# THE EFFECT OF TERMS OF TRADE SHOCKS ON AGRICULTURAL PRODUCT IN IRAQ FOR THE PERIOD (1990 – 2022)

**Raja T. Al-Wasity**
**Assist. Prof.**
**Dept. Agric. Econ./ Coll. of Agric. Engin. Sci. University of Baghdad**
raja.t@coagri.uobaghdad.edu.iq

**Hala A. Al-Attabi**
**Researcher**
**Dept. of Plan. Prot./ Min. of Agric./ Iraq**
halaghaniss@gmail.com

**Saad A. Al-Badawi**
**Researcher**
**Dept. of Plan. Prot./ Min. of Agric./ Iraq**
saadizeddin@gmail.com

**ABSTRACT**

**This research was aimed to study and analyze the impact of the shocks of the agricultural net terms of trade (NBTT) on agricultural product (AP) in Iraq during the period (1990 – 2021), which are among the shocks affecting the agricultural sector and foreign trade, the research used quantitative approaches in estimating the levels of impact, including VAR model, variance decomposition analysis (VDA) and impulse response function (IRF). The results showed that VDA of AP was weak in respect of agricultural NBTT and vice versa. While IRF of NBTT was negative in respect of Ap, and the same result was for IRF of AP. The study recommended the need to consider strategies to support smallholder farmers, such as providing access to credit, soft loans, technical assistance and markets for their products, in addition of support the technological advancements for their role in shaping the relationship between agricultural trade and agricultural production.**

**Keywords: NBTT, impulse response, variance decomposition, vector autoregressive.**

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## تأثير صدمة معدل التبادل التجاري الزراعي على الناتج الزراعي في العراق للمدة (1990–2022)

**رجاء طعمة الواسطي**
**أستاذ مساعد**
**قسم الاقتصاد الزراعي – كلية علوم الهندسة الزراعية/ جامعة بغداد**

**هالة عبد الغني العتابي**
**باحثة**
**دائرة وقاية المزروعات وزارة الزراعة**

**سعد عبد القهار عز الدين**
**باحث**
**دائرة وقاية المزروعات وزارة الزراعة**

**المستخلص**

**هدف البحث الى دراسة وتحليل أثر صدمات معدل التبادل التجاري الصافية الزراعية (NBTT) على الناتج الزراعي (AP) في العراق خلال الفترة (1990 – 2021)، والتي تعد من الصدمات التي تؤثر على القطاع الزراعي والتجارة الخارجية، استخدم البحث المنهج الكمي في تقدير مستويات التأثير ومنها نموذج VAR، تحليل تحلل التباين (VDA) وتحليل استجابة النبضة (IRF). أظهرت نتائج تحليل التباين ان تثير الناتج الزراعي كان ضعيفا فيما يتعلق بمعدل التبادل التجاري والعكس صحيح. بينما كان تحليل استجابة الصدمة للمتغير NBTT سلبيا بالنسبة للناتج الزراعي، والعكس صحيح أيضًا. وأوصت الدراسة بضرورة النظر في استراتيجيات دعم صغار المزارعين، مثل توفير إمكانية الحصول على الائتمانات والقروض الميسرة والمساعدة التقنية والأسواق لمنتجاتهم، فضلًا عن دعم التطورات التكنولوجية لدورها في تشكيل العلاقة بين التجارة الزراعية والإنتاج.**

**الكلمات المفتاحية: معدل التبادل التجاري الصافي، تحليل استجابة النبضة، تحليل تجزئة التباين، متجه الانحدار الذاتي.**

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## INTRODUCTION

The economy is affected by a wide range of variables and conditions that interact with each other, and the effects of their changes are reflected in the economy depending on the impact of the variable affecting it on the one hand and the flexibility and efficiency of the economy with responding to that variable on the other hand, especially in light of the difficulty of closing any economy from the outside world in terms of generating its multiple needs. The aspects of spending that express aggregate domestic demand overlap between internal and external factors, which include aspects of private spending of individuals and institutions, the public sector mediated by the local products sector, as well as external demand for domestic goods and services, which is depicted by the national (income-output) equation, as in Figure 1.

