AN ECONOMIC STUDY OF THE RELATIONSHIP BETWEEN AGRICULTURAL IMPORTS AND AGRICULTURAL PRODUCT IN IRAQ FOR THE PERIOD 1991-2018 USING TODA-YAMAMOTO CAUSALITY TEST

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ABSTRACT

This study aims to analyze empirically the causality relationship between agricultural imports and agricultural product in Iraq for the period 1991-2018 basing on the causality developed by Toda – Yamamoto. Results indicated that there is a bidirectional causality relationship between agricultural imports and agricultural product, throw the value of chi-square which was 5.6 in case of the dependent variable is agricultural product, and this value was significant at 5% level. While the value of chi-square was 6.2 in case of the dependent variable is agricultural imports, and it is significant also at 5% level. That means there is a bidirectional causality relationship between the two variables in Iraq. The study recommended that it is necessary int to interest to import the investment agricultural goods in order to support agricultural production, and to increase the level of self-sufficiency in Iraq.

Keywords: Stationary, Lag, Foreign trade, Bidirectional.

دراسة اقتصادية للعلاقة بين الاستيرادات الزراعية والناتج الزراعي في العراق للمدة 1991 – 2018 باستخدام اختبار سببية تودا – ياماموتو

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المستخلص

تهدف هذه الدراسة الى التحقق من وجود واتجاه العلاقة السببية بين الاستيرادات الزراعية والناتج الزراعي في العراق للمدة 1991 – 2018 بالاستعانة بالسببية المطورة من قبل Toda – Yamamoto وتوصل البحث الى وجود علاقة سببية باتجاهين بين الاستيرادات الزراعية والناتج الزراعي قيد الدراسة اذ بلغت قيمة Chi–sq حوالي 5.6 في حال كون الناتج الزراعي متغير تابع وهي معنوية على مستوى 5%، وبلغت Chi–sq حوالي 6.2 في حال كون الاستيرادات الزراعية متغير تابع وهي معنوية على مستوى 5% ايضاً، وهذا يعني وجود علاقة سببية ثنائية الاتجاه (Bi–Directional) بين الاستيرادات الزراعية والناتج الزراعي في العراق، واوصت الدراسة بالاهتمام باستيراد السلع الزراعية الاستثمارية وذلك لدورها في دعم الناتج الزراعي ورفع مستوى الاكتفاء الذاتي في البلد.

كلمات مفتاحية: استقرارية، إبطاء، التجارة الخارجية، ثنائية الاتجاه.

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INTRODUCTION

Foreign trade is the engine of economic growth in all countries of the world, it is expanded significantly between countries because the increasing in production and easiness of transportation, as well as the emergence of economic blocs and the World Trade Organization. Agricultural imports are considered as a part of the agricultural activity, through the role they play in providing agricultural and food commodities to face the deficit in agricultural products and meet increasing in demand of these products and bridging the gap between supply and demand due to the increase in population and the high levels of income, as well as, the providing the raw materials of agriculture to the agricultural production process from outside, in addition the expansion of modern technological imports will encourage the expansion of agricultural investment and thus lead to better production quality and quantity, which leads to growth in agricultural product in developing countries. The imports control has undesirable economic effects, as it has negative effects on the national economic sectors, which is reflected negatively in the declining in income and employment (11). The trade of agricultural goods and foodstuffs is one of the most important items of the global trade because it is related to meeting the increasing demand of these commodities in order to provide food security (8). Agriculture has become increasingly important recently due to the existence of a large and significant food gap in the national economy in the major cereal crops, which makes food security one of the most important priorities that should be addressed, and narrowing the gap and achieving self-sufficiency in major crops (9). The Iraqi market still suffers from severe dumping in agricultural products as well as very small contribution of agricultural exports within the total exports of Iraq and a persistent deficit in the agricultural trade balance, with these enormous resources when the deterioration in the agricultural sector in Iraq happen, it is certain that the policy of agriculture in its various aspects bear the greatest burden in this deterioration (1). The growing capacities of developing countries to secure agricultural growth requirements is closely linked to agricultural imports to ensure the flow of capital and intermediate goods needed to implement the agricultural growth programs(5). Historically, high agricultural growth and increased national incomes rates have affected the pattern of foreign agricultural traders in light of contemporary international changes (6). The importance of research comes from that agricultural imports being one of the most important economic activities in Iraq through their role in providing agricultural commodities to fill the gap of domestic demand for them as a result of increasing population and high incomes as well as providing the necessary inputs in the process of agricultural production, as the increasing of agricultural imports led to the high competition of imported products for local products and the deterioration of local production, which requires to stand on the most important in this matter, in addition to its role in providing modern necessary agricultural techniques which are important to growth and development of the agricultural sector in Iraq. Agricultural imports reflect the demand for foreign goods, which increases the demand for foreign currencies and causes a rise in foreign exchange rates relative to the local currency, and thus adversely affects the agricultural trade balance. The agricultural sector in Iraq contributes only few percentages of production to meet the country's need for food products. This has led to the importation of various types of food products such as fruits, vegetables, cereals, white and red meat, in addition to the inputs of agricultural production. Inefficient management of the agricultural sector and the decrease in prices of imported products versus local products besides (dumping policy) reducing the efficiency of agricultural production and consequently lowering self-sufficiency from agricultural products (10). This making import-related policies and decisions were weakly affecting overall agricultural economic development, and inability of agricultural imports to creating desired growth in the agricultural sector. The research hypothesized a causal relationship between agricultural imports and agricultural product during the studied period, as agricultural imports will assume to cause an increase in agricultural

