AN ECONOMIC STUDY OF THE FACTORS AFFECTING THE FOOD SECURITY COEFFICIENT OF THE RICE CROP IN IRAQ FOR THE PERIOD (2003-2020)

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ABSTRACT
This research was aimed to study the most important factors affecting the food security coefficient in Iraq for the period 2003-2020. Where the food security coefficient was calculated for the rice crop, the results showed that the rice food security coefficient amounted to about 0.55, which is nearly enough for six months, which requires maintaining the level of food security of rice and then study the factors affecting food security, considering the food security factor as a dependent variable, and each of the population, local production, available for consumption and imported quantities of rice as independent variables. Statistical and standard methods were used to find out the most important aspects of this subject in the agricultural sector, and Johansen's co-integration method was employed for this purpose, and unit root tests such as Phillips - Perron used, for the purpose of determining the stability of the data and then testing the optimal analysis method and formulating the standard model. The most important finding of the analysis is that there is an equilibrium relationship and a joint integration between the food security factor of rice and each of (population, local production, available for consumption, quantity of imports) despite the presence of short-term unequilibrium, and the value of the error correction parameter was (-1.48) which It means that 148% of the errors or unequilibrium that occur in the short term can be automatically corrected in less than a year to reach equilibrium in the long term.

Keywords: imports, stability, ARDL model, co-integration test.
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دراسة اقتصادية للعوامل المؤثرة في معامل الأمن الغذائي لمحصول الرز في العراق للمدة (2003−2020)

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المستخلص
يهدف البحث دراسة أهم العوامل المؤثرة في معامل الامن الغذائي في العراق للمدة 2003−2020. حيث تم حساب معامل الامن الغذائي لمحصول الرز، أظهرت النتائج أن معامل الأمن الغذائي للرز بلغ حوالي 0.55 ، وهو ما يكفي تقريبا لستة أشهر مما يتطلب المحافظة على مستوى الامن الغذائي من الرز ومن ثم دراسة العوامل المؤثرة على الامن الغذائي وذلك باعتبار معامل الامن الغذائي متغير تابع، وكل من عدد السكان، والانتاج المحلي، والمتاح للاستهلاك والكميات المستوردة من الارز كمتغيرات مستقلة. استخدمت الأساليب الاحصائية والقياسية للوقوف على اهم جوانب هذا الموضوع في القطاع الزراعي، ووظفت لهذا الغرض اسلوب التكامل المشترك لجوهانسن، كما تم الاستعانة باختبارات جذر الوحدة مثل Phillips – Perron، لغرض الوقوف على استقراريه البيانات ومن ثم اختبار اسلوب التحليل الامثل وصياغة الانموذج القياسي. اهم ما توصل الية التحليل الى وجود علاقة توازنيه وتكامل مشترك بين معامل الامن الغذائي من الرز وكل من (عدد السكان، الانتاج المحلي، المتاح للاستهلاك، كمية الاستيرادات) على الرغم من وجود اختلالات قصيرة الاجل، وان قيمة معلمة تصحيح الخطأ (1.48−) مما يعني أن 148% من الأخطاء أو الاختلالات التي تحصل في الأجل القصير يمكن تصحيحها تلقائياً في مدة أقل من سنة لبلوغ التوازن في الأجل الطويل.

الكلمات المفتاحية : الاستيرادات، الاستقرارية، انموذج ARDL ، اختبار التكامل المشترك
*البحث المستل من رسالة الماجستير للباحث الأول.

