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ANALYSIS OF CAUSAL AND INTEGRATIVE RELATIONSHIP BETWEEN INFLATION, TERM OF TRADE AND FOOD PRICES IN IRAQ FOR 2000-2021

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ABSTRACT

This study mainly aims to shed light on the evolution of the inflation rate and analyze the relationship between food prices and terms of trade and the inflation rate in Iraq by analyzing the cointegration and measuring the causal relationship between them in the period 2000-2021. To achieve this, the Johansen Integration test, and the Granger methodology for causality developed by Toda and Yamamoto, was used. The research found the existence of cointegration between the variables through three equations with a significant level of 5%, as it was based on the values of the trace coefficient (8.05, 18.3, 46.1) according to the Trace test, and the existence of two equations for cointegration at the same level of significance according to the Max-Eigen Test of (0.0045) at (at most 2). The research also found the existence of a causal relationship in one direction of food prices towards the term of trade and a Bi-directional causal relationship between the food price and the rate of inflation in Iraq. In light of this, the study recommended adopting structural reforms by the government that help overcome the economic distortions that caused significant rises in inflation rates.

Keywords: Stationary, foreign trade, optimum lag, complementary interactive.

INTRODUCTION

Food prices and foreign trade are closely related in which both the supply and demand for food products in world markets are affected. Since countries rely on foreign trade to meet their food needs, changes in global food prices become an important factor affecting national economies and food security. For example, the cost of importing food increases, affecting the state's general budget and its ability to meet the needs of people. It may also lead to increased inflation and a decline in the purchasing power of consumers. Moreover, higher food prices may increase demand for domestic products, reducing the quantities available for export, and this can negatively affect the country's trade revenues and reduce the surplus of foreign trade. On the other hand, food prices and foreign trade are affected by multiple factors such as agricultural policies, production technologies, global economic and political developments, climatic conditions, natural disasters and others. Understanding this complex relationship requires continuous monitoring and analysis of the effects of these factors and their developments on global markets. Price fluctuations are one of the basic characteristics of agricultural markets, so the analysis of food price volatility is a very important topic in the economy, as the price has an active role in economic theory led by both production and consumption. But other factors may affect the decisions of both the producer and the consumer at the internal level in addition to the price, government policies, personal preferences of farmers, and the impact of climate, soil and the abundance of agricultural equipment greatly affect the nature of agricultural products produced by the farmer every year. On the other hand, the consumer is affected by factors that guide his consumption pattern, such as advertisements for agricultural goods, the style of display, such as packaging and others.

Some factors can determine the role of price for the producer and the consumer. If consumers become more luxurious, purchases of food products may be less responsive to price changes. As for the agricultural product, it may have high fixed investments, so its production becomes less responsive to price changes. That is, it must continue to produce a certain commodity within reasonable limits despite the low price to recover part of the fixed cost (Al-Zobaie, 2014).

The rise in food prices has several effects, including medium- and long-term effects, which are mainly related to the volume of food commodity supply, resource allocation and crop compositions, including short-term effects on demand and consumption of food

commodities, food expenditure, food quality, per capita income and poverty level, and trade balances at the level of economies (League of Arab States, 2009).

When deriving theoretical tables of individual consumer demand, prices are treated as given, so the quantity demanded is a function of price only. Causality is seen as extending from prices to quantities, however, in practice for market demand relations, prices and quantities can be determined simultaneously. For agricultural products in particular, the causal relationship may extend from changes in quantities to changes in prices, as in perishable goods such as liquid milk. In both cases, there is no problem in determining an inverse demand function, since P equals the price and Q equals the quantity demanded (Tomek and Kaiser, 2014).

The supply of the agricultural commodity is subject to the so-called Cobweb Theorem, which states that the price response for the current season is in the next season, which is that quantity that is offered in the market at a specific time and at a specific price, and the hypothetical relationship between price and supply is a direct relationship, the higher the price of the agricultural commodity leads to an increase in the quantity offered of that commodity, and there are many elements related to supply, the most important of which is what follows (Al-Attabi, 2022):

- The level of availability of raw materials necessary for agricultural production processes.
- The level and quantity of imports of this commodity, the more imported quantities of a specific agricultural commodity, the more supply in the agricultural market of that product.
- The available areas of agricultural land for the cultivation of this commodity or the cultivation of some or all of its components (as is the case in food processing products), and the more available areas of agricultural land lead to an increase in the volume of supply of the agricultural commodity.
- The extent of the spread of agricultural pests that affect the crop, the more spread of these pests, the less the supply of agricultural products.
- The nature of the climate and environmental conditions, as each type of agricultural product requires specific climate conditions, and the lack of these conditions affects the size of the supply of this or that type.