GDP, especially the import of agricultural investment goods such as agricultural machinery and equipment as well as production requirements such as improved seeds, types of fertilizers, pesticides and new irrigation techniques on the one hand, also import of modern agricultural techniques on the other hand, especially with high productivity per acre of grain crops such as wheat. The research trying to show the reality of the structure of agricultural imports and agricultural product in Iraq and highlight the most important variables during the period studied, and analyze the causal relationship between agricultural imports and agricultural product and determine which affects the other by applying the causality of Toda-Yamamoto. The most important research and studies conducted in this regard was Uğur study about the relationship of imports and economic growth in Turkey via using the multi-regression vector Multivariate VAR. The study found a bidirectional relationship between GDP and imported investment goods and a one-way relationship between GDP and imported consumer goods (17). Erkisi also examined the relationship of trade liberalization to economic growth in the transitional economies of European states for the period 1995 - 2016 for several variables including imports, he found that imports lead to an increase of 0.11% of GDP (4). Guru-Gharana and Deergha studied the econometrical analysis of the relations between export and import, with foreign direct investment and GDP in China by applying the causality of Toda-Yamamoto (7). Al-Fatlawi and Shaker in 2016 studied the causal relationship between exports, imports and economic growth in Iraq for the period 1980 – 2013, and the results showed the existence of a causal relation, that each one of them effects the other (2). In 2016, Rashid published a research entitled analysis of the relationship between Iraq's foreign trade and economic growth for the period 1980-2013, by using the exports, imports, exchange rate and GDP, to verify the existence of a co-integration relationship between them. The results showed a long and short term relationship between them (14).

MATERIALS AND METHODS

Theoretical and Econometrics Framework

Toda - Yamamoto Causality Test

Granger causal models suffer from the problem of instability, and the difficult part in this test when applied to several variables is the difficulty of ascertaining the relationship of co-integration and how to correctly estimate the VAR model when the system is self-contained (13). - Yamamoto overcome the problem of the inappropriateness of the critical values approach when applying causality testing with unstable data or even involving common integration. One of the benefits of this methodology is that it makes Granger causality easier. Researchers do not have to test co-integration or convert the VAR self-regression model into the VECM error correction model(16). The test is carried out through the following steps (15):

1- Determine the degree of integration and deceleration between the variables according to the self-regression formula for each variable. The Schwarz Information Criterion is used to determine the deceleration of the variables

2- VAR model is estimated

3- The relationship between the variables is estimated at a lag (k + dmax). This means that k ≥ dmax and Wald count, which follow the distribution of χ^2 with a degree of freedom equal to the number of views and express the model for two variables as follows:

$$Y_t = a_1 + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{i=k+1}^{k+d_{max}} \beta_i Y_{t-i} + \sum_{i=1}^{k} \lambda_i X_{t-i} + \sum_{i=k+1}^{k+d_{max}} \lambda_i X_{t-i} + \mu_t$$

$$X_t = a_2 + \sum_{i=1}^{k} \Psi_i Y_{t-i} + \sum_{i=k+1}^{k+d_{max}} \Psi_i Y_{t-i} + \sum_{i=1}^{k} \zeta_i X_{t-i} + \sum_{i=k+1}^{k+d_{max}} \zeta_i X_{t-i} + \upsilon_t$$

where:

a_1, a_2, β, λ, ψ and ζ: model parameters.