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INTRODUCTION

Cereal crops in general and rice crop are among the most important strategic crops because of their nutritional importance and their fundamental role in economic and social development as well as the main pillar of food security and their role in the farmer income. The term food security is of greatest interest from the international organizations, experts and researchers (8). And can distinguish between two levels of food security, absolute food security, and it's intended to produce food within a single country equivalent to or exceeding domestic demand, a level synonymous with full self-sufficiency and therefore called self-food security, and relative food security and the ability of a state or group of countries to provide goods and food in whole or in part (6), The problem is that Iraq's rice crop production is insufficient to meet domestic demand, and that resulting in increased imports, because of the failure of local production to meet the growing demand for this crop as a result of high population growth rates and in the light of many problems that have stood to make it worse, foremost among them drought, water scarcity and soil salinization, among other geographical factors, resulting in a food gap and the need to provide rice crops with the necessary varieties and quantities throughout the year, forcing the state to import large quantities of rice to cover domestic demand and foreign currency, which weighs on its budget. This study was aimed to identify the food security situation of rice by measuring the food security coefficient, which requires estimating the size of the strategic stock, and identifying the most important factors affecting the security coefficient of the rice crop in Iraq. The study refers to the hypothesis that Iraq is one of the countries that attaches great importance to achieving food security, whether by supporting the local product or by filling the deficit through imports and others, it is expected that Iraq will be a food security investigator of the rice crop, but the permanence of this level of food security requires increasing local production and attention to the cultivation of rice crops and continuing programs supporting the expansion of the agricultural area. Food security has been addressed in several studies, (3, 15, 16, 18, 20 , 20), as well as the publication of (13) a studies aimed at indicating the conditions of food security through the study of production and consumption of the most important grain crops (wheat and rice) for the period 1990-2016 and the extent of its impact in reducing the chronic food deficit in Iraq while proposing some future guidance for food security. This study was based on secondary data, namely, time series data for the period 2003-2020 obtained from government agencies and international agencies such as: Ministry of Planning and Development Cooperation, Central Bureau of Statistics and Information Technology, Ministry of Commerce, General Grain Trading Company, Planning and Follow-up Department, Statistics Division, Ministry of Agriculture and Agricultural Statistics Department, Arab Organization for Agricultural Development, Annual Book of Arab Agricultural Statistics.

MATERIALS AND METHODS

Food security: Food and Agriculture Organization (FAO) defined that food security "It is achieved when all people, at all times, have the physical and economic possibilities to obtain proper nutrition that addresses their nutritional needs and includes the foods they prefer to ensure a healthy and lively life." (4). Another definition of the organization itself is that "The situation in which every human being, at all times and when obtaining safe and rich food in order to live a healthy and vital life" (2). And in this concept, the organization identifies three essential elements of food security, the first of which is the provision of food supplies, the second is its stability, and finally ensuring that all individuals have appropriate food needs (14). Another FAO definition of food security is "when all people have at all times access to adequate, safe and nutritious food that meets their nutritional needs and nutritional tastes and ensures that they live a healthy and active life" (10). The latter definition has moved away from the traditional concept of food security and clarified a broader idea of "the ability of the country or countries to secure food for the nutrition of the population so that it meets the basic needs of the population." For human growth and survival in good health, there must be a stock of food that can be used in the event of natural disasters that reduce food production or if the country cannot obtain food through imports from abroad" (5). The latter definition was linked to the term self-sufficiency, reliance on local resources to meet the basic food needs of its members. Strategic stock: The strategic stock of a commodity is defined as the quantities maintained by the government and the private sector to meet the expected local demand or export for this commodity during a future period of time, and the strategic stock during a certain time period is the sum of each of the surplus directed to the development of the strategic stock in some years and the amount of the deficit that is withdrawn from that stock during other years in which a deficit in local consumption appears, and there are many factors affecting the organization and management of the strategic stock, including the periods of sufficiency of production and import coverage for local consumption, temporal and spatial consumption differences and the conditions of the global market for the commodity (11). Food security coefficient estimate: Correctly estimating the size of the surplus and food deficit allocated to domestic consumption is important to determine the scope and dimensions of the food security problem. By achieving this goal, it is possible to know the magnitude of the economic crises of the necessary food commodities, which may be either the disappearance of the commodity from local markets or its presence in limited quantities and at high prices. Maintaining a strategic stock is one of the most important axes of achieving food security, and in the light of data production, consumption and import, the size of the surplus and deficit is estimated for domestic consumption.

Food security coefficient can be calculated through the following formula (15):

$$\textbf{Food security coefficient} = \frac{\textbf{Deficit and surplus (strategic stock size)}}{\textbf{Ratior of (Annual domestic consumption average)}}$$

The value of food security coefficient ranges between zero to the correct one (0.1), as the value of food security coefficient approaches zero, the food insecurity and vice versa, as closer the value of the food security coefficient to one, the greater the food security coefficient of the commodity in the country.