Most political leaders generally assume that price stability is the desired aspect of their economy, so they devote a lot of resources to achieving this. Economists are increasingly skeptical about the desire or feasibility of long-term price stability. Price stability at the global level is difficult due to short- and long-term difficulties for both supply and demand. Price stability at the domestic level is easier as international trade can be used as a "counterweight", in contrast to international price stabilization projects that must rely on inventory to adjust changes in supply and demand. As the economist Johnson pointed out in the early seventies, the world market price has gradually become unstable, and this increases the pressure on the countries of the world to cut the link between their internal prices and world prices. This eventually led to the price stability of food commodities becoming a luxury that only some rich countries such as Japan, Europe and America could provide. Thus, different countries cannot guarantee long-term price stability at low prices – lower than the global market. All experiments guaranteed prices above the level of global market trends (Al-Zobaie, 2014).

The research analyzed the relationship between food prices and the rate of trade and their relationship to price inflation to see the role of each in causing the other and find the complementary interactive and mutual relationship between these factors, as the rate of trade as it is known refers to the value of goods and services traded between countries. Trade exchange can affect food prices through several ways, if the country's imports of food increase significantly, this may lead to an increase in demand for food products hence the increase in prices. Similarly, if a country's agricultural exports increase, there could be pressure on the domestic supply of food and lead to higher prices.

Walsh in 2011 addressed the Role of Food Prices in Inflation and found that food prices are excluded from inflation metrics monitored by policymakers, either because of their temporary nature or high volatility. However, in low-income countries, food price inflation is not only more volatile but also on average higher than non-food inflation. Food inflation is in many cases more stable than non-food inflation, especially given the rise in global commodity price inflation in recent years, a policy focus on measures of core inflation that excludes food prices can misdefine inflation, leading to higher inflation expectations, a downward bias for predictions of future inflation and a slowdown in policy response. When developing measures of core inflation, the researcher recommended that policymakers should not assume that excluding food price inflation will provide a clearer picture of underlying inflation trends than macro-inflation (Walsh, 2011).

Gad and Atallah, in 2021, researched general inflation and food prices on economic stability in Egypt and concluded that the variable of the percentage of monetary overflow, followed by the variable of the size of the monetary reserve, is one of the most important determinants that affect domestic inflation. The domestic price gap has a positive impact on domestic inflation, but the foreign price gap has a smaller impact on the level of inflation prevailing in Egypt (Gad and Atallah, 2011).

FIRSTLY: MATERIALS AND METHODS

1. Food prices, term of trade and inflation in Iraq through 2000 - 2021

The Food Price Index (FPI) is a measure of the monthly change in international prices of a basket of food commodities. It consists of an average of five price indices for the group of commodities weighted by the average export shares for each group during the period (2014-2016) as a basis. According to FAO, the index includes (Meat, Dairy, Cereal, Oil and Sugar). Shocks caused by rising global food prices have been transmitted to domestic food prices in almost all MENA countries (Ianchovichina, 2011). It is clear from Figure 1 that food prices were characterized by fluctuation and rise in the general trend and witnessed sharp fluctuations during the period from 2007 to 2015 reflecting the global food crisis from the end of 2007 to reach its maximum level in 2011 with a value of 131.8 The crisis has affected various countries and inflicted the most severe damage, according to FAO reports, on poor countries (FAO, 2011) High prices, even for short periods, may lead farmers to sell their productive assets, sometimes land and livestock, if they cannot obtain loans for inputs, and this can lead to lower production (Al-Attabi, 2022).