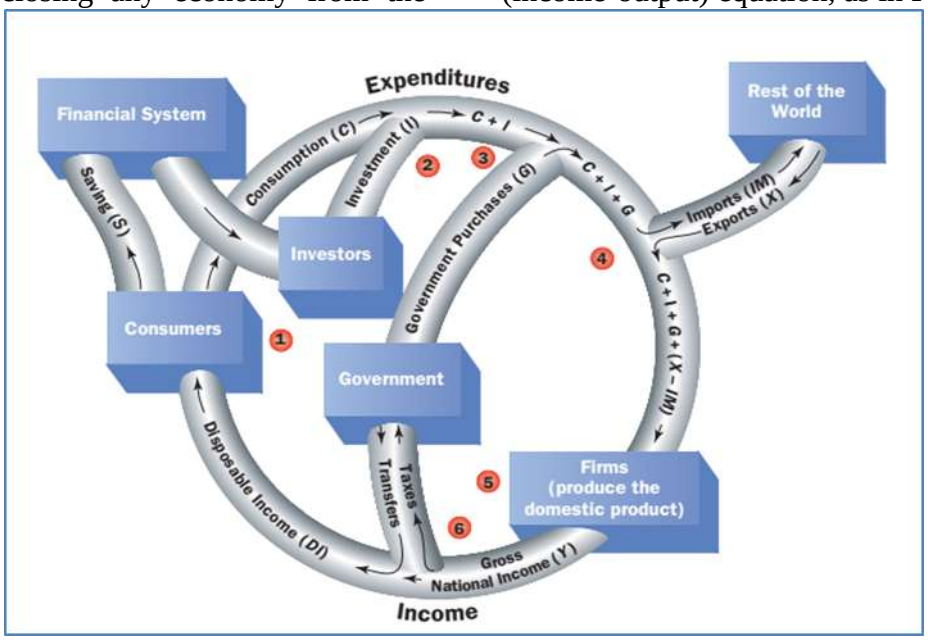


**Figure 1. The Circular Flow of Expenditures and Income.**

**Source: Baumol, 2009, 156**

External sector factors affect some variables at the macro level (by affecting one of the components of aggregate demand or supply), which is related to the degree of sensitivity of the economy to that variable, especially if all the details of the external sector are included by trade in goods, services and remittances within the framework of the current account, or in calculating the capital and financial account side of it, which forms the basis of the balance of payments, that means affecting one of the commodity or financial aspects or both, as the changes in them or in one of their variables will be reflected through a series of actions and reactions, and different time periods, expressed in economic shocks, and economic shock is generally defined as an unexpected disorder that has a significant impact on the economic system, and although there may be some shocks that have a positive impact (for example, technological developments), the term is largely used in phenomena that have a negative impact on the economy (3). The more open a country's economy is, the more vulnerable it is to macroeconomic shocks from abroad by shifts in the trade balance (12). Foreign trade roles the direction of influence of various domestic and foreign policies (7). Therefore, the research aims to identify the shock of the net terms of trade that the country was exposed to during the study period to know the extent of its impact on agricultural output, the direction of the shock and its time dimension. In general, the shock of the agricultural trade exchange rate can significantly affect agricultural output and the national economy, countries need to develop appropriate strategies to manage trade exchange and improve productivity and quality in the agricultural sector, especially that agriculture is the main sector in most non-oil economies (19). The research problem, revolves around how fluctuations in the prices of agricultural products affect agricultural product and output in producing and exporting countries, and what are the mechanisms that determine the

negative or positive impact of the agricultural trade rate shock on agricultural output? What are the internal and external factors that can affect this relationship? As well as identifying government and economic policies that can be adapted to absorb the impact of this shock, and answering these questions helps to understand the relationship between the agricultural trade rate shock and its impact on agricultural output. Many researches have been found on this topic, such as "Terms of trade fluctuations and economic growth in developing economies" in a simple open economy using a stochastic growth model. The research found that the model's output process has a random walk component so even transient price shocks have permanent effects on output levels. The size of the random walk component depends on the country's trade share, the supply response of exports and other structural parameters. Also, more variable export prices generally reduce expected domestic investment. These results are consistent with the estimated variance ratios and impulse response functions for several LDCs (9). Another was "Coping with Terms-of-Trade Shocks in Developing Countries" Sharp swings in a developing country's terms of trade the price of its exports relative to the price of its imports can seriously disrupt output growth. An analysis of the effects of a decline in export prices in seventy-five developing economies suggests that countries with a flexible exchange rate will experience a much milder contraction in output than their counterparts with fixed exchange rate regimes (11). Another research is "Terms of trade and economic growth in Japan and Korea: an empirical analysis" which examines the impact of terms of trade and terms of trade volatility on economic growth in Japan and Korea using time series data. The results of the Johansen cointegration method show that real gross domestic product (GDP) per capita and terms of trade are jointly determined. Generally, an increase in terms of trade volatility will lead to a decrease in real GDP per capita. An increase in oil prices will lead to a decrease in terms of trade. The results of the generalized forecast error variance decompositions show that the important contributors to real GDP per capita are different between Japan and Korea. Favourable and less volatile terms of trade are important for economic growth (26).

## MATERIALS AND METHODS

### Shocks of terms of trade

Agricultural foreign trade is considered a direct means of consolidating international relations as it connects countries of the world with each other and contributes to providing many agricultural products and services with low prices by depending on the principle of specialization (17). The terms of trade of a nation are defined as the ratio of the price of its export commodity to the price of its import commodity. Terms of trade shocks are sudden changes that occur in the terms of trade of a country, whether these changes are on import prices side or export prices side. Thus, shocks may be temporary due to government intervention through taking financial measures that limit or work to stop these shocks, especially the negative ones, and they may be permanent shocks that the government cannot address, so they last for a long time, and the trade exchange rate can be calculated by the percentage of the total indicators of exports and imports of goods (6). In light of the foregoing, it can be said that the type of shock, whether positive or negative, temporary or permanent, does not matter much, as some types of shocks are generated by external conditions such as low prices of raw materials (such as oil) and the state has no role in the decline in its prices, but as a result of the decline in global demand for it or to increase the supply of the commodity in question from another country, but what matters to us is how to deal with these shocks and here the issue is an internal affair, countries can adopt policies that mitigate the effects Negative shock or positive shock management is prudent to avoid expected or unexpected future negative shocks (13). The index of trade exchange rates is based on the prices of six commodities (food, fuel, agricultural raw materials, minerals, gold, and beverages), and the exchange rate is calculated as follows (2).

