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Estimation and analysis of the economic effects of the Corona Virus on Food Security in Iraq

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ABSTRACT

The coronavirus pandemic is one of the types of communicable and infectious diseases that have caused very significant impacts in many economic variables, especially the food gap for wheat and rice crops in Iraq and in the majority of the world. The problem of research lies in the nature of the challenges and constraints to the production of these two crops, which has made the effects of the pandemic add additional burden to it. Iraq has thus lost its ability to achieve food security, while food prices have risen significantly, reflecting the high rate of deficits in the State's general budget, as Iraq is a net importer of most types of agricultural products, particularly the strategy. The research aims to study the reality of food security from wheat and rice crops during the period of the pandemic and its repercussions in the Iraqi economy. A number of findings have been reached in the practical aspect of the study, including the emergence of the inverse relationship between the quantities produced by wheat and its food gap. The relationship between the quantities produced and imported from rice and its food gap has been expulsive. The State's general budget deficit relationship with the food gap in both crops was expulsive. We recommend diversifying the production of the Iraqi economy, reducing dependence on the oil sector's foreign exchange revenues, adopting a policy of protection for domestic products from foreign competition and developing agricultural infrastructure to the extent that it is capable of achieving food security from both crops at all times.

KEY WORDS:

Strategic crops, food gap, coronavirus

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تقدير وتحليل الآثار الاقتصادية لفيروس كورونا في الامن الغذائي في العراق

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قسم الإقتصاد الزراعي، كلية الزراعة والغابات، جامعة الموصل، الموصل، العراق

الخلاصة

تعد جائحة كورونا احد انواع الامراض السارية والمعدية التي تسببت بتأثيرات بالغة الاهمية في العديد من المتغيرات الاقتصادية ولا سيما الفجوة الغذائية لمحصولي القمح والرز في العراق وفي اغلب دول العالم. تكمن مشكلة البحث في طبيعة التحديات والمعوقات التي تواجه انتاج هذين المحصولين مما جعل اثار الجائحة تضيف عبئا اضافيا عليها وبذلك فقد العراق مقدراته على تحقيق امته الغذائي منهم، في حين شهدت اسعار الغذاء ارتفاعا كبيرا وذلك عكس اثره في ارتفاع معدلات العجز في الموازنة العامة للدولة كون العراق مستورد صافي لاغلب انواع المنتجات الزراعية ولا سيما الاستراتيجية منها، هدف البحث الى دراسة واقع الامن الغذائي من محصولي القمح والرز خلال فترة الجائحة وتداعياتها في الاقتصاد العراقي. وقد تم التوصل الى عدد من النتائج في الجانب العملي من الدراسة منها ظهور العلاقة العكسية بين الكميات المنتجة من القمح وفجوته الغذائية اما العلاقة بين الكميات المنتجة والمستوردة من الرز وفجوته الغذائية كانت طردية، وكانت علاقة العجز في الموازنة العامة للدولة مع الفجوة الغذائية في كلا المحصولين طردية. ونوصي بتنويع انتاج الاقتصاد العراقي وتقليل الاعتماد على ايرادات القطاع النفطي من العملات الاجنبية واعتماد سياسة الحماية للمنتجات المحلية من المنافسة الاجنبية وتطوير البنى التحتية الزراعية الى الحد الذي يجعلها قادرة على تحقيق الامن الغذائي من كلا المحصولين في كافة الاوقات.

الكلمات المفتاحية: محاصيل استراتيجية، فجوة غذائية، فايروس كورونا.

INTRODUCTION

Food security is a strategic objective that all countries seek to associate with their national security. It remains a major challenge for many of them as they produce what they can produce or import food commodities that are affected by several internal and external factors. States endeavor to strengthen their food security and build their resilience during economic crises, high prices and widespread hunger and disease. Despite the availability of agricultural infrastructure in Iraq, there are obstacles and problems affecting Iraq's food security during the two decades owing to the decline in cultivated areas, lack of water resources, high salinity in large areas of agricultural land in central and southern Iraq, and population growth, The low productivity of one dunam of strategic crops and climate change, This has caused a significant gap between production and domestic food consumption, contributing to the reality of a political system that is incompatible with modern agricultural development projects, resulting in serious repercussions on Iraqi food security, which was not qualified to deal with any emergency conditions in the economic and agricultural sector. Work to increase the production of strategic crops contributes to the country's food and economic security, thereby achieving the State's strategy of increasing productivity and reducing import burdens the State budget (Alzubaidi and Almullah, 2022).