The terms of trade are the ratio of the total indicators of commodity exports and imports, and this indicator is based on the prices of six commodity categories (food, fuel, agricultural raw materials, minerals, gold, and beverages (Aizenman, et al, 2012). As for the total trade exchange rate, it is the ratio of the indices of the quantity of exports to the import indices of the country concerned (Al-Badri, 2020):

$$GBTT = (Q_x/Q_m) * 100$$

Q_x: Quantity of Agricultural Exports Index, Q_m: Quantity of Agricultural Imports Index.

The larger the result (greater than 100), the more favorable the State under study, and this relationship represents the number of units exported by the country for each imported unit, whether the value of exports is smaller, greater or equal to the value of imports.

The agricultural trade exchange rate GBTT was affected in one way or another by the tensions that occurred at the level of prices and quantities globally during the study period, we see that it fluctuated significantly between the upper limit of 185.4% in 2003 and the minimum of 11.5%, and it is noted that most of the years of study were in the interest of Iraq, as we see that the value of the index is less than 100 in most years, as shown in Figure 1. The decrease in the index of agricultural exports, which was reflected in the value of the index, means obtaining fewer quantities of agricultural imports in exchange for more quantities of agricultural exports.

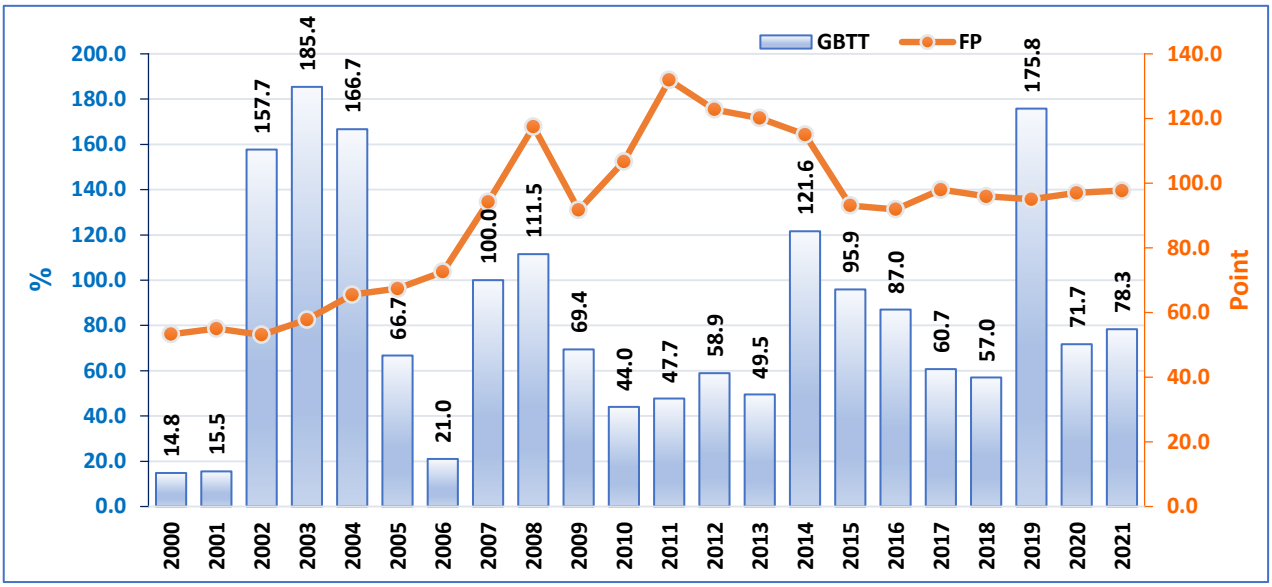


Figure 1. Food prices FP and the agricultural gross trade exchange rate (GBTT).

Resource: By Authors based on FAO data.