$$ToT = IiI \frac{(Pi\ muv)^{Xij}}{} IiI\ Pi\ muv^{Mij}$$

Where $I$ the 6 categories of commodities, $Xij$ the share of exports of good $i$ in the total trade of country $j$, $Mij$ share of imports of good $i$ in

the total trade of country *j*. Countries are often exposed to shocks in their terms of trade, and it is one of the shocks affecting the agricultural sector and agricultural foreign trade, as these rates are not only affected by internal conditions but also by externals. As well as, the terms of trade are affected by the occurrence of recessions or recovery to which the economy is exposed to one or all of its joints because foreign trade is part of this economy, so it is positively or negatively affected by the fluctuations of the economic cycle, or these rates may be affected by a crisis. This effect increases if the country is exposed to cases of dumping in agricultural products and commodities, so it imports and exports many goods and services that make it affected by any movement to which the outside world is exposed (16). From the perspective of developing countries, the hypothesis of unequal growth between industrialized and non-industrialized economies prevails and the terms of trade are a crucial element according to the vision of both (25) and (22). And this situation is reflected in the terms of trade, global technical changes and the conditions of demand that countries face regarding the degree of specialization and the type of product in which they specialize. The terms of trade also have distributional effects that occur as a result of changes in international prices, which represent the essence of the theory (Stolper and Samuelson 1941), and that these distributional effects may cause social conflict, which can have a negative impact on economic growth, that the success of programs to improve the balance of payments, achieve sustainable economic growth and encourage price stability and the level of employment depends largely on changes in the TOT, the improvement of TOT leads to an improvement in both welfare and the standard of living, One study found that its fluctuations in developing countries are weak because of the large fluctuations in the prices of raw materials on which developing countries depend, and because their impact is simple on the prices of their exports due to their economic structures, it is an exogenous variable of foreign trade variables for them because it is determined by forces outside the control of developing countries (1).

**Variant of terms of trade**

There are many types of terms of trade, as follows (23):

a- **Gross Barter Terms of Trade**

$GBTT = (Q_X/Q_M)100$

Where $Q_X$ Index of the quantity of agricultural exports, $Q_M$ Index of the quantity of agricultural imports (4).

b- **Commodity or Net Barter Terms of Trade**

If we define *N* as the ratio of the price index of the nation's exports $P_X$ to the price index of its imports $P_M$ multiplied by 100 (to express the terms of trade in percentages) That is:

$$NBTT = (P_X/P_M)\,100$$

It is a dynamic criterion, reflecting the competitive strength of the county and its position in the international market, we can use it to judge the balance of trade in a country by comparing its values with the values of the GBTT (18).

c- **Income terms of trade**

$$I = \left(P_X \frac{}{P_M}\right) Q_X$$

Where $Q_X$ is an index of the volume of exports. Thus, *I* measures the nation's export-based capacity to import.

d- **Single factorial terms of trade (S)**

$S = (P_X/P_M)\,Z_X$

Where $Z_X$ is a productivity index in the nation's export sector. Thus, *S* measures the amount of imports the nation gets per unit of domestic factors of production embodied in its exports.

e- **Double factorial terms of trade (D)**

$$D = \left(\frac{P_X}{P_M}\right)\left(\frac{Z_X}{Z_M}\right)100$$

Where $Z_M$ is an import productivity index. Thus, *D* measures how many units of domestic factors embodied in the nation's exports are exchanged per unit of foreign factors embodied in its imports. There are two types of terms of trade shocks, a positive TOT shock refers to a sudden increase in export prices, a sudden drop in import prices, or both (14). A negative TOT shock refers to a sudden drop in export prices, or sudden rise in import prices, or both (10). Countries are often exposed to shocks in their trade exchange rates, which are among the shocks affecting the agricultural sector and agricultural foreign trade. The agricultural term of trade (NBTT) was affected

in one way or another by the tensions that occurred at the level of prices and quantities globally during the study period. As the Gross agricultural term of trade GBTT fluctuated greatly between a maximum of 185.4% in 2003, and a minimum of 11.5% in 1993, and it was found that most of the study years were not in favour of Iraq, as we see that the value of the index is less than 100 in most years. Where, the decrease in the index of the quantities of agricultural exports, which was reflected in the value of the index, means obtaining smaller quantities of agricultural imports in exchange for more quantities of agricultural exports. As for the agri. NBTT indicator, it fluctuated between a maximum of 204.5% in 1991 and a minimum of 57% in 2008, with values less than 100% in most years of the study. Imports indicate the deterioration of the rate of agricultural foreign trade exchange for Iraq, and that this trade exchange is not in favour of Iraq, and the main reason may be attributed to the small quantities of agricultural exports to Iraq (which are mainly represented by dates, leather, wool and some types of vegetables) compared to the large quantities of its various agricultural imports (8).

