL

Table 6 shows the results of the initial estimation for the impact of public spending (X1), exchange rate (X2), trade openness (X3), and agricultural credit (X4) on agricultural exports (Y2). It was found that both public spending X1 and agricultural credit X4 have a clear effect on agricultural exports, but no effect was observed for both the exchange rate X2 and trade openness X3 on agricultural exports, in addition to the effect of agricultural exports in previous periods on agricultural exports in the current period.

Table 6. ARDL Initial Estimation.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Y2(–1)	1.191364	0.11585	10.28369	0
Y2(–2)	–0.44249	0.113068	–3.91349	0.0003
X1	–1.58474	0.882802	–1.79513	0.0781
X1(–1)	1.281708	0.877649	1.460388	0.1499
X2	1.927981	3.618067	0.532876	0.5963
X2(–1)	–5.08269	3.614962	–1.40602	0.1653
X3	–0.38111	2.122983	–0.17952	0.8582
X3(–1)	4.077361	2.942712	1.385579	0.1715
X4	2.610467	0.775996	3.364021	0.0014
X4(–1)	–3.26874	1.317092	–2.48178	0.0162
C	3.904631	2.560182	1.525138	0.133
R-squared	0.932328	Mean dependent var		4.910576
Adjusted R-squared	0.913871	S.D. dependent var		0.594594
S.E. of regression	0.174499	Akaike info criterion		–0.45843
Sum squared resid	1.674751	Schwarz criterion		0.051466
Log likelihood	32.2744	Hannan-Quinn criterion		–0.25566
F-statistic	50.51592	Durbin-Watson stat		2.052171
Prob(F-statistic)	0			

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

It is clear that the determination coefficient reached 93%, and that the corrected determination coefficient reached 91%, meaning that independent variables explain 93% of the changes that occur in the agricultural exports.

4.2.2. Optimal Lag Period

From **Figure 2** it is clear that the model was chosen according to the (ARDL) methodology is of rank (2,1,1,5,2), for the variables Y2, X1, X2, X3, X4.

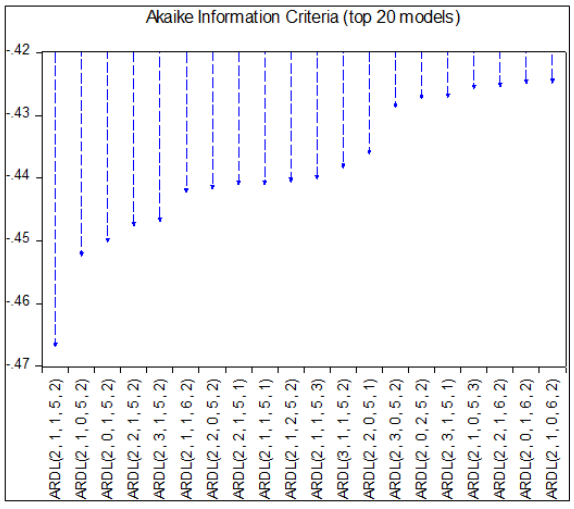

Figure 2. The Optimal Lag Period Using Akaike.

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

4.2.3. Bound Test

We test the existence of a long-term relationship between the independent variables and agricultural exports, **Table 7** shows that the calculated (F) is equal to (3.569865) which is greater than the critical (F) value at the (5%) level, thus we reject H0 and accept H1, which means the existence of a joint integration of a joint relationship between the variables.

Table 7. Bound Test.

Test Statistic	Value	k
F-statistic	3.569865	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.50%	3.25	4.49
1%	3.74	5.06

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

4.2.4. The Short-Term and Long-Term Parameters Estimation

The results of **Table 8** indicate the existence of a long-term joint integration between the agricultural export and the independent variables affecting it. The error correction parameter (–0.2511) was negative and statistically significant; this means that any imbalance will be corrected in the long run and balance will return within (0.25) of time. The short-term and long-term results show a negative relationship between public expenditure and agricultural exports. This contradicts economic theory, which can be explained by the fact that public expenditure is not directed towards exports in general and agricultural exports in particular. As for the relationship with the dollar/dinar exchange rate, it turned out to be a negative relationship, this can be justified by the fact that the exchange rate is fixed and its re-change is subject to the desire to generate revenues from oil exports rather than improving the trade balance in general from other exports. It is also a positive relationship between the agricultural exports and both economic openness and agricultural credit.