Economic factors that determine the food security coefficient of the rice crop

Population: Table 1 shows that the population census in Iraq during the period 2003-2020 ranged between a minimum of about 26,340 thousand people in 2003, and a maximum of about 40,150 thousand people in 2020, an increase equivalent to 52.43%, than it was in 2003, with an annual average of about 33364 thousand people during the study period. The population factor is considered one of the most important factors that affect the quantities consumed by crops, because the population increase is accompanied by the entry of new consumers of the commodity, which leads to an increase in the number of consumers and thus an increase in the demand for food crops. The population growth rate was calculated during the period 2003-2020, and it was found that The population growth rate has reached about 0.024, i.e. 2.4%, and it came with a positive sign indicating the increase in the population during the study period. Local production: Table 1 shows that the general average of rice production amounted to 2890 thousand tons and ranged between a maximum of 575 thousand tons in 2019 and a minimum of 81.3 thousand tons in 2003, with a growth rate of 0.028. That is the growth rate is 2.8%, and it is a positive sign and indicates an increase in the demand for the crop that exceeds the actual production. Available for local consumption: The table shows 1, which indicates that the amount of rice available for consumption in Iraq during the period 3200-2020 ranged between a minimum of about 358 thousand tons in 2010, with a decrease of about 55.99% from the average consumed quantity, which is about 813.52 thousand tons during the study

Table 1. The economic factors determining the food security coefficient of the rice crop in Iraq for the period (2003-2020).

Years	Population (thousand people) (1)	local production (thousand tons) (2)	Available for domestic consumption (thousand tons) (3)	import quantity (thousand tons) (4)
2003	26340	81.3	524	433.5
2004	27139	250	684	652
2005	27963	308	743	827
2006	28810	363	797	115
2007	29682	393	827	433.5
2008	31895	248	945	694
2009	31664	173	870	756
2010	32490	156	358	230
2011	33338	235	437	118
2012	34208	361	563	913
2013	35096	452	1033	151
2014	36005	403	605	930
2015	35213	109	1101	130
2016	36169	181	1069	366
2017	37140	266	689	308
2018	38124	181	1133	799
2019	39128	575	1133	760
2020	40150	464	1133	115
average	33364	288.85	813.52	485.05
maximum	40150	575	1133	930
Minimum	26340	81.3	358	115
growth rate%	0.024	0.028	0.031	-0.022

period, and a maximum of about 1133 thousand tons in 2018, an increase of about 39.27% over the annual average of the quantity available for consumption of rice, and the consumption growth rate was about 0.031, 3.1% It came with a positive sign, and this percentage indicates an increase in annual consumption===Import Quantity: By reviewing the data in the Table 1, which indicates that the quantity of rice imports in Iraq during the period 3200-2020 ranged between a minimum of about 115 thousand tons in 2020, with a decrease of about 76.29% from the average amount of imports, which is about 485.1 thousand tons during the study period, and a maximum of about 930 thousand tons in 2014, an increase of about 91.71% over the average amount of imports during the study period. The growth rate of imports was about -0.022, by -2.2%. With a negative sign, this percentage indicates a decrease in imports.

RESULTS AND DISCUSSION

Estimated rice food security coefficient shows in Table 2, as a ratio between the strategic stock volume of about -713.15 thousand tons to average annual domestic consumption estimated at 813.525 thousand tons, or as a percentage between the annual change in the size of strategic stock to annual domestic consumption, it is clear that the food security coefficient for rice was about 0.55 which indicates that the value of the food security factor is less than the correct one, but it is greater than 0.50 which is almost enough for six months, which requires maintaining the level of food security of rice and seeking to increase that rate by the relevant state agencies, either by expanding the cultivation of rice crops or increasing imports, which leads to an accumulation of strategic stock sufficient for domestic consumption to enhance food security of rice and the ability to cope with the emergency conditions that the country may facing.

Description of the economic factors specified in the food security coefficient of Iraq's rice crop for the duration 2003-2020

Table 2. Estimate rice food security coefficient in Iraq during the period (2003-2020).

Years	Amount of change in strategic stock(1.000) tons (1)	Annual domestic consumption (2)	Ratio of change in strategic stock to domestic consumption (3)= (1/2)
2003	-9.2	524	-0.0175
2004	218	684	0.3187
2005	392	743	0.5276
2006	-319	797	-0.4003
2007	-0.5	827	-0.0006
2008	-2.9	945	-0.0031
2009	59.1	870	0.0679
2010	28.05	358	0.0784
2011	-83.9	437	-0.1920
2012	711.1	563	1.2633
2013	-429.95	1033	-0.4162
2014	728.05	605	1.2035
2015	-862	1101	-0.7829
2016	-522	1069	-0.4883
2017	-115	689	-0.1669
2018	-153	1133	-0.1350
2019	202	1133	0.1783
2020	-554	1133	-0.4890
Average	-39.61	813.525	0.030
Total	-713.15	14643	0.5459

The food security coefficient function of the rice crop was described and estimated for the variables used in the model during the study period 2003-2020 as follows:

$$Y = B0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + U_i$$

Where: Y: Food security coefficient for rice crop .