**Table 1. Trade indicator and agri. TOT in Iraq (2014 – 2016 =100)**

| Year | Quantity Index | | Price Index | | GBTT | NBTT |
|---|---|---|---|---|---|---|
| | Agr. Import | Agr. Export | Agr. Import | Agr. Export | | |
| 1990 | 47 | 61 | 53 | 60 | 129.8 | 113.2 |
| 1991 | 25 | 6 | 44 | 90 | 24.0 | 204.5 |
| 1992 | 36 | 7 | 44 | 75 | 19.4 | 170.5 |
| 1993 | 26 | 3 | 52 | 79 | 11.5 | 151.9 |
| 1994 | 19 | 9 | 55 | 56 | 47.4 | 101.8 |
| 1995 | 22 | 12 | 67 | 39 | 54.5 | 58.2 |
| 1996 | 18 | 15 | 69 | 42 | 83.3 | 60.9 |
| 1997 | 38 | 26 | 48 | 41 | 68.4 | 85.4 |
| 1998 | 41 | 31 | 46 | 46 | 75.6 | 100.0 |
| 1999 | 38 | 17 | 49 | 61 | 44.7 | 124.5 |
| 2000 | 61 | 9 | 43 | 47 | 14.8 | 109.3 |
| 2001 | 58 | 9 | 41 | 62 | 15.5 | 151.2 |
| 2002 | 52 | 82 | 40 | 24 | 157.7 | 60.0 |
| 2003 | 41 | 76 | 48 | 33 | 185.4 | 68.8 |
| 2004 | 57 | 95 | 46 | 28 | 166.7 | 60.9 |
| 2005 | 72 | 48 | 51 | 38 | 66.7 | 74.5 |
| 2006 | 81 | 17 | 47 | 60 | 21.0 | 127.7 |
| 2007 | 66 | 66 | 61 | 47 | 100.0 | 77.0 |
| 2008 | 78 | 87 | 93 | 53 | 111.5 | 57.0 |
| 2009 | 85 | 59 | 77 | 57 | 69.4 | 74.0 |
| 2010 | 84 | 37 | 99 | 69 | 44.0 | 69.7 |
| 2011 | 88 | 42 | 101 | 85 | 47.7 | 84.2 |
| 2012 | 90 | 53 | 105 | 85 | 58.9 | 81.0 |
| 2013 | 91 | 45 | 107 | 111 | 49.5 | 103.7 |
| 2014 | 88 | 107 | 100 | 108 | 121.6 | 108.0 |
| 2015 | 97 | 93 | 103 | 98 | 95.9 | 95.1 |
| 2016 | 115 | 100 | 97 | 94 | 87.0 | 96.9 |
| 2017 | 135 | 82 | 90 | 122 | 60.7 | 135.6 |
| 2018 | 151 | 86 | 97 | 89 | 57.0 | 91.8 |
| 2019 | 132 | 232 | 99 | 118 | 175.8 | 119.2 |
| 2020 | 106 | 76 | 97 | 96 | 71.7 | 99.0 |
| 2021 | 143 | 112 | 102 | 92 | 78.3 | 90.2 |
| Max | | | | | 185.4 | 204.5 |
| Min | | | | | 11.5 | 57.0 |

**Source: Indices from FAO website: www.fao.org.faostat, GBTT and NBTT are calculated by the Authors**

**Agricultural products in Iraq for the period 1990-2022:** Agricultural production refers to the process of cultivating crops, raising livestock, and producing other agricultural products. Agriculture products are vital components of economic activity in any country and play a crucial role in meeting global food and nutritional needs. Although, it is influenced by various factors, including climate, soil conditions, agricultural

technology, government policies, and global markets. Improving agricultural production is essential for achieving food security, promoting economic development, and ensuring environmental sustainability. Strategies to enhance agricultural production include crop diversification, improved agricultural techniques, provision of financial resources, technological advancements, farmer training and awareness, and the development of agricultural infrastructure. Agricultural products in Iraq clearly varied during the period studied, and the first and lowest decline was in 1991 as a result of the beginning of the imposition of economic sanctions, as it reached $ 3598 million in 1991 after it was $ 4849.1 million in 1990 and a negative annual change rate of 25.8%, after which agricultural output gradually improved due to the state's orientation at the time towards supporting the agricultural sector to provide food needs, due to the scarcity in food imports as a result of economic sanctions, but not Stable until the acute shock associated with the events of 2003, especially under circumstances of agricultural commodity dumping that Iraqi agricultural market suffered of after 2003 (5) in addition of technology Gap (15). As agricultural output fell from $ 5968.7 in 2002 to $ 4743.1 million in 2003, and the sharp decline in the water levels of the Tigris and Euphrates rivers in 2008 negatively affected agricultural production, as the amount entering the Euphrates River on the Syrian border was estimated at approximately 14.7 billion cubic meters, while the average years 2006, 2007 and 2009 amounted to 20 billion cubic meters, as for the Tigris River, it witnessed a decrease of more than 50% in the rate of water import flow from 43 billion $m^3$ in the average of the same years to 20.03 billion $m^3$ in 2008 (21), thus showing that the value of agricultural output fell sharply in that year. After that, agricultural production recovered from 2010 to reach its peak in 2014 with an agricultural output of $ 6 billion, to witness new crisis as a result of the hard security conditions that the country experienced in 2014, as agricultural output decreased to $ 3074 million in 2015 and $ 3156.4 million in 2017. Then the gradual improvement returned to reach about $ 6505.6 million in 2022 as shown in Figure 2.