The coronavirus pandemic has contributed negatively to food security due to the total lockdown and precautionary measures taken at the local and global levels. The total lockdown has led to the failure of the economy, disrupted the movement of individuals, affected many economic activities and productive events, its operations and cash flows, disrupted the functioning of economic units and increased unemployment rates (Ardini,

2020). Reduced demand and supply of both food and agricultural products due to the sudden stagnation of logistics services and trade, the epidemic posed a significant risk to the production of food and agricultural products, due to the difficulty in the movement of factors of production such as intermediate inputs (fertilizer, seeds,... etc.), employment, fixed capital (machines, etc.) due to quarantine, This has led to disruptions in input supply, lower availability and/or higher prices of agricultural inputs affecting yields and crop production as this shock comes from the government's stringent efforts to contain the spread of coronavirus. Previous lessons in food security Published (Sultan *et al*, 2019) in their study on "The reality of major grain production in Iraq and its impact on food security for the period 1995-2016) The research aims to study the reality of production and food security of wheat and rice crops. Researchers found that there is a consumer gap and that its consumption is increasing because of the increase in population and the gap is addressed by import, which increases the state's general budget burden. (AL-Batah, 2020) published her study on (the economic and social effects of the coronavirus on Egypt's economy and agriculture), which was the decline in per capita income as a result of the partial ban, unstable work and a rise in food prices. Food value chains should be maintained to avoid any food shortages by preserving critical logistics in food chains. Published (Mouloudj *et al*, 2020) in search of (the impact of the coronavirus pandemic on food security on developing countries) aimed to analyze and discuss the impact of the pandemic on food security at the international level with a focus on developing countries, including Algeria. The study found that the pandemic had a significant impact on perishable foods and caused significant food shortages in poor countries.

Conflict and war-affected areas with food dependence and precautionary measures taken by all States have affected developing countries' supply chains and food supply and revealed vulnerability in developed countries that have failed to secure and deliver food to affected countries From wars such as Yemen, Palestine and Syria as quickly as possible, researchers recommended identifying the administrative, organizational and financing aspects of farmers and adopting an agricultural policy to increase domestic production and achieve self-sufficiency. (Islam *et al.*, 2020) explained in their research on (the potential economic effects of the Corona pandemic on the economies of South Asia) aiming to analyze the economic impact of the pandemic, and concluding that the pandemic has slowed GDP growth rates This has been accompanied by more serious impacts on the service and manufacturing sectors in all South Asian countries. The researchers recommended that governments adopt and implement expansionary fiscal strategies with monetary stimulus, provide special support for the export and import of essential materials and invest funds in small and medium-sized agricultural enterprises, and adopt short-term temporary business programmers for the unemployed. (Erinle *et al*, 2021) in their search for (the impact of the coronavirus pandemic on agriculture and food security for developing), The study aimed to assess the effects of the pandemic on food provision, access and utilization, The study found an increase in food security for developing countries experiencing food insecurity prior to the pandemic, such as India, Nigeria and Egypt, Researchers recommended the need to achieve food security by stabilizing food prices, developing agricultural infrastructure, adopting modern agricultural practices and increasing investment in agricultural research and policy. Both (Jumaa and Mahmoud, 2021) published research on (the economic and social effects of the coronavirus pandemic on Iraq's), The two researchers found that the pandemic caused a decline in the value of GDP and increased budget deficits due to low oil prices and lack of food production. The two researchers recommended that the government should undertake a general reform to cope with the crisis and the collapse of oil prices and provide essential commodities in markets and protect them from rising prices. published (AL-Auid, 2022) a study on (the economic repercussions of the Corona virus on the Omani economy) which was the most remarkable event in its economic history as a result of the deterioration of oil prices as a