X_1: Population 1.000 person.

X_2: Domestic production 1.000 tons.

X_3: Available for domestic consumption 1.000 tons.

X_4: Amount of imports 1.000 tons

Econometric model test

The recent analysis of time series of stationary tests unit root tests), which is the necessary condition for selecting the econometric model, is one of the most important tests that take us to the next stage, which is to choose a model commensurate(3). with the stability of the data, as the use of the Ordinary Least Square OLS) without addressing stability tests may give misleading and inaccurate results although there may be a significant relationship, but this relationship is Suparius inaccurate and cannot be adopted for interpretation (12).

Unit root tests (Phillips-Perron test)

The Philips-Peron (PP) test will be relied upon because the PP test is more accurate for data results in small samples (18). The unit root test aims to examine the properties of the time series of all function variables under study of food security coefficient (y), population (X_1), domestic production (X_2), available for consumption (X_3), amount of imports (X_4) with constant presence and with constant presence, direction and without constant and direction) and ensure its stability time series of variables economic and determine the rank of integration of each variable. Table 3. establishes the results of the Phelps-Peron stationary test for related variables by testing the null hypothesis (∂ : H0 = 0) by unstable time chains versus the alternative hypothesis (∂: H1 $\neq$ 0).

Table 3. PP test results at I(0) and I (1)

At Level		Y	X1	X2	X3	X4
With Constant	t-statistic	-5.7336	-0.4733	-2.8890	-2.6566	-11.208
	Prob.	0.0003	0.8742	0.0674	0.1017	0.0000
		***	No	**	No	***
With Constant& Trend	t-statistic	-5.9559	-2.5137	-2.8741	-3.2111	-12.725
	Prob.	0.0009	0.3180	0.1936	0.1151	0.0000
		***	No	No	No	***
Without Constant& Trend	t-statistic	-5.8640	6.4255	-0.3560	0.5675	-1.8072
	Prob.	0.0000	1.0000	0.5413	0.8286	0.0682
		***	No	No	No	**
At First Difference		D(Y)	D(x1)	D(x2)	D(x3)	D(x4)
With Constant	t-statistic	-15.651	-5.2414	-4.4521	-9.2226	-18.855
	Prob.	0.0000	0.0008	0.0036	0.0000	0.0000
		***	***	***	***	***
With Constant& Trend	t-statistic	-15.192	-5.1074	-4.3322	-10.816	-17.616
	Prob.	0.0001	0.0047	0.0179	0.0000	0.0001
		***	**	**	***	***
Without Constant& Trend	t-statistic	-15.792	-1.8705	-4.5900	-7.6547	-18.566
	Prob.	0.0001	0.0603	0.0001	0.0000	0.0001
		***	**	***	***	***

The results of the Phillips-perron stationary test showed that X_1 , X_2 and X_3 variables were not stable at the level and the results indicate that we accepted the null hypothesis with the presence of a unit root and the non-stationary of time series. That is, they are unstable series because Tau's calculated value is smaller than its scheduling value $\boldsymbol{\tau_c < \tau^*}$. The results showed after taking the first difference the variables came stable in the three cases when taking the first difference at a significant level 1%, i.e. Tau's calculated value was greater than its scheduling value $\boldsymbol{\tau_c > \tau^*}$**.** This suggests that the null hypothesis can be rejected (∂ : H_0= 0) and the alternative hypothesis accepted, i.e. that the previous chains (not containing the root of a unit, i.e. stable at the first difference), the dependent variable (food security coefficient) as well as the independent variables of each (population, local production, available for consumption, quantity of imports).