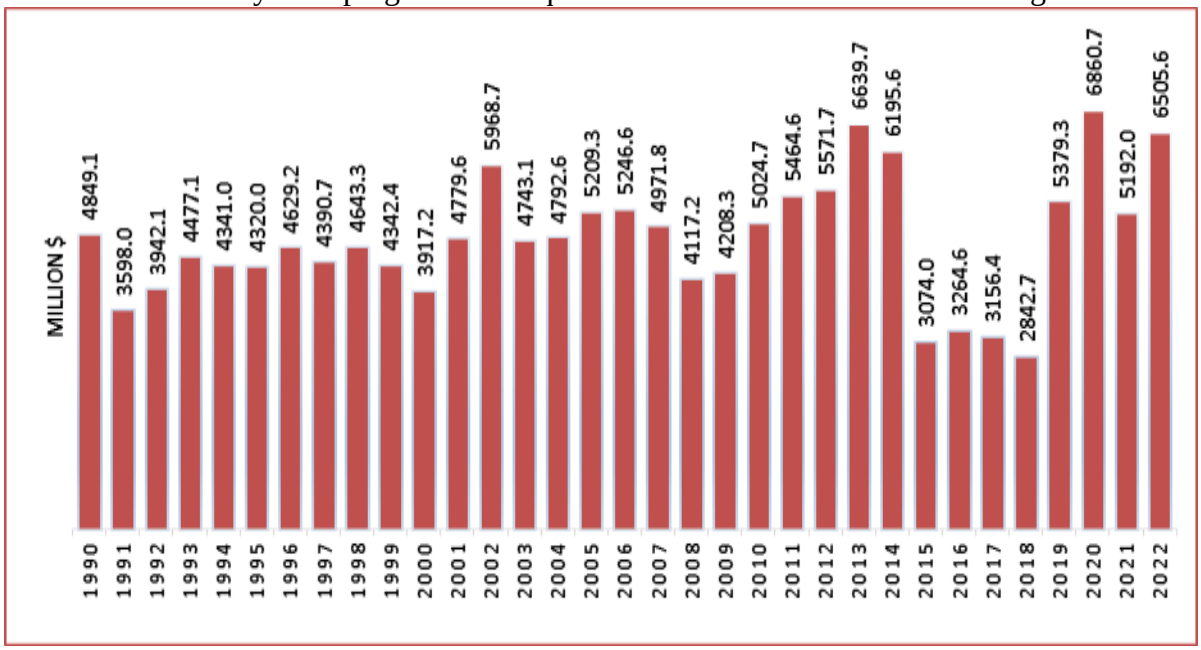


**Figure 2. The evolution of the value of agricultural output in Iraq.**

**Source: By authors using FAO data**

## RESULTS AND DISCUSSION

**Unit root test:** The results in Table 2 indicate that the time series of all study variables were not stationary in their levels, where (*NB*) stands for agri. NBTT for the hole research and (*AP*) for Agricultural products. When we applied the difference of these variables, they become stationary, as the PP values calculated at the absolute value of all variables were greater than the tabular values at the level of significance 5% or 10%. That is, they are integrated from degree *I(1)*, and we note the stability of the data for the variables when taking the first difference to them and at a significant level of 1%.

**Table 2. Unit root test (PP)**

| | | I(0) | | Δ | |
|---|---|---|---|---|---|
| | | NB | AP | d(NB) | d(AP) |
| With Constant | t-Statistic | -3.1157 | -3.0433 | -8.1997 | -5.6637 |
| | Prob. | 0.0357 | 0.0418 | 0.0000 | 0.0001 |
| | | ** | ** | *** | *** |
| With Constant & Trend | t-Statistic | -3.3203 | -3.2703 | -9.9167 | -5.3508 |
| | Prob. | 0.0817 | 0.0900 | 0.0000 | 0.0008 |
| | | * | * | *** | *** |
| Without Constant & Trend | t-Statistic | -0.7411 | -0.3535 | -7.8753 | -5.7710 |
| | Prob. | 0.3872 | 0.5493 | 0.0000 | 0.0000 |
| | | No | No | *** | *** |

**Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1% and (no) Not Significant**

**Source: Output of Eviews 12**

**Estimated VAR model**

To estimate the shocks affecting the TOT, it is necessary to estimate the VAR model first, and one of the important variables in this field is variable (agricultural output AP). The model will be as follows:

$$NB_t = a_1 + \sum_{k=1}^{m} \beta_{11} NB_{t-k} + \sum_{k=1}^{m} \beta_{12} AP_{t-k} + \varepsilon_{t1}$$

$$= a_2 + \sum_{k=1}^{m} \beta_{21} NB + \sum_{k=1}^{m} \beta_{22} AP_{t-k} + \varepsilon_{t2}$$

Where: *AP* Agricultural Production, NBTT Agricultural Net Barter Terms of Trade, $\varepsilon$ random error and *m* optimal lag period. Before the model estimation process, it is required to conduct the selection of the optimal slowdown period for the model variables, according to the known criteria represented by (AIC, SC and HQ), and based on this origin, the optimal lag period of the model was extracted, represented by one period according to SC and HQ criteria, as shown in Table 3. Based on the results obtained from the unit root tests and the selection of the optimal lagged period, it is possible to estimate the VAR model, and Table 4 shows the analysis results of the estimated model.

**Table 3. VAR lag order selection criteria**

**Endogenous variables: NB AP**
**Exogenous variables: C**
**Sample: 1990 2021**
**Included observations: 30**

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -392.5251 | NA | 9.07e+08 | 26.30167 | 26.39508 | 26.33155 |
| 1 | -382.4985 | 18.04775* | 6.08e+08 | 25.89990 | 26.18014* | 25.98955* |
| 2 | -378.3669 | 6.885962 | 6.06e+08* | 25.89113* | 26.35820 | 26.04055 |

*** indicates lag order selected by the criterion**

**Source: By the Authors using Eviews 12**

**Table 4. Vector Autoregression Estimates**

**Sample (adjusted): 1991 2021**
**Included observations: 31 after adjustments**
**Standard errors in ( ) & t-statistics in [ ]**

| | *NB* | *AP* |
|---|---|---|
| NB (-1) | 0.463810 | -1.804081 |
| | (0.16639) | (4.74625) |
| | [ 2.78751] | [-0.38011] |
| AP (-1) | -0.004760 | 0.460210 |
| | (0.00599) | (0.17085) |
| | [-0.79472] | [ 2.69365] |
| C | 75.40276 | 2716.521 |
| | (36.0345) | (1027.89) |
| | [ 2.09252] | [ 2.64283] |

**Source: output of Eviews 12.**

Before starting IRF or Variance Decomposition Analysis, the research requires a set of tests to ensure the integrity of the estimated model (24). These tests are as follows:

**Roots of characteristic polynomial**

This test assumes that the roots of the polynomial characteristic of the estimated set of functions matrix in the VAR model are less than the one, so the model does not pass the stability property if we confirm that it has a root greater than the integer (20). Going back to the test result, Table 5 shows that the model does not have roots up to one integer and that all roots are located in the unit circle as in Figure 2, so the model has passed the stability condition.