Inflation represents cases of economic imbalance in the markets of goods, services and factors of production, and it is caused by imbalances between cash flows and flows of goods and services in the market, as the increase in cash flows is at a higher pace than the increase in commodity and service flows, which leads to the emergence of inflation in the economy concerned, and even turning it into a phenomenon that that economy suffers from with the permanence of high money supply compared to commodity supply in the market, which is three types of moderate, fast and unbridled and each Among they are its details and characteristics (Samuelson and Nordhaus, 1995). The hyperinflation that Iraq was exposed to in the nineties of the last century had negative repercussions on economic indicators such as the exchange rate, interest rate and others, and caused confusion to the financial and monetary policy in Iraq during the nineties greatly affected the freedom to follow its tools in order to achieve stability in the general level of prices and reduce inflation, as the Iraqi economy faced a sharp and continuous rise in prices resulting from the economic sanctions imposed since August 1990, which resulted in a significant decrease in the country's public revenues (which oil is the most important source) in exchange for increasing government spending, that contributed to increasing the budget deficit, which prompted the government at the time to print large quantities of currency without considering the actual market need, as well as the application of some policies such as the policy of supporting strategic agricultural crops and buying them from farmers at encouraging prices (Al-Badawi, 2022) With the beginning of the third millennium, the Iraqi economy witnessed a major

transformation after the military operations in March 2003 and the subsequent change of the political system, which led to a change in the economic system and the trend towards a market economy, the lifting of economic sanctions and openness to the outside world, as well as the impact of increasing total spending, which was a reflection of the expansion of the phenomenon of government current spending, due to the increase in salaries and wages, which led to an increase in aggregate demand pressures and a rise in the general level of prices and then an increase in inflation rates. Which increased from 12.17% during the period from (1998-2001) to 29.21% during the period from (2002-2005) on average, as shown in Figure 2.

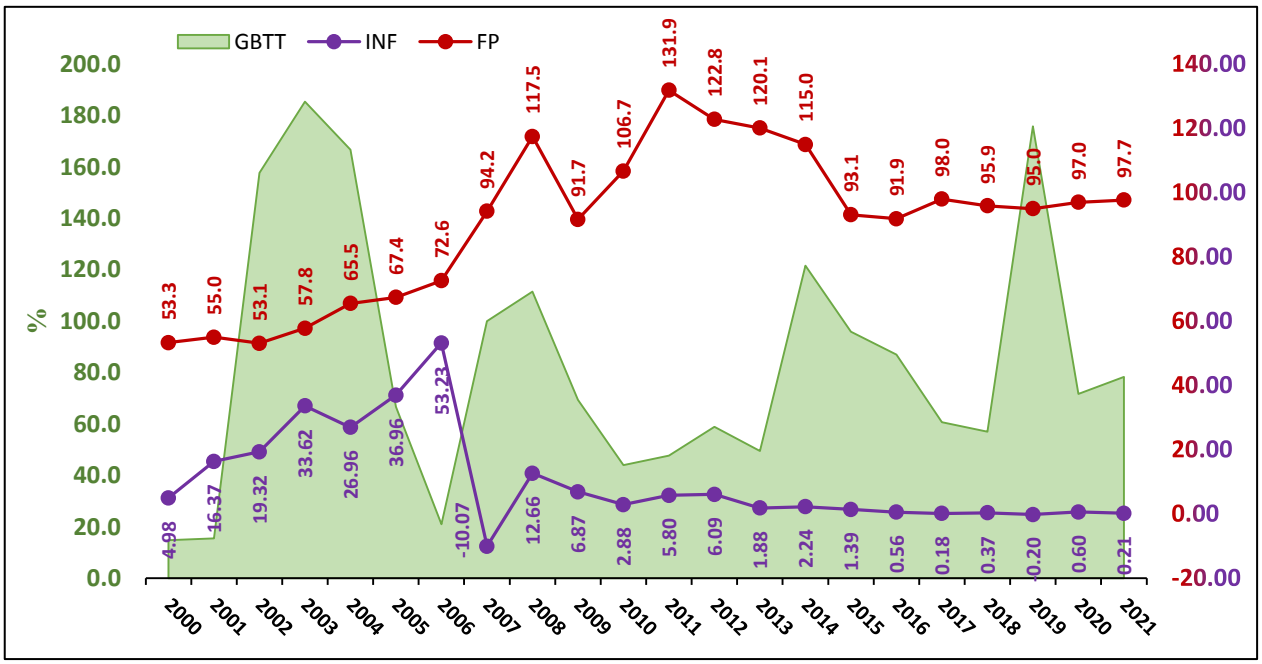


Figure 2. Inflation and term of trade in Iraq.

Resource: By Authors based on FAO data.