Co-integration test

When conducting a joint integration test of the variables, the series must be stable at its first difference, i.e. integrated in I (1). After testing the stability of the variables in their first difference, i.e. their integration of I (1),we can conduct the Joint Integration Test based on the Johansen-Juselius test, which is one of the most comprehensive, because it takes small samples and also determines the number of common integration relationships by calculating the statistical value based on the Greater Probability Function (Likelihood Function Maximum), trace test and Maximum Eigen Value as both give the same result (7).

A- **Trace test (Trace)**

It is measured according to the following formula (1):

$$\boldsymbol{\lambda_{\text{Trace}} = -T \sum_{i=r+1}^{n} ln\left(\hat{\lambda}_i\right)}$$

As:

r = Number of common integration vectors

$\boldsymbol{\hat{\lambda}_i}$ = The subjective value of the contrast and contrast matrix

T = Sample size

B- **Maximum Eigen Value test (λ Max)**

It's calculated in the light of the following formula (1):

$$\boldsymbol{\lambda_{max} = -T\, ln\left(1 - \hat{\lambda}_i\right)}$$

Also, the two non-existent (r=0) and alternative assumptions (r ≥ 1) are tested, when the calculated value of the greater possibility test is smaller than the table value, here we accept the null hypothesis and reject the alternative, which means that there is no vector for joint integration, but when the calculated value of the test of greater possibility is greater than the tabulated value, we accept the alternative hypothesis and determine the number of vectors of integration shared between the variables studied. As shows in Table 4 the calculated value of the λ Trace were (177.28 and 52.31). At (at None-most1) is greater than the critical value (69.81 and 47.85) respectively at a significant level of 5% which indicates the rejection of the null hypothesis which states that there is no vector for joint integration (r=0), and we accept the alternative hypothesis that there are two equations of co-integration (r=2) at the significant level 5%, and therefore there is a common integration or long-term balancing relationship. The results of the Max-Eigen test note the calculated value of the greater possibility 124.97 at (None) greater than the critical value 33.87 at a significant level 5%, which means rejecting the null hypothesis that states that there are no number of common integration vectors, and accept the alternative hypothesis that there is an equation of common integration at the significant level 5%. This proves a long-term equilibrium relationship in more than one direction.

Table 4. Results of the (λ Trace) and (λ Max)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.999595	177.2791	69.81889	0.0000
At most 1 *	0.795033	52.31164	47.85613	0.0180
At most 2	0.653000	26.95310	29.79707	0.1028
At most 3	0.427027	10.01819	15.49471	0.2793
At most 4	0.066879	1.107526	3.841466	0.2926
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.999595	124.9675	33.87687	0.0000
At most 1	0.795033	25.35854	27.58434	0.0938
At most 2	0.653000	16.93491	21.13162	0.1751
At most 3	0.427027	8.910665	14.26460	0.2937
At most 4	0.066879	1.107526	3.841466	0.2926
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				

Estimate using ARDL model

The model can be applied to stable integrated variables of the same level, whether integrated at level I (0) or integrated at the first difference I (1) or a combination between them, but provided that they are not integrated at the second difference I (2), and this model is developer of the error correction model, which should be assumed to be integrated variables of the same rank, through which the short-term relationship between study variables as well as the extraction of common integration is estimated according to the boundary test. which proves or negates the long-term relationship between variables. Several attempts were made to reach the best results in terms of conformity with econometrics and free of econometric problems, as shows in Table 5 which shows the results of the estimate obtained using ARDL model using the program (Eviews10), and showed the formula of lagged results (2,2,2,2,1) which means that all variables have 2 laged, and one lagged of the food security variable.

Table 5. ARDL Model results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Y(-1)	-0.480351	0.154504	-3.108997	0.0897
X1	-0.000138	3.17E-05	-4.364171	0.0487
X1(-1)	4.01E-05	3.06E-05	1.311047	0.3201
X1(-2)	0.000123	3.34E-05	3.665679	0.0670
X2	0.000624	0.000202	3.084033	0.0910
X2(-1)	0.001679	0.000237	7.077339	0.0194
X2(-2)	-0.000224	0.000153	-1.458839	0.2820
X3	-0.001321	6.24E-05	-21.15861	0.0022
X3(-1)	-0.000448	0.000178	-2.523298	0.1277
X3(-2)	-0.000625	0.000129	-4.863644	0.0398
X4	0.001153	7.71E-05	14.95857	0.0044
X4(-1)	0.000454	0.000188	2.412763	0.1373
X4(-2)	-0.000203	6.68E-05	-3.031093	0.0938
C	0.094160	0.163355	0.576416	0.6226
R-squared	0.999211	Mean dependent var		0.015288
Adjusted R-squared	0.994081	S.D. dependent var		0.569699
S.E. of regression	0.043830	Akaike info criterion		-3.746420
Sum squared resid	0.003842	Schwarz criterion		-3.070405
Log likelihood	43.97136	Hannan-Quinn criter.		-3.711803
F-statistic	194.7803	Durbin-Watson stat		2.584121
Prob(F-statistic)	0.005119			