**Table 5. Roots of Characteristic Polynomial**

| Endogenous variables: NB AP<br>Exogenous variables: C<br>Lag specification: 1 1 | |
|---|---|
| **Root** | **Modulus** |
| 0.554695 | 0.554695 |
| 0.369325 | 0.369325 |
| No root lies outside the unit circle.<br>VAR satisfies the stability condition. | |

**Source: Output of Eviews 12**

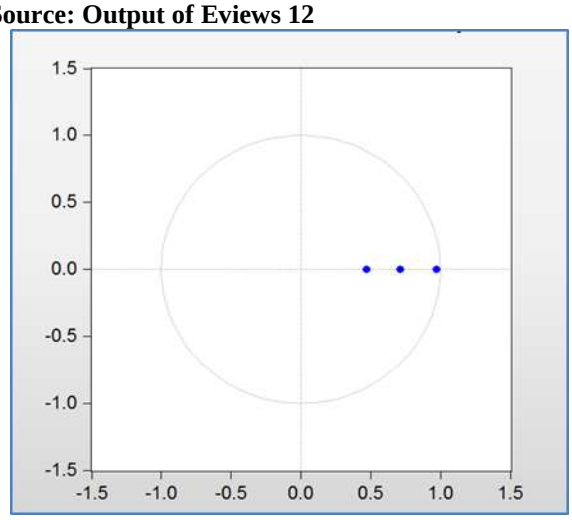


**Figure 2. Invers root of AR characteristic polynomial.**

**Source: Output of Eviews 12**

## Autocorrelation LM Test

The test results show that there is no Autocorrelation problem for lag levels up to 3, as the significant statistic shows, where it reached to 0.1029 for the first lag, while the second lag reached 0.175 The third lag amounted to 0.803, and this means accepting the null hypothesis, which states 'there is no serial correlation for the rank of slowing h', which is here one rank as in the Table 6.

**Table 6. VAR Residual Serial Correlation LM Tests**

| Sample: 1990 2021<br>Included observations: 31<br>Null hypothesis: No serial correlation at lag h | | | | | | |
|---|---|---|---|---|---|---|
| **Lag** | **LRE* stat** | **df** | **Prob.** | **Rao F-stat** | **df** | **Prob.** |
| 1 | 7.709813 | 4 | 0.1028 | 2.039971 | (4, 50.0) | 0.1029 |
| 2 | 6.339753 | 4 | 0.1752 | 1.654570 | (4, 50.0) | 0.1753 |
| 3 | 1.629087 | 4 | 0.8036 | 0.405732 | (4, 50.0) | 0.8036 |

**Source: Output of Eviews 12**

## VAR Residual Heteroscedasticity Tests

The test results as in Table 7. showed that the probability of the problem of instability of the homogeneity of variance according to the White test was 0.3219, which is of course not significant, and therefore we accept the null hypothesis based on the absence of the problem.

**Table 7. VAR Residual Heteroskedasticity Tests**

| Sample: 1990 2021<br>Included observations: 31<br>Joint test: | | |
|---|---|---|
| **Chi-sq** | **df** | **Prob.** |
| 13.67553 | 12 | 0.3219 |

**Source: By the Authors using Eviews 12**

## Variance Decomposition

The variance segmentation analysis measures the amount of variance in the prediction of the dependent variable resulting from the prediction error in the variable itself or in other variables in the model, and the variables of the agri. NBTT and agricultural output *AP* variables will be analyzed.

### 1- Variance decomposition of agri. NBTT

Table 8 shows the variation in the gross agri. NBTT and the role of agricultural output in this variation and knowing the most important fluctuations in it when it is exposed to a shock of one standard deviation, and it is clear that 100% of it was explained by the fluctuations of the same variable in the first year until to decrease to 96% in the tenth year. The AP variable had no effect in the first year, but in the second year it reached 1% and stabilizes at the level of 3% starting from the fourth year to the end of the long term (10 years), and then the percentage of the AP variable becomes approximately 3% and its relative importance was low, on the contrary, On the contrary of agri. NBTT, whose relative importance was high, reaching approximately 96%, as shown in Figure 3.

**Table 8. Variance Decomposition of agri. NBTT**

| Period | S.E. | NB | AP |
|---|---|---|---|
| 1 | 31.44603 | 100.0000 | 0.000000 |
| 2 | 35.12301 | 98.54045 | 1.459553 |
| 3 | 36.12253 | 97.44193 | 2.558072 |
| 4 | 36.42816 | 96.91326 | 3.086743 |
| 5 | 36.52447 | 96.70225 | 3.297751 |
| 6 | 36.55491 | 96.62605 | 3.373950 |
| 7 | 36.56448 | 96.60010 | 3.399897 |
| 8 | 36.56748 | 96.59158 | 3.408418 |
| 9 | 36.56841 | 96.58885 | 3.411153 |
| 10 | 36.56870 | 96.58798 | 3.412019 |