Table 8. Short-term and Long-term Parameters.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y2(–1))	0.442492	0.113068	3.913487	0.0003
D(X1)	–1.58474	0.882802	–1.79513	0.0781
D(X2)	1.927981	3.618067	0.532876	0.5963
D(X3)	–0.38111	2.122983	–0.17952	0.8582
D(X3(–1))	4.808052	2.597	1.851387	0.0695
D(X3(–2))	–1.35271	2.592637	–0.52175	0.6039
D(X3(–3))	3.339845	2.729178	1.223755	0.2263
D(X3(–4))	–4.98825	1.78935	–2.78774	0.0073
D(X4)	2.610467	0.775996	3.364021	0.0014
D(X4(–1))	–1.41939	0.78618	–1.80543	0.0765
CointEq(–1)	–0.25113	0.058985	–4.25747	0.0001
Cointeq = Y2 – (–1.2067*X1 –12.5622*X2 + 7.5233*X3 + 3.0308*X4 + 15.5484)				

Table 8. *Cont.*

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	–1.20669	1.134713	–1.06343	0.2922
X2	–12.5622	3.066598	–4.09646	0.0001
X3	7.523304	1.775562	4.237138	0.0001
X4	3.03082	1.148916	2.637983	0.0108
C	15.54842	10.41444	1.492968	0.1412

Source: ARDL model estimation results using Eviews10 software and based on data on the Iraqi economy available on the official website of the Central Bank of Iraq: https://cbi.iq/

We also test the standard model quality using (ARCH) and the results clearly indicate that there is no heterogeneity problem of variance, and the calculated (F) value reached (2.157359) at the probability level (0.1465), which was not significant at the level (5%). Also with the use of (LM) tests the results of the calculated (F) reached (0.743929) at the probability level (0.4801), which was not significant at the level (5%).

After statistically analyzing the results, we conduct an economic analysis of them. With regard to the relationship between independent variables and agricultural GDP, the results are consistent with the economic theory regarding public expenditure and agricultural production relationship. With the growth of government expenditure, the economic sectors grow and according to the results 0.5% of production fluctuations are explained by changes in government expenditures, meaning that an increase of 1% in government expenditure will lead to an increase of 0.5% in agricultural output. As for the relationship with the dollar/dinar exchange rate, the result does not match the economic theory, the relationship is negative between the dollar/dinar exchange rate and agricultural output. Exchange rate fluctuations explain 1.6% of output fluctuations. Perhaps the reason for this is that the exchange rate is fixed and not floating, so its rise or fall is not related to or independent of the sector and actual output and does not act as an incentive for its growth. The change in the exchange rate primarily targets the size of oil revenues and does not work to stimulate real output, as there is a major structural imbalance in the economy and the exchange rate alone cannot improve or stimulate output. What is required is a package of reforms and a large size of investments pumped into the agricultural sector to stimulate it. Evidence of this is the Iraqi government reducing the exchange rate of the dinar against the dollar in 2021, and this procedure did not work to stimulate production or exports. Regarding the relationship with economic openness, the results was expected for the Iraqi economy, which is a negative relationship, economic openness is not in favor of agricultural production and the more openness increases, the lower the growth rates of agricultural output, a 1% increase in trade openness will lead to a 0.019% decline in agricultural output. While the relationship with agricultural credit appeared to be a positive relationship, which is consistent with the logic of economic theory, with the growth of agricultural loans, agricultural output grows, so a 1% increase in the size of agricultural lending will lead to a 0.19% increase in output.

As for the relationship between agricultural exports and independent variables, the results showed an inverse relationship between public expenditures and agricultural exports, which is contrary to economic theory. An increase of 1% in government expenditure will lead to a decline in agricultural exports by 1.2%. This can be justified for several reasons, including that public expenditure is not in the interest of supporting agricultural exports or the export sector in general, and is indirectly directed to the import process. We can also justify this by the weakness of expenditures directed to the agricultural sector in general, which weakens its impact. The results showed that the relationship between agricultural exports and the dollar/dinar exchange rate is a negative relationship, which does not agree with economic theory. Exchange rate fluctuations explain 12.56% of export fluctuations, which is a significant effect, but it is contrary to economic thought. A

positive relationship also appeared between agricultural exports and economic openness, which is consistent with the theory. An increase of 1% in trade openness will lead to an increase of 3.03% in agricultural exports, as openness creates foreign markets for local goods. There is also a positive relationship between agricultural exports and agricultural lending, which is also a logical relationship, since credit works to grow exports, whether it is cash credit or pledged credit to facilitate the foreign trade process, a 1% increase in the size of lending will lead to a 15.54% increase in agricultural exports