major resource for the country, which is a rent economy, The researcher reached the conclusion that the self-sufficiency system of agricultural products was weak, and recommended that the value of investment allocations should be increased to increase the production of strategic crops that contribute significantly to the country's food security. (Jubeir and Ajeel, 2023) In their study on (the repercussions of the Corona pandemic on the prices of global agricultural commodities and its impact on food prices) The study aimed to analyze the impact of the coronavirus pandemic on the prices of agricultural commodity inputs and its impact on high food prices and low levels of food security, and found that food prices were rising due to higher prices of grain crops affected by higher prices of production inputs, The researchers recommended that measures be taken to reduce rising prices of food commodities, provide support to agricultural entrepreneurs, provide inputs and subsidized prices to raise global food security levels. The problem of research lies in the major challenges and constraints facing the production of the Iraqi agricultural sector, especially wheat and rice crops. The coronavirus pandemic has added a new burden that has compounded its negative effects to the extent that it is unable to achieve self-sufficiency from both crops. In addition to its impact on prices, supply chains, farm operations and agricultural imports, Iraq relies heavily on the import of agricultural and food products, thus increasing the weight of the State's general budget and widening the food gap from most food products, including wheat and rice crops. The research relied on a hypothesis that there were a number of economic factors contributing to the food gap of Iraq's wheat and rice crops during the coronavirus pandemic. The research aims to study the reality of the production of wheat and rice crops in Iraq during the coronavirus pandemic by affecting a number of economic factors in the food gap in both crops during the period 2019-2021. . The importance of research comes from the exceptional importance of producing wheat and rice crops in Iraq and their role in achieving food security, especially in times of emergency crisis at the local and regional levels, which is a real test of the realities of agricultural sector production and its role in closing the food gap from both crops. The research adopted the methodology of the inductive method of a number of previous studies on this subject, as well as the use of statistical data for a number of variables, consisting of local production values, import from both crops, average per capita income, population, government support and deficit in the State's general budget As independent variables while adopting nutritional gap values for both crops as approved variables and during the research period using the usual micro-square method and the statistical program Eviews 10 in estimating the impact of independent variables in the approved variable and for each crop to the extent that they give the best unbiased linear estimates that are often consistent with the logic of economic theory.

The disease resulting from coronavirus infection is a communicable and infectious disease that can be transmitted from one person to another. The coronavirus represents an infectious disease and is one of the latest strains of fever, fatigue and dry cough, a rapidly spreading virus (Mofton, 2022). The world and the Arab region have experienced an exceptional circumstance in the context of the spread of HIV/AIDS and its widespread economic impacts at several levels and the vulnerability of global supply chains, the international trade movement, consumption activity and investment (AL-Said. 2022). Because of disrupted livelihoods, job losses and successive shocks in food systems in terms of high food prices, low food demand due to loss of income, high prices, especially food prices, Poor purchasing power has a negative impact on the quantity and quality of food systems, thus increasing the risk of malnutrition and the number of food insecure. The pandemic and the accompanying economic crisis have already affected food and agriculture systems, a pandemic similar to previous pandemics in its rapid spread, intensity and uncertainties, exacerbating pressure on agriculture and food security. The international health crisis has revealed the fragility of the global economic system and the fact that Iraq is a

net food importer. Self-reliance must therefore be required in meeting the basic needs of individuals, rearranging priorities, reformulating strategies and formulating policies and commensurate with new realities. Domestic agricultural production plays a key role in achieving food security, especially in times of international crisis. Maintaining or even expanding agricultural production during the coronavirus pandemic is a top priority for all governments and all over the world. The pandemic has had a direct impact on agricultural crop production (Abbas, 2021). Communities and all commercial, industrial, agricultural and service activities have faced difficult and unexpected strategic challenges resulting from the outbreak of the pandemic that have clearly led to the complete and partial paralysis of a large number of sectors of economic activity (AL-Ali and Ibrahim, 2021). This crisis can be used as an incentive for reform, diversifying sources of investment in the early warning system for food security, and restructuring economic policy and social protection can enhance the resilience of Iraq's food and agricultural system in the face of current and future shocks (FAO, 2022).

MATERIALS AND METHODS

The research adopted the investigative and analytical method of methodological approaches undertaken by a number of studies in this regard. Reliance on data and statistics on the economic effects of the pandemic on food security in Iraq, as well as a number of economic variables that affected food security under the pandemic during the period (2019-2021), using the statistical program (Eveiws10), and the joint integration mechanism and error correction methodology.