**Resource: Output of Eviews 12**

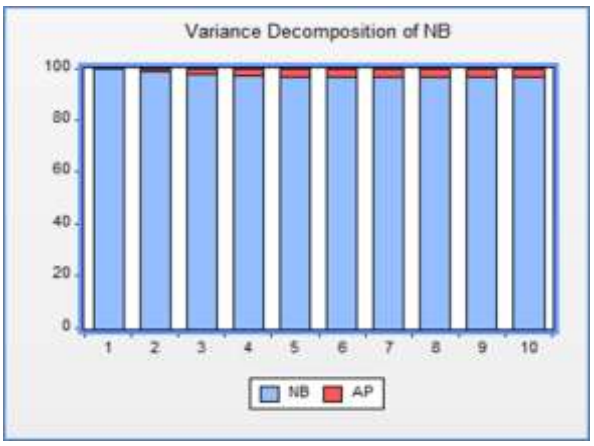


**Figure 3. Variance decomposition of Agri. NBTT**

**Resource: Output of Eviews 12.**

### 2- Variance decomposition of AP

Table 9 includes an analysis of the decomposition of variance of agricultural products, in which we see in the first year that 98% of the variance of the AP variable is due to the same variable, it decreased in the second year to approximately 97%, to stabilize in this manner for up to 10 years, while the agri. NBTT variable has a weak role in explaining the variance of the AP variable, this variance is weak in the first year, reaching 1%, then to rise to approximately 2.8% in the tenth year, as shown in Figure 4.

**Table 9. Variance Decomposition of AP**

| Period | S.E. | NB | AP |
|---|---|---|---|
| 1 | 897.0000 | 1.231566 | 98.76843 |
| 2 | 991.6836 | 2.076835 | 97.92316 |
| 3 | 1013.687 | 2.525741 | 97.47426 |
| 4 | 1019.481 | 2.716047 | 97.28395 |
| 5 | 1021.106 | 2.787205 | 97.21280 |
| 6 | 1021.578 | 2.811931 | 97.18807 |
| 7 | 1021.718 | 2.820151 | 97.17985 |
| 8 | 1021.760 | 2.822809 | 97.17719 |
| 9 | 1021.773 | 2.823654 | 97.17635 |
| 10 | 1021.777 | 2.823920 | 97.17608 |

**Resource: Output of Eviews 12.**

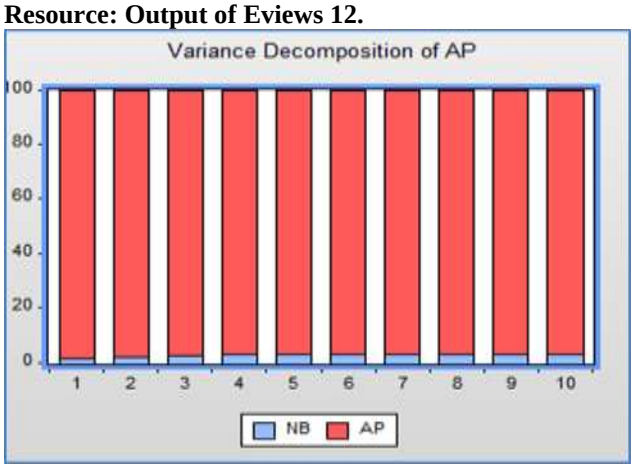


**Figure 4. Variance decomposition of AP**

**Resource: By the Authors using Eviews 12.**

### Impulse Response Function – IRF

It reflects how the variables respond to any sudden shock by one standard deviation in any of them in the model over time, and this shock has been analyzed in the model variables agricultural NBTT, and agricultural products AP using the Cholesky system, where the coloured lines indicate 95% confidence limits, and the black line indicates the impulse response function and is interpreted as a shock (also called Impulse or innovation) by one standard deviation in a variable, leading to Increase (or decrease) in the other variable

### 1- Impulse response of agri. NBTT

The response of the agri. NBTT variable to a shock of one standard deviation in the same variable and the other variables over ten years, and it is found that there was a positive effect of the shock in the same agri. NBTT variable in the first year and that the impact of this shock remained positive throughout the subsequent ten years, but it gradually decreased starting from the second year and reached low values at the end of the period. As for the shock by one standard deviation in the AP variable, it did not have an effect in the first year on the AP variable, but its negative effect on the AP variable began in the second year and decreased in the third year, and then gradually decreased until the end of the period. As in Table 10 and figure 4, it means that the relationship between the two variables is weak, but the shocks to which the agri. NBTT (*NB*) was exposed during the research period are positive, but they were not in favour of the country (i.e. less than 100) in most of the years of study.

**Table 10. Response of NB**

| Period | *NB* | *AP* |
|---|---|---|
| 1 | 31.44603 | 0.000000 |
| 2 | 15.05880 | -4.243279 |
| 3 | 7.472513 | -3.920874 |
| 4 | 3.819765 | -2.753676 |
| 5 | 1.998700 | -1.741211 |
| 6 | 1.064311 | -1.044788 |
| 7 | 0.573986 | -0.608696 |
| 8 | 0.312337 | -0.348409 |
| 9 | 0.171017 | -0.197238 |
| 10 | 0.094037 | -0.110876 |