Table 5 shows the results of estimating independent variables on the child variable with their slowing periods, and shows that the value of the R^2 was 0.99, meaning that 99% of fluctuations in the dependent variable (food security coefficient) were caused by the variables shown in the model, and that 1% of fluctuations were not included in the model or had absorbed by random variable, and as it turns out that the value of the F statistic to measure the significant of the whole model was 194.78 and it is significant at a significant level 1%, which means a significant relationship between independent variables in the model and the dependent variable also indicate the significant e of the model in estimating short- and long-term parameters.

ARDL analysis and tests

In order to characterize the mathematical model, several tests must be performed =as follows:

A- Autocorrelation test

One of the most important tests is the model error limit serial Autocorrelation test using the Lagrange Multiplier test developed by Godfrey and Breusch, and the test results showed no Autocorrelation using the Lagrange multiplier test and therefore accept the null hypothesis that there is no problem of sequential Autocorrelation of errors in the model as shows in Table 6.=

Table 6. Lagrange Multiplier LM Test

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.560580	Prob. F(1,1)	0.4297
Obs*R-squared	9.751416	Prob. Chi-Square(1)	0.0018

Source: Outputs of Eviews10 program

B- Bounds test

Table 7 shows the F-Statistic was 22.256 appeared and is significant at the level 5% and has proven its significant at acceptable levels and was significant in value when compared with the value of the tabulated F, and the limit test contains two higher limits and lowest calculated F value came above the upper limit at a significant level 5% of 4.37, thus rejecting the null hypothesis, which states that there is no long-term relationship between independent variables and the dependent variable, and accept the alternative hypothesis that there is a long-term equilibrium relationship. Among the explanatory variables towards the dependent variable (food security coefficient) the existence of a common integration relationship between the variables in the model.

Table 7. Bounds Test

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	22.25681	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Outputs of Eviews10 program

C- Heteroskedasticity Test

Table 8. shows that the calculated F value was obtained at 0.1778 and its significant was 0.9826, which is greater than the significant level 0.05, and also confirmed the results the contrast homogeneity test also limits the error that Chi-Square's statistical value of 0.8040 is also higher than its significant level 0.05, so we accept the null hypothesis that there is no problem of heteroskedasticity.

Table 8. Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.177838	Prob. F(13,2)	0.9826
Obs*R-squared	8.578670	Prob. Chi-Square(13)	0.8040
Scaled explained SS	0.234714	Prob. Chi-Square(13)	1.0000

Source: Outputs of Eviews10 program

D- Error Correction Model (ECM)

If the two variables are integrated into a common integration, the error correction model is used to show the equilibrium relationship in the short term, as the model is based on the hypothesis that there is a long-term equilibrium relationship, and although this relationship exists, it is difficult to achieve and thus take (Y) different values from its equilibrium values and represents the difference between the two values at each time by the equilibrium error and the error is corrected or part of it in the long term. So it's called the error correction model, as the model enables us to analyze the behavior of variables in the short term in order to reach a long-term equilibrium, the short- and long-term parameter identification of the relationship between variables requires a vector model to correct ECM error in the estimate. Table 9. shows the short-term equation is shown in the light of the R^2 value of 0.99, which means that 99% of fluctuations in the dependent variable in the short term have been interpreted by the independent variables shown in the model, and that only 1% of fluctuations were not included in the model or absorbed by their random variable effect. CointEq (-1) it was -1.480 which is negative and significant at the level 1%, i.e. there is a long-term equilibrium between variable Y causes in X, this means that the sufficient condition and the necessary condition have been achieved in the estimated model, which means that 148% of short-term errors or unequilibriums can be automatically corrected in less than a year to achieve long-term equilibrium, i.e. they need (1÷1.48=0.6) (0.6*12=7.2) for approximately seven months to correct their

long-term equilibrium position

E- **Test of Normality Distribution For the rest Jarque-Bera:** From Figure 1 we shows that the rest are naturally distributed in the model, and that the value of Jarque-Bera was 3.748, which indicates the acceptance of the null hypothesis , which states that the rests of the estimated model follows the natural distribution because the probability value is greater than 0.05, which confirms the acceptance of the null hypothesis, that random errors are naturally distributed, and therefore this is a good indicator of the estimated model.