μ & υ: error limits by total and center zero account each.

This method tests the null hypothesis that there is no causal relationship going from X to Y which can be formulated as follows:

$$\boldsymbol{H_0 : \lambda_i = 0 \; \forall \; i = 1, 2, \dots, k}$$

The main objective of the test is to ascertain the nature of the relationship between agricultural imports and agricultural product and to determine the direction of any possible relationship between them. The reason for this is to avoid any possibility of spurious causality (3).

LR: Sequential modified LR test statistic (each test at 5% level)

FPE: Final Prediction Error

AIC: Akaike Information Criterion:

$$\ln\left|\sum \varepsilon\right| + \frac{2k^2P}{T}$$

SC: Schwarz information Criterion:

$$\ln\left|\sum \varepsilon\right| + \frac{2logT}{T}k^2P$$

H. Hannan-Quinn information criterion:

$$\ln\left|\sum \varepsilon\right| + \frac{k^2Pln(T)}{T}$$

Where: k number of variables, T number of observations, P number of time lags, $\Sigma\varepsilon$ variance matrix and co-variance of residuals. The last step is the process of estimating the trend of causality by the Toda-Yamamoto method between agricultural imports (LM) and agricultural product (LA). This test is subject to Chi-square distribution. The adoption of the Toda-Yamamoto version of the Granger non-causality test for two vectors of the autoregressive vectors (d_{max} = 1 and k = 1) follows the following system of equations (13):

$$\begin{bmatrix} E_t \\ Y_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + \sum_{i=1}^{2} \begin{bmatrix} E_{t-i} \\ Y_{t-i} \end{bmatrix} \begin{bmatrix} \beta_{1i} & \gamma_{1i} \\ \beta_{2i} & \gamma_{2i} \end{bmatrix} + \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{bmatrix}$$

Where: $E_T(\epsilon_t) = \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{bmatrix} = 0, \;\; E(\epsilon_t, \epsilon_t') = \Sigma$

To test that agricultural imports do not cause agricultural product, a self-regressive vector model has been estimated that agricultural product does not include agricultural imports.

This means that agricultural imports do not appear in the agricultural product equation.

$H_{0:}\ \gamma_{11} = \gamma_{12} = 0$

$H_{1:}\ Y_t$ does *Granger-cause* X_t, if $\sum_{j=1}^{l} \gamma_1 \neq 0$

The same case at the agricultural import equation, the *null hypothesis* as follows:

$H_{0:}\ \beta_{21} = \beta_{12} = 0$

$H_{1:}\ X_t$ does *Granger-cause* Y_t, if $\sum_{j=1}^{l} \gamma_2 \neq 0$

The existence of causality between agricultural imports and agricultural product is based on the rejection of the null hypothesis.

*First, there is a one-way causal relationship (Uni-directional) from agricultural imports to agricultural product

*Second: Uni-directional causal relationship from agricultural product to agricultural imports.

*Third, there is a bi-directional causal relationship between agricultural imports and agricultural product.

*Fourth: the absence of a causal relationship between agricultural imports and agricultural product.

RESULTS AND DISCUSSION

Agricultural product in Iraq for 1991-2018

The Iraqi agricultural sector faces many problems and challenges that have increased their impact with the successive years of drought, the fluctuation of rains, and the various environmental, political and demographic changes. There is an urgent need to developing new and effective strategies and policies to development the agricultural sector which they are capable of responding to the requirements of development and balancing the economic dimension (increasing returns and competition ability) with social and environmental dimensions in the short and long terms, and integration of agriculture with other sectors of the economy.