The results of our study are consistent with the results of some previous studies regarding trade openness and its impact on the agricultural sector, such as Djokoto (2013), who demonstrated the negative impact of trade openness on the performance of the Ghanaian agricultural sector and called for a review of trade liberalization policies and the provision of support to the agricultural sector. Regarding government expenditure, the results on the impact of government expenditure on the agricultural sector are also consistent with many previous studies. Ali and Ali (2020) showed that weak public agricultural investment expenditure led to a decline in agricultural output. Oladipo et al. (2019) demonstrated a positive relationship between tax revenues and output and called for tax-funded expenditure to be directed towards the agricultural sector. Shevchuk and Kopych (2017) also demonstrated a positive impact of government expenditure on the agricultural sector and vice versa. Regarding the impact of the exchange rate, the results of our study contradict many previous studies that demonstrated a positive impact of the exchange rate on the agricultural sector, such as Moh'd (2020), Iliyasu (2019), Aroriode & Ogunbadejo (2014), and Fidan (2006), but it consistent with some studies, such as Adongo et al. (2020) which demonstrated a negative relationship with output, which called for achieving exchange rate stability. Regarding agricultural credit, the results are consistent with many studies that examined loan volume and interest rates as variables affecting the agricultural sector, such as the study by Aroriode & Ogunbadejo (2014) which demonstrated that agricultural loans have a positive impact on agricultural growth. The study by Salim & Ahmed (2019) demonstrated that interest rates are inversely related to agricultural output, and other studies have also found this.

5. Conclusions

Macroeconomic policies play an influential role on real economic variables, which means that these polices act as a guide for economic activity in order to achieve ultimate goals. The role of these policies and the extent of their success depend on many factors, including the degree of policy independence, the extent of coordination between them, and the degree of economic growth. Therefore, some tools may appear weak or ineffective, or they may work in the opposite direction. Considering the situation of the Iraqi economy, where real (non-oil) GDP growth rates have declined, bank credit have been weak, financial and economic corruption has been widespread, and there is an ongoing exposure to economic shocks, budget deficits, and many other problems that pose real challenges to the authorities due to the weakness of their economic tools that affect real activity. The agricultural sector is one of the real sectors that suffers from a clear weakness in the size of production and the size of exports, especially after 2003. This weakness is due to problems within the sector itself, such as the water scarcity, salinity, and agricultural pests, as well as problems outside the sector, including weak agricultural bank credit, a decrease in allocation of public expenditure to agriculture, and a decline in private investment, in addition to trade openness and the problem of foreign competition for local goods. We studied the impact of some economic policy tools on some indicators of the agricultural sector's performance including agricultural GDP, agricultural exports. Most of the results were consistent with economic theory regarding agricultural output, showing a positive relationship between agricultural output and both expenditure and agricultural credit, and a negative relationship with economic openness, but the relationship appeared negative with the exchange rate, this relationship contradicts economic theory and we can justify this by saying that the exchange rate is a variable whose effectiveness is limited mainly to oil revenues and exports more than its impact on real sectors.

As for the relationship of independent variables with agricultural exports, some disagreed with the theory, as the exchange rate was inversely related to agricultural exports, while appeared a positive relationship between agricultural exports and trade openness on the one hand and bank credit on the other hand, and this is consistent with the logic of economic theory. As for the relationship between public expenditure and agricultural exports, the relationship appeared to be inconsistent with economic theory, and this is due to the imbalance of the public expenditure structure and its weak direction in a way that is not in favor of the export sector, especially agricultural exports. The impact of the four variables appeared strong in the short and long term, and this requires the authorities to pay attention to raising the allocation for the agricultural sector and the export sector in the government budget and monitoring the size of trade openness and verifying the size and type of imported goods because of its influence on the local production, as well as achieving stability in the exchange rate and directing it to serve the growth of the size of exports and the growth of agricultural output.

Author Contributions

Writing—original draft preparation, investigation, formal analysis N.A.F.; methodology, writing—review and editing, W.H.A.A. All authors have read and agreed to the published version of the manuscript.

Funding

This work received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Data are available in Central Bank annual reports and the Ministry of Planning.

Acknowledgments

The authors would like to express their gratitude to their respective institutions for providing the necessary resources for this research.

Conflicts of Interest

The authors declare no conflict of interest.

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