F- **CUSUM and CUSUMSQ Cumulative Total And CusumSQ Test:** They are one of the most important tests in the suitability of the model for regression, as CUSUM and CUSSQ testing have been used from structural stability tests of the model in the short and long terms, and as shown in Figure 2 we note from the test results that all transaction values fall within the limits of confidence (critical limits) at a significant level5%, structural stability in the study variables and the harmony of the model in the short and long term, which means that the estimated model is good

Table 9. Error Correction Model (ECM).

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X1)	-0.000138	9.47E-06	-14.58021	0.0047
D(X1(-1))	-0.000123	1.00E-05	-12.22055	0.0066
D(X2)	0.000624	4.95E-05	12.61834	0.0062
D(X2(-1))	0.000224	4.67E-05	4.792285	0.0409
D(X3)	-0.001321	2.45E-05	-54.01553	0.0003
D(X3(-1))	0.000625	3.75E-05	16.65827	0.0036
D(X4)	0.001153	1.88E-05	61.35505	0.0003
D(X4(-1))	0.000203	2.01E-05	10.08455	0.0097
CointEq(-1)*	-1.480351	0.068474	-21.61927	0.0021
R-squared	0.999712	Mean dependent var		-0.050480
Adjusted R-squared	0.999383	S.D. dependent var		0.943197
S.E. of regression	0.023428	Akaike info criterion		-4.371420
Sum squared resid	0.003842	Schwarz criterion		-3.936839
Log likelihood	43.97136	Hannan-Quinn criter.		-4.349166
Durbin-Watson stat	2.584121			