2. Co-integration

Among the most important tests of cointegration is the Johansen and Juselius test (Johnson,1990), which uses the Trace test, and the Full Information Maximum Likelihood (FIML) method in the case of multiple variables, and all variables are treated as internal variables, and show whether there is a long-term equilibrium relationship or not (Al-Taei and Al-Shammari, 2014):

3. Trace Test, calculated as follows:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} ln\,(1 - \hat{\lambda}_{r+1})$$

T: sample size, *r*: number of cointegration vectors.

The null hypothesis states that there are cointegration vectors equal to at most r, i.e. the number of these vectors is equal to or less than r.

4. Maximum Eigen Test:

It is calculated in the following formula:

$$\lambda_{max}\,(r, r+1) = -T\ln(1-\hat{\lambda}_{r+1})$$

If the value of the percentage of the possibility exceeds the critical value at a certain significant level, we reject the null hypothesis, which indicates the absence of any vector for cointegration, but if it is less, we cannot reject the null hypothesis that there is at least one vector for cointegration.

5. Toda – Yamamoto causality test

The causal relationship is a cause-effect relationship, *X* (partially) causes *Y* if *Y* (partially) is a result of *X*, and the term "partially" was used because it is rarely one of the factors that are the unique source of the relationship, and to discover the causality of the relationship between the study variables or not, an important test has been resorted to in the econometric literature, which is the Toda-Yamamoto test, that is based mainly on the famous Granger test (Toda and Yamamoto, 1995). The test is applied by the following steps (Al-Attabi et al, 2019):

- The degree of integration and deceleration between variables is determined according to the subjective regression of each variable and the Schwarz Information criterion is used to determine the deceleration of variables, so we get the deceleration *k*, and the upper limit of data stability d_{max}.
- The VAR model is estimated.
- The relationship between the variables is estimated by deceleration ($k + d_{max}$), which means that $k \geq d_{max}$, and we adopt the Wald statistic, which follows the χ^2 distribution with a degree of freedom equal to the number of observations, and the model for two variables is expressed as follows:

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

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

a_1, a_2, β, λ, ψ and ζ model estimators, μ & υ error terms with a sum and a mean of zero for each

This test is based on the null hypothesis that there is no causal relationship from *X* to *Y*, which can be formulated as follows:

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

SECONDLY: RESULTS AND DISCUSSION

1. Time series stability test

The results of the unit root test (Phillips–Perron test) showed that the time series data for the variables used (inflation INF, GBTT and food prices FP) were not stationary at level *I(0)* and time series data at the macro level are usually affected by the general trend that reflects certain circumstances that affect all variables and make them change in the same direction although there is no real relationship between them (Attia, 2004) After applying the first difference, it is observed that all variables are stable at a significant level of 1%.

Table 1. Unit root test (Phillips–Perron test)

		At *I(0)*			**At *I(1)***		
		INF	***GBTT***	***FP***	***d(INF)***	***d(GBTT)***	***d(FP)***
With Constant	t-Statistic	-2.5920	-3.4434	-1.7053	-9.1619	-5.4876	-4.3913
	Prob.	**0.1102**	**0.0208**	**0.4143**	**0.0000**	**0.0003**	**0.0029**
		No	**	No	***	***	***
With Constant & Trend	t-Statistic	-4.1266	-3.3638	-1.3417	-8.3829	-5.1564	-6.9840
	Prob.	**0.0198**	**0.0836**	**0.8480**	**0.0000**	**0.0027**	**0.0001**
		**	*	No	***	***	***
Without Constant &	t-Statistic	-2.0030	-1.2104	0.3300	-8.7240	-5.7135	-4.3838

Trend	**Prob.**	**0.0455**	**0.1997**	**0.7714**	**0.0000**	**0.0000**	**0.0002**
		**	No	No	***	***	***
Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (No) Not Significant							

Resource: By authors using Eviews 12.

The results came to indicate the rejection of the null hypothesis and the acceptance of the alternative hypothesis based on the values of the impact coefficient at the null hypotheses (None, At most 1, At most 2 and At most 3) of (8.05, 18.3, 46.1) respectively, and these values are greater than the critical values (29.7, 15.4, and 3.8) respectively and at a significant level of 5%, which confirms the existence of three common integration equations at this level of significance for this test.