Description of the model used

One of the most important and difficult stages used in estimating and analyzing economics is the model's most difficult points in formulating the model in correct terms. The three-year time series (2019, 2020, 2021) was adopted. The data was divided into 32 views after the data was divided into a month to determine its impact on the Iraqi economy during the duration of the pandemic.

A standard model has been adopted to include the following economic variables:

The main model of analysis.

First: Independent variables:

- 1-Local production..... X_1 ton.
- 2-Imports..... X_2 ton.
- 3-Average per capita income... X_3 D.
- 4- Population..... X_4 Individual.
- 5- Agricultural government support is X_5 \$ billion.
- 6- State budget deficit... X_6 \$ Billion.

Second: Adopted variable food gap... Y ton.

Food security and its most important indicators:

Food security means a situation where members of society have access to their food needs according to their available income limits. It does not mean self-sufficiency in food achieved only locally according to the state's capacity. It means providing food needs for all individuals both through domestic production and through import, so countries vary in their degree of food security due to surplus or deficit in their trade budget (Waer and Dovi, 2021).

Indicators of food security indicators are as follows:

Self-sufficiency: a country's ability to supply its food needs through production and, if this is not possible, the value of imports of food commodities is not assumed to be greater than the value of exports (AL-Najafi and AL-Alaf, 2015), and the proportion of food self-sufficiency

gives a more realistic impression of the food situation at the national level. It reflects production's ability to meet consumption requirements (Mudhi *et al*, 2012).

Food Gap: Reflects the adequacy of domestic food production to meet consumption requirements at the local level. The food gap is measured by the difference between domestic production and diverse food product requirements (Abdul Mahdi and Sakab, 2021). There is a direct correlation between self-sufficiency and the magnitude of the food gap. The wider the gap, the greater the availability of self-sufficiency and the more exposed the country to food-exporting countries.

Strategic Food Inventory: are limited and essential food commodities in human life. Quantities of such commodities are kept under government supervision. The Food and Agriculture Organization of the United Nations (FAO) has determined the size of such stocks to be equivalent to 17% of the country's annual domestic consumption. However, economic analysis of inventory volume depends on its supply whether it is price stabilization by reducing annual supply fluctuations or being used to create an appropriate volume of strategic crops, especially cereals, to cover risks arising from political and economic entanglements (Mudhi *et al*, 2012).

Food dependence: means an unequal mutual dependence relationship in access to food, which may result in an increase in the size of internal deficits as well as an increase in the state's dependence on external sources of food and most types of crops that constitute the basic food of the population and its subordination to the negative effects of monopolistic and food-exporting state practices (AL-Badiri and Jumaa, 2021).

Nutritional needs: Nutritional needs are defined as the daily energy rates necessary for a group of individuals to exercise their normal lives in good health. Nutritional needs vary by age, sex, weight and physical activity. Benchmarks are used as indicators to calculate and assess the adequacy of food needs so as to determine the best possible health situation, calculating the average plus minus the standard deviation limit, taking into account the margin of individual differences. These indicators fit 97.5% of the population (AL-Najafi and AL-Alaf, 2015).

Table (1): Food Security Indicators for Wheat and Rice Crops in Iraq for 2000-2021