Table 1. Agricultural production in Iraq for the period 1991 – 2018 (Million Dollar)

Year	Agricultural Product	Annual growth (%)
1991	662.91	-
1992	1,089.18	64.3
1993	673.84	-38.1
1994	728.22	8.1
1995	823.34	13.1
1996	1,033.32	25.5
1997	867.69	-16.0
1998	1,153.32	32.9
1999	1,258.93	9.2
2000	971.74	-22.8
2001	1,484.45	52.8
2002	1,794.92	20.9
2003	1,999.95	11.4
2004	2,542.17	27.1
2005	3,440.32	35.3
2006	3,775.58	9.7
2007	4,379.37	16.0
2008	4,785.62	9.3
2009	6,769.09	41.4
2010	7,150.63	5.6
2011	8,477.19	18.6
2012	8,990.95	6.1
2013	11,188.56	24.4
2014	11,259.54	0.6
2015	6,990.95	-37.9
2016	6,626.10	-5.2
2017	6,268.22	-5.4
2018	4,380.67	-30.1

Source: Iraqi Ministry of Planning/ COSIT

The average agricultural product in Iraq during the period studied was about 3.8 billion dollars, with values ranged from 663 million dollars at minimum in 1991, because of the economic sanctions imposed on Iraq at that time, and a maximum of 11.2 billion dollars. Figure 1 shows the rise of the value of agricultural product in Iraq gradually because of the dependence on the agricultural sector to meet the domestic demand from food commodities until 2014, which it is reaching the highest value 11.2 billion dollars, but the security conditions that plagued Iraq has led to a decline in the value of agricultural product to about $ 7 billion in 2015 with a negative annual growth of -37.9%.

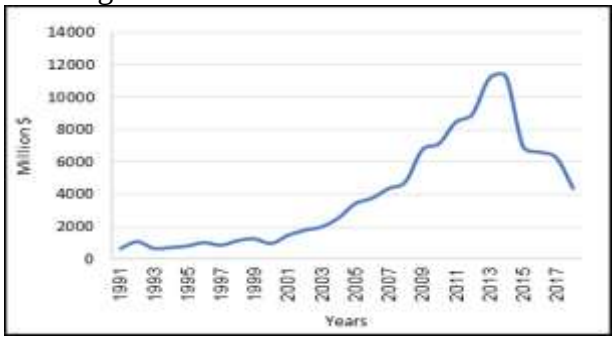

Figure 1. Agricultural product in Iraq

Source: Based on table (1)

Agricultural imports in Iraq for 1991-2018

Agricultural imports faced a significant fluctuation during the period, as shown in figure 2, they were low during the period of economic sanctions extended from 1991 to 2002 and reached its lowest value in 1998 by about 97 million dollars, which reflects the country's dependence on local agricultural production, to meet the demand for food commodities, then began to rise gradually as shown in table 2.

Table 2. Agricultural imports in Iraq for the period 1991 – 2018 (Million Dollar)

Year	Agricultural Imports	Annual growth (%)
1991	169.20	-
1992	196.65	16.2
1993	941.24	378.6
1994	585.30	-37.8
1995	638.45	9.1
1996	445.57	-30.2
1997	278.99	-37.4
1998	97.19	-65.2
1999	161.41	66.1
2000	187.94	16.4
2001	241.87	28.7
2002	1,645.73	580.4
2003	1,587.66	-3.5
2004	2,274.16	43.2
2005	3,042.01	33.8
2006	3,085.29	1.4
2007	2,951.29	-4.3
2008	5,305.44	79.8
2009	4,396.18	-17.1
2010	1,930.51	-56.1
2011	10,553.25	446.7
2012	4,447.63	-57.9
2013	2,762.15	-37.9
2014	2,185.34	-20.9
2015	2,907.03	33.0
2016	1,924.73	-33.8
2017	3,659.95	90.2
2018	3,529.65	-3.6

Source: Iraqi Ministry of Planning/ COSIT

However, the most important characteristic of the studied period is the high relative changes for the years (1993, 2002 and 2011) by about (378%, 580%, and 446%) respectively, which are reflect the absence of vision and planning among decision makers, while the highest value of agricultural imports in 2011, they amounted to 10.6 billion dollars, and it is the highest value of agricultural imports during the period, an annual change rate was 446.7% for the year 2010, which was estimated at 1.9 billion dollars, and this is due to the import of 11.9 million tons of rice by about 4.6 billion dollars, and also purchasing of 9.5 million tons of wheat by about 2.51 billion dollars from different countries and that consisted 67% of

the total agricultural imports for the year 2011. Then agricultural imports returned to their normal levels, and reaching about $ 4.5 billion in 2012 as shown in figure 2.