The results of the Max- Eigen Value test came at the null hypotheses (None, At most1 and At most2) with values of (27.7, 10.3, 8.05) respectively, which are greater than the critical values of (21.1, 14.2, 3.8) respectively at a significant level of 5%, thus we reject the null hypothesis and accept the alternative hypothesis that there are three equations for the cointegration of this test.

Table 2. Trace and Max test results. Eigenvalue for co-integration

Sample (adjusted): 2002 2021

Included observations: 20 after adjustments

Trend assumption: Linear deterministic trend

Series: INF GBTT FP

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.750099	46.10936	29.79707	0.0003
At most 1 *	0.403020	18.37559	15.49471	0.0179
At most 2 *	0.331626	8.058162	3.841466	0.0045

Trace test indicates 3 Cointegration eqn. (s) at the 0.05 level

*Denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Own Statistic	0.05 Critical Value	Prob.**
None *	0.750099	27.73377	21.13162	0.0051
At most 1	0.403020	10.31743	14.26460	0.1919
At most 2 *	0.331626	8.058162	3.841466	0.0045

Max-eigenvalue test indicates 1 Cointegration eqn. (s) at the 0.05 level *Denotes rejection of the hypothesis at the 0.05 level

Resource: By authors using Eviews 12.

The existence of a common integration between inflation, the rate of trade and food prices indicates a correlation between these economic factors and their mutual impact on each other, when there is a joint integration between inflation on the one hand and the rate of trade and food prices on the other, an increase in food prices can contribute to an increase in inflation in general, especially if food constitutes a large proportion of the consumer basket. Changes in food prices can also have an impact on the value of imports and exports, which in turn affects the country's terms of trade. While the population and even the economy are greatly affected by changes in food prices, food prices are vulnerable to many factors, such as demand, supply and climatic conditions related to the production of agri-food crops as well as economic policies, and when there are a joint complementarity between food prices on the one hand and inflation and the rate of trade on the other, changes in food prices can affect the level of inflation and international trade.

2. Determining the duration of the optimal slowdown

The optimal lag period for the VAR model was determined using Eviews 12 software by applying several criteria and as shown in Table 3, it was found that the best slowdown time for the model is represented by four periods according to the criteria (AIC, SC and HQ), noting that the SC standard is preferred to be adopted because it is the best in short periods.

Table 3. Optimum lag selection criteria

Endogenous variables: INF GBTT FP Exogenous variables: C Sample: 2000 2021 Included observations: 18						
Was	LogL	LR	FPE	AIC	SC	HQ

0	-238.5411	ON	90840356	26.83790	26.98630	26.85836
1	-225.5248	20.24760*	59449355	26.39164	26.98523	26.47349
2	-215.2152	12.60065	57202464	26.24613	27.28490	26.38936
3	-204.0693	9.907487	60552352	26.00769	27.49165	26.21231
4	-184.9169	10.64018	40078184*	24.87966*	26.80880*	25.14566*

* Indicates lag order selected by the criterion

Resource: By Authors using Eviews 12.

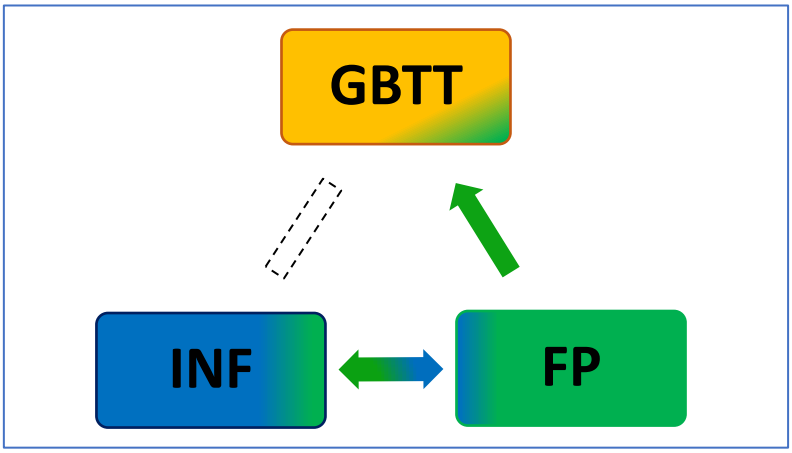
3. Causality test according to Toda–Yamamoto

We can see from Table 4. For the relationship between GBTT as a dependent factor, there is a uni-directional causal relationship from food prices FP towards the GBTT which is significant at the level of 1%, and the absence of this relationship from inflation INF to the terms of trade. There is a bi-directional relationship between FP food prices and INF inflation, as briefly shown in Figure 3.