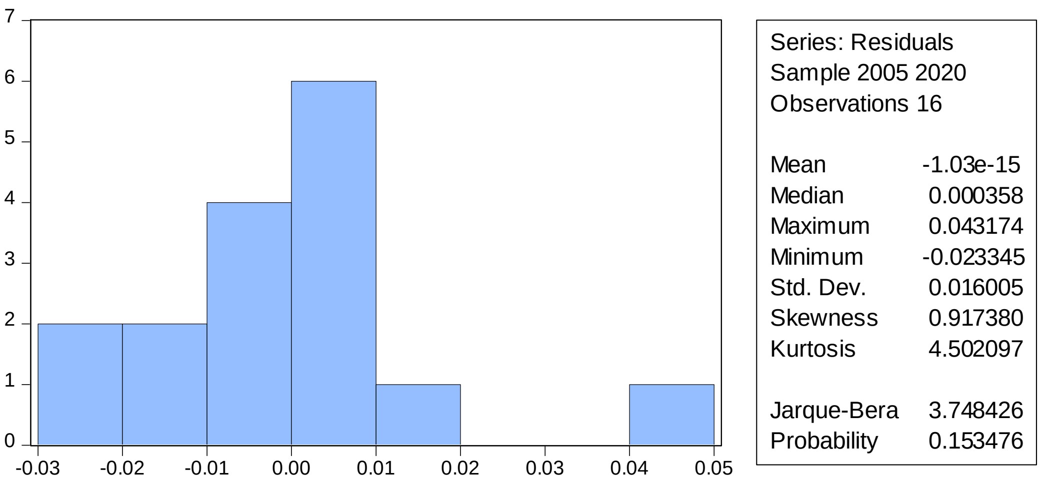

Fig 1.Test of Normality Distribution Jarque-Bera

Source: Outputs of Eviews10 program

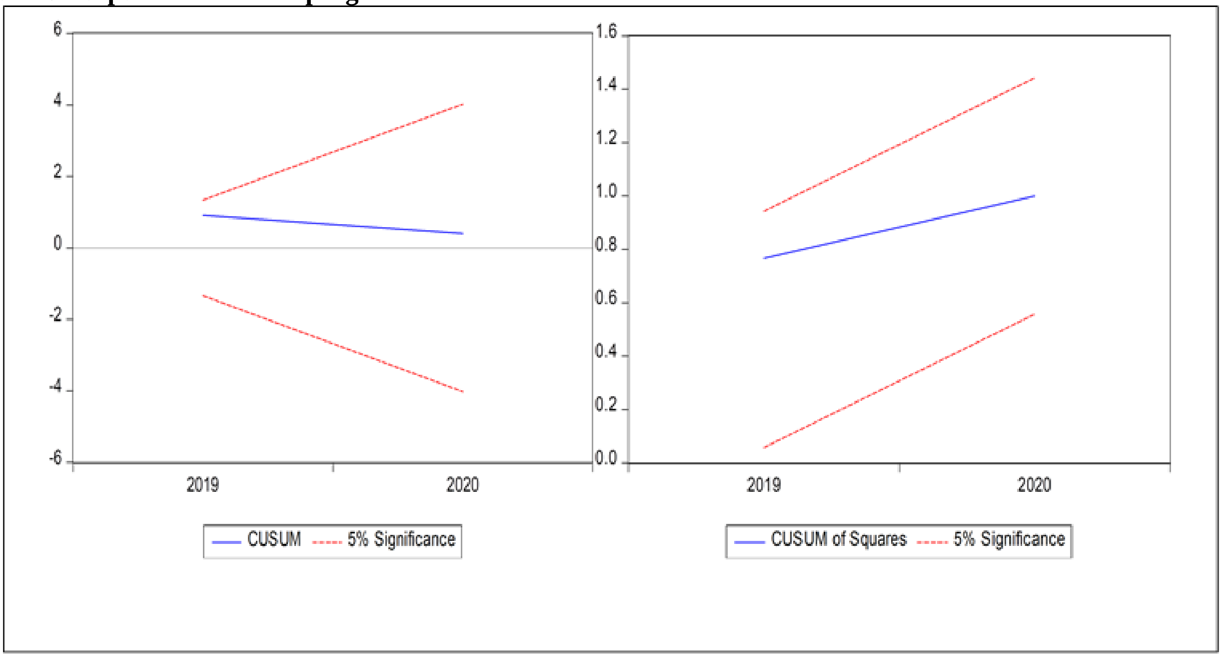

Fig 2. CUSUM and CUSUMSQ tests

Source: Outputs of Eviews10 program.

Long-term equation

From Table 10, we shows the long-term equation or the common integration between the dependent variable and the explanatory variables as follows: (X_1) signal is positive and significant at the level of 5% the positive signal means that there is a direct relationship between the population and the food security coefficient the long term, which means that by increasing the population, the food security coefficient will not decrease from the rice crop, possibly because of increased production or the closing of this increase through imports. The signal of the local production parameter (X_2) was positive and significant at the level 1% and the positive signal means a long-term expulsion relationship between domestic production and food security coefficient in the long term, which means that there is a correlation between production and food security, which makes sense as a result of closing the deficit locally and providing food, while the variable parameter available for domestic consumption (X_3) has appeared negative and significant at the level (1%) and means a long-term reverse relationship between the variables. That is, they move in the opposite direction, which makes sense that increased consumption leads to a decrease in the duration of food security, but the signal parameter of the amount of imports (X_4) appeared positive and significant at the level 1% to indicate a long-term and directly relationship between them. Food security deficits are filled through imports and increased imports to secure stocks increase food security from the crop. After calculating the food security coefficient it was found that Iraq has food security of rice estimated at about six months, which requires maintaining this level of food security and seeking to increase that rate by expanding the cultivation of rice crops or increasing its import for the purpose of enhancing the country's food security from this crop. Through the results it was found that the most important factors that continue to have a long-term impact on food security coefficient are (population, local production, available for consumption and quantity of imports) all of which have a positive impact on food security except for the variable available for consumption of rice, as its impact is negative and corresponds on economic logic.

Table 10. Long-term equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	1.65E-05	3.43E-06	4.818365	0.0405
X2	0.001405	0.000194	7.232891	0.0186
X3	-0.001618	7.37E-05	-21.95554	0.0021
X4	0.000948	9.60E-05	9.879622	0.0101
C	0.063607	0.108502	0.586227	0.6171
EC = Y - (0.00001*X1 + 0.0014*X2 -0.0016*X3 + 0.0009*X4 + 0.0636)				

Source: Outputs of Eviews10 program

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