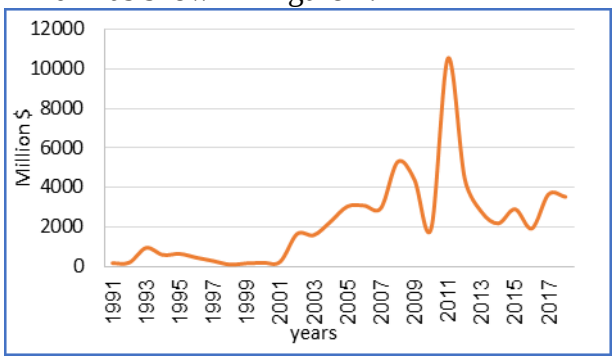

Figure 2. Agricultural imports in Iraq

Source: Based on table 2.

Optimal Lag Determination

Table 3 shows, that the optimal lag period is 1 based on all the criteria applied to it, including the SC standard, which is reliable in such test because it is the most sensitive to the lag intervals (12).

Table 3. Results of VAR analysis

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-56.24408	NA	0.439558	4.853673	4.951844	4.879718
1	-16.18926	70.09593*	0.021840*	1.849105*	2.143619*	1.927240*
2	-14.29529	2.998782	0.026285	2.024608	2.515464	2.154832
3	-12.44943	2.614971	0.032169	2.204119	2.891317	2.386433
4	-7.086619	6.703516	0.029948	2.090552	2.974092	2.324955

Source: Outputs of Eviews 10 Program, *: represent choices for optimal lag

Time series stationary test

A time series stationary test was conducted, table 4 shows the test results of the studied economic variables, to verify at which level the data stationary and from which value of d_{max} can be determined. The test results were as follows:

Table 4. PP test results of stationary

		I (0)		Δ	
		LA	LM	d(LA)	d(LM)
With Constant	t-Statistic	-1.3792	-1.7017	-5.5256	-6.1018
	Prob.	0.5773	0.4191	0.0001	0.0000
		N0	N0	***	***
With Constant & Trend	t-Statistic	-0.5398	-2.2590	-5.5462	-6.0241
	Prob.	0.9747	0.4405	0.0007	0.0002
		N0	N0	***	***
Without Constant & Trend	t-Statistic	1.2859	0.6053	-5.3562	-6.0461
	Prob.	0.9456	0.8410	0.0000	0.0000
		N0	N0	***	***

*****: significant at 1%, No: not significant.**

Source: Outputs of Eviews 10 program

As we note the stationary of the data for the two variables achieved when we apply the first difference at 1% level of significant, so the value of d_{max} is 1.

Toda-Yamamoto Causality Test

It is noticed from the test results that the statistical value of Chi-sq was 5.6 with probability of 0.05, so it is significant at the level of 5%, therefore we accept the alternative hypothesis that there is a causal relationship between the dependent variable (agricultural product) and the independent variable (agricultural imports). In the same way, the output shows that in case of agricultural imports represented as (dependent variable) and agricultural product represented as (independent variable), the value of Chi-sq about 6.2, Therefore, we also accept the alternative hypothesis that there is a causal relationship between the two variables. Overall conclusion that there is a bi-directional between agricultural imports and output the agricultural as in table 5.

Table 5. Toda-Yamamoto Causality Test

Dependent variable: LA			
Excluded	Chi-sq	Df	Prob.
LM	5.645962	2	0.0594
Dependent variable: LM			
Excluded	Chi-sq	Df	Prob.
LA	6.205647	2	0.0449

Source: Outputs of Eviews 10 Program.

So, we can reach to couple of conclusions that carry the answer to the problem of research, and test hypothesis that have been put forward and the research included:

The hypothesis of the study is that there is a causal relationship that goes from agricultural imports to agricultural product was proved. Moreover, there is a causal relationship from the other direction, that is, agricultural product causes agricultural imports. The importing of agricultural investment productive goods has a

positive aspect in increasing agricultural product such as various types of irrigation systems as well as high-yield seeds and good and safety pesticides, can lead to achieve significant increases in agricultural product, which is notable in way of increasing the productivity especially by strategic crops such as wheat, corn, barley and rice etc. We recommended to whom in charge to care of modern agricultural technologies because of its positive impact on agricultural product, and raise the awareness of farmers in this aspect through seminars, conferences and media. also reconsidering the tariff structure for importing agricultural commodities and trying to reduce it for investment goods and raise them for consumer goods to support the domestic production.

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