Table 4. The causal relationship between study variables

VAR Granger Causality/Block Exogeneity Wald Tests Sample: 2000 2021 Included observations: 17				Direction of causality
Dependent variable: *GBTT*				
Excluded	Chi-sq	df	Prob.	
INF	8.688227	4	0.0694	No

				causality
FP	21.06836	4	0.0003	*FP* → *GBTT*
Dependent variable: *INF*				
Excluded	Chi-sq	df	Prob.	
GBTT	4.106538	4	0.3918	No causality
FP	14.39634	4	0.0061	*FP* → *INF*
Dependent variable: *FP*				
Excluded	Chi-sq	df	Prob.	
GBTT	4.458701	4	0.3475	No causality
INF	23.26948	4	0.0001	*INF* → *FP*



Resource: Prepared by researchers.

Figure 3. The direction of causal relationship between variables.

Resource: By Authors based on Table 4.

CONCLUSIONS

When conducting a cointegration test between the dependent variable GBTT, inflation rate and food prices, which are integrated from the *I(1)* degree, it was found that there are three relationships of cointegration among the variables in the light of the results of the Trace test, while the results of the Maximum Eigenvalue found one cointegration relationship among the variables was found, which proves the validity of the existence of a long-term equilibrium relationship among them.

The deterioration of GBTT in Iraq may be due to semi-monolithic exports and the dependence of the agricultural trade balance on exports of dates and some by-products such as leather and wool on the one hand, and the multiplicity of imports of the rest of the agricultural food, consumer and even investment commodities on the other hand.

The two-way causal relationship between the inflation rate and food prices indicates a mutual influence between them, as they affect each other, when the inflation rate increases, the general price of goods and services becomes higher, and among the most important of these goods and services come food prices. When inflation increases, the cost of producing and distributing food increases, leading to higher food prices. Moreover, when food prices increase, it leads to an increase in inflation. Increased food prices mean an increase in the costs of consumers and firms, which translates into an increase in the costs of production and other services, which in turn leads to an increase in the general prices of goods and services. Thus, a reciprocal circulation can develop between high inflation and higher food prices, as they affect each other mutually, which means that there is a two-way causal relationship between them.

A causal relationship from food prices towards the terms of trade suggests that changes in food prices can affect trade performance and trade between countries. There are two main directions of this relationship, the first is the increase in food prices and the decline in trade, when the price of food increases, it may reduce the competitiveness of the food-producing country in international markets. This increases production, distribution and transportation costs, thus leading to higher prices for food exports. In this case, the terms of trade may decrease and the exports of producing countries may be negatively affected. The second trend of this relationship is the increase in food prices offset by increased trade: in some cases, higher food prices may lead to increased trade. For example, if a producing country grows highly nutritious crops and faces increased demand for these products, rising food

prices may increase the value of its exports. However, it should be noted that the relationship between food prices and the terms of trade is complex and varies from country to country, and many factors such as global supply and demand, production costs, trade policies and international trade affect the relationship between them.

We recommend governments adopt structural reforms that help overcome the economic distortions that caused the large rises in inflation rates and control it through monetary and fiscal policy tools. For example, central banks can control the money supply directly or indirectly by selling government securities, the central bank or implementing policies can reduce the money supply, it can withdraw money from circulation, which can have a contractionary effect on the economy and help curb inflation.

Use of government spending and taxes to increase the national product and raise and improve the level of income of individuals and society, and the adoption of the trade rate criterion as one of the criteria for drawing agricultural development plans in Iraq as one of its basic indicators to link import capacity with export capacity. ignoring this criterion is a clear deficiency in the plans to develop the agricultural sector in Iraq, also recommends encouraging those interested to implement studies that focus on the relationship between food prices and the rate of trade because of its role in improving the trade balance and improving the international trade of the producing country.

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