**Resource: Output of Eviews 12.**

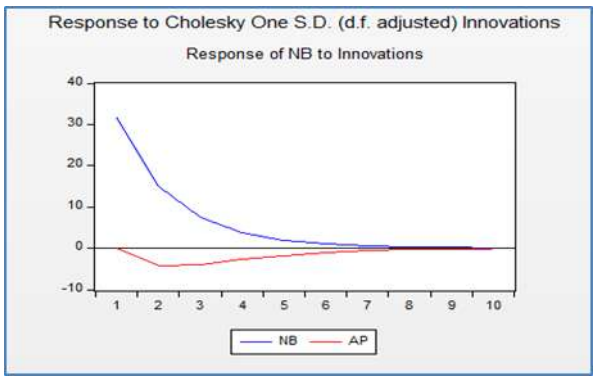


**Figure 4. Impuls response of NB**

**Resource: Output of Eviews 12**

## 2- Impulse response of AP

Table 11 and figure 5 represent the response of the AP variable to a shock of one standard deviation in the same variable and the other variables over ten years, and it is found that there was a significant positive effect of the shock in the same AP in the first year and that the impact of this shock remained positive throughout the subsequent ten years, but it began to gradually decline starting from the second year and reached low values at the end of the period. As for the shock by one standard deviation in the agri. NBTT, it did not have an effect in the first year on the AP variable, but its effect began in the second year, and this is normal due to the clear impact of changes in the net agricultural trade exchange rate on agricultural output, and then gradually declined until the end of the period. The situation differed for the agri. NBTT variable, as a shock of one standard deviation had a negative effect on the AP variable starting from the first year and then declining in the long term to the end of the period, which means that the relationship of the two variables is strong, but the shocks that the agri. NBTT variable was exposed to during the study period, which are undoubtedly negative shocks, with evidence that they were not in the interest of the country (i.e. less than 100) in most of the study years except for the second year (so this was reversed), Adversely affect the AP variable in the form of a negative response. It is noted in this analysis that all the variables had a Symmetric effect, meaning that there are no reciprocal (negative and positive) effects of the same variable during the time, although there is a negative effect of the agri. NBTT on AP, this effect remained negative until the end of the period and vice versa despite the fluctuation of agri. NBTT. But, the impact of the shock remained negative, which means the great impact of the negative shocks on the agri. NBTT, and did not fluctuate between positive and negative in time, this is called symmetry.

**Table 11. Impulse Response of Ap**

| Response of AP: | | |
|---|---|---|
| **Period** | **NB** | **AP** |
| **1** | **-99.54541** | **891.4594** |
| **2** | **-102.5430** | **410.2587** |
| **3** | **-74.35862** | **196.4604** |
| **4** | **-47.70161** | **97.48665** |
| **5** | **-28.84393** | **49.83220** |
| **6** | **-16.88009** | **26.07457** |
| **7** | **-9.688490** | **13.88466** |
| **8** | **-5.494258** | **7.487999** |
| **9** | **-3.091994** | **4.074611** |
| **10** | **-1.731495** | **2.231010** |
| **Cholesky Ordering: NB AP** | | |

**Resource: Output of Eviews 12**

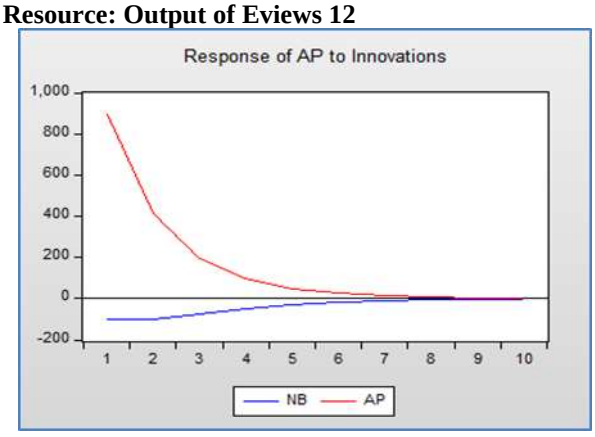


**Figure 5. Impulse response of AP**

**Resource: Output of Eviews 12**

The research reached to some conclusions, such as the weak relationship between agricultural TOT and agricultural products can be explained by several reasons: Agricultural dependency, the agricultural sector may heavily rely on the domestic market rather than the global market. In this case, the term of trade may have a limited impact on agricultural production, as the prices of agricultural products are primarily determined by domestic supply and demand factors. Trade restrictions: Iraq face trade protectionism and other trade barriers that affect the volume of agricultural trade. In this case, the impact of term of trade on agricultural production are limited, as direct effects of international trade price movements on the agricultural sector are reduced. Despite the direct impact of term of trade on agricultural production being weak in the case of Iraq, it can still have indirect effects through its influence on the national

economy's ability to provide necessary investments, technology, and infrastructure to improve agricultural production. Additionally, term or trad can affect the financial sustainability of the agricultural sector and its ability to meet domestic market needs in cases where Iraq reduce reliance on external agricultural imports. Liberalization of the economy and transition to the global economy, where there may be a shift in economic activities from agriculture to industry, services and the Oil sector. In addition, weakness of optimal allocation of resources and focus on products that have high competitiveness, which may not necessarily be the ones produced in the country in large quantities, and thus a gap can occur between the agricultural term of trade and agricultural output. However, agricultural trade can also lead to negative consequences, especially for small farmers. Trade liberalization has opened markets to cheaper imports from abroad, putting pressure on local farmers to lower their prices or exit business altogether. This led to the loss of means of subsistence and a decline in an adequate standard of living in rural communities. The research recommended to addressing these challenges often requires a comprehensive approach that takes into account the complex interplay between trade, agriculture and development. Considering that diversify sources of income and reduce dependence on oil as the main source of national income due to severe fluctuations and the unexpected in its prices. Decision-makers need to contemplate strategies to support smallholder farmers, such as providing access to credit, soft loans, technical assistance and markets for their produce. They may also need to consider ways in which the benefits of trade policy liberalization can be balanced with the need to protect domestic producers and ensure food security. Especially, the terms of trade is one of the criteria for drawing agricultural development plans as one of its basic indicators to link import to export capacity, and ignoring this criterion is a clear deficiency in the development plans of the agricultural sector in Iraq. Technological advancements are also playing an increasingly important role in shaping the relationship between agricultural trade and production. For example, advances in precision agriculture, and other areas are helping farmers increase their yields and improve the quality of their products. At the same time, new technologies are also creating opportunities for e-commerce and other digital platforms, which can help connect farmers with new markets and buyers.

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