years	Wheat Production tons (1)	Import tons (2)	Available for consumption Tons (*) (3)	Number Population million (4)	Food Gap Tons (**) (5)	Self-sustainmen t rate % (***) (6)	Production of rice Tons (7)	Import tons (8)	Available for consumption Tons (9)	Food Gap tons (10)	Self-sustain ment rate % (11)
2000	1474869	3860	2551100	24.086	-1076231	57.813	389475	1200	388365	1110	1.02
2001	1101598	3880	3202100	24.813	-2100502	34.403	218484	1278167	949200	-730716	23.01
2002	1040326	3862	3756200	25.656	-2715874	27.696	213980	1162000	1256153	-1042173	17.03
2003	2219446	1276667	2233000	26.088	-13554	99.393	4900	433500	71265	-66365	6.87
2004	2589467	2501412	2300000	27.139	289467	112.585	193767	651641	1013348	-819581	19.12
2005	2329198	2535520	2370000	27.963	-40802	98.278	81315	830639	978199	-896884	8.31
2006	1832138	2838813	2442000	28.810	-609862	75.026	250275	1329089	1083204	-832929	23.10
2007	2221162	2423713	2523000	29.682	-301838	88.036	308660	735900	1120589	-811929	27.54
2008	2286311	2963320	6623140	31.895	-4336829	34.520	363338	1051916	796500	-433162	45.61
2009	2202777	3050409	7007920	31.664	-4805143	31.432	392803	1099560	826500	-433697	47.52
2010	1254975	1854525	4708000	490.32	-3453025	26.656	248157	1854525	681500	-433343	36.41
2011	3650000	2674720	4799000	338.33	-1149000	76.057	334784	2674720	12099000	-11764216	2.76
2012	3610000	2643064	4925000	34.208	-1315000	73.299	361000	2643064	12332000	-11971000	2.92
2013	4178000	2326140	5053000	35.096	-875000	82.683	631000	3084500	12656000	-12025000	4.98
2014	5055000	3018237	5184000	36.005	-129000	97.511	403000	3025581	12985000	-12582000	3.10
2015	2645000	1042504	5274000	36.434	-2629000	50.151	1092000	1059008	13321000	-12229000	8.19
2016	4589000	302500	5229000	36.883	-640000	87.760	608000	1720905	13153000	-12545000	4.62
2017	3617000	214553	5251000	37.139	-1634000	68.882	850000	1164431	13237000	-12387000	6.42
2018	4103000	1552301	5240000	38.124	-1137000	78.301	729000	2783889	13195000	-12466000	5.52
2019	6331116	14148	4357148	39.09	-1973968	145.304	574700	1636011	2210711	-1636011	25.99
2020	8573683	1263	6239263	40.22	-2334420	137.414	464200	2103691	2781891	-2317691	16.68
2021	7144233	52257	5278803	40.86	-1045089	80.203	301500	1869851	3898760	2794856	7.33
lowest value	104032	1263	2233000	24.086	-4805143	26.656	4900	1200	71265	-12582000	1.002

years	Wheat Production tons (1)	Import tons (2)	Available for consumption Tons (*) (3)	Number Population million (4)	Food Gap Tons (**) (5)	Self-sustainability rate % (***) (6)	Production of rice Tons (7)	Import tons (8)	Available for consumption Tons (9)	Food Gap tons (10)	Self-sustainability rate % (11)
highest value	6238392	3050409	7007920	40.86	289467	112.585	1092000	3084500	13321000	1110	47.526
Average	3037038	1513530	4393030	32.6220	-1355992	71.71	409743	1554263	5342059	-5055338	15.639
CAGR (****)	7.2%	-0.3%	4.1%	2.5%	---	3.1%	9%	12.9%	11.3%	---	1.6%

Source: Columns 1, 2, 7 and 8 of the Republic of Iraq, Ministry of Planning and Development Cooperation, Planning and Follow-up Department, Agricultural Statistics Department, Annual Statistical Package 2000-2021.

-Columns 3 and 9 of the researchers' preparation are calculated according to the following formula:

* Available for consumption = domestic production + net foreign trade (exports-imports)

-Column 4 of the Republic of Iraq, Ministry of Planning and Development Cooperation, Central Agency for Statistics and Information Technology, annual statistical package for the years 2000-2021.

-Columns 5 and 10 of the researchers' preparation are calculated according to the following formula:

**Size of the food gap = production - consumption.

-Columns 6 and 11 of the researchers' preparation are calculated according to the following formula:

***Self-sustainability ratio = production / Disposable consumption * 100.

****Composite annual growth rate by the following formula: $CGR_t = \left(\frac{P_t B}{P_t A}\right)^{1/n} - 1$.

RESULT AND DISCUSSION

Table (1) shows a fluctuation in the size of the food gap and the proportion of self-sufficiency of the wheat and rice crop in Iraq during the period 2000-2021 due to inadequate domestic production and growth in consumption rates and the varying size of the food gap between rise and decrease due to increased imports to meet consumption rates requiring foreign currencies. In their study on economic analysis and measurement, In their study on economic analysis and measurement, Hamad and Latif 2022 recommended that the import of wheat in Iraq for the period 1990-2022 should control the import of the crop, increase support to the local product, stop imports during the peak production period and determine the minimum price of agricultural goods (Hamad and Lateef, 2022). The lowest food gap for wheat crops during the period 2000-2021 was about -4805134 in 2009, and the highest food gap for wheat during the same period was 289,467 in 2004, the lowest food gap for rice crops during the period 2000-2021 was about -12582000 in 2014, and the highest food gap for rice crops during the same period was 1115 in 2000. The reason for the fluctuation is policies, import conditions and the country's dependence on imports to fill the deficit in domestic production, increase consumption and inability to meet the population's need for domestic production, owing to the inability to increase production, the lack of government support and the cultivation of rice requires many water. The lack of use of modern methods in agriculture, irrigation, land drought and salinity are all reasons for the low production and high food gap, which posed a threat to the country's food security, and the combined growth rate of both (production of wheat crop, import, available for consumption, population and self-sufficiency) It stood at (7.2%, -0.3%, 4.1%, 2.5% and 3.1%) respectively, while the combined growth rate for both (rice crop production, import, available for consumption, and its self-sufficiency ratio) was (9%, 12.9%, 11.3% and 1.6%) respectively.

The coronavirus pandemic has had a negative impact on Iraq's economy:-

Oil prices: The coronavirus pandemic resulted in a major collapse in global oil prices, significantly affecting the volume of resources available in the country. Iraq's economy is a rewarding economy dependent on oil production and export. Oil is the largest contributor to a financial return to Iraq's general budget. It is used to finance its various expenditures, and to stop all productive projects in various commodity and service economic activities. These factors contributed to a dramatic drop in oil demand and its supply is greater than required,

resulting in a drop in its global prices (Jumaa and Mahmoud, 2021). The lack of diversification of Iraq's export structure and its dependence on oil exports amounting to 99% has made the Iraqi economy more vulnerable to the possible global crises that are having effects on oil price changes (Mahmoud and Sabbagh, 2022). Iraq's reliance on oil revenues and exports without political or institutional reform and without real production, and its economy is therefore entirely dependent on oil production, resulting in paralysis in other sectors and the transformation of society into a consumer pattern and its dependence on external imports. The decline in global oil demand led to a 10.4% contraction in Iraq's gross domestic product (GDP) in 2020, and oil production fell to its lowest level in five years in Iraq. The decline in the demand of China and India for Iraqi oil has led to a deterioration in financial revenues and the overall decline of the Iraqi economy because most of its oil exports to China constitute a 33% and India constitute 28%. These ratios show the extent to which Iraq's economy has been affected by the pandemic (Mounir and Al-Jabouri, 2023). Iraq's dependence on oil exports has also increased its current economic instability and discouraged it from investing in sectors including the agricultural sector (FAO, 2020). A combination of a sharp fall in prices and a significant fall in output led to a 40% drop in oil exports and consequently fiscal revenues and a deficit of 15.2% of GDP in 2020 (FAO, 2021), and the volatility of oil revenues poses a challenge to Iraq's economy, resulting in destabilizing the economy and reducing the efficiency of government expenditure, including agricultural investment (Madloul *et al.*, 2023)

Exchange rate: Iraq's financial crisis caused by the coronavirus pandemic has led to a deficit in the State's general budget and is a negative impact of the oil sector in Iraq because fluctuations in global oil prices and their decline in particular have had a catastrophic impact on oil exporting countries. Not only does it affect the decline in growth rates, but it has a negative impact on these countries' currency (Hussein, 2018), Monetary policy and through the Central Bank play an important role in the economic system, affecting the amount of money in circulation in society's economic activities (Alzubaidi and Sultan, 2023) As a result, the decision of the Iraqi Central Bank to devalue the currency against the dollar was a proactive step to ensure that foreign reserves were not drained, and to help the Government secure employees' salaries. The Central Bank acknowledged that the purchase rate of the dollar from the Ministry of Finance would be 1,450 dinars, while the dollar rate for banks through the foreign currency sale window would be 1,460 dinars. The Ministry of Finance's justification for this decision is an attempt to confront the financial crisis that the country has suffered due to the repercussions of Anson. The decision to devalue the currency in unstable political conditions has had a multiplier negative effect, leading to confusing market conditions and increasing demand for foreign currency with weak confidence in the national currency (Ahmed and Bouhaji, 2021). As a result of the 23% fall in the value of the Iraqi dinar against the dollar in 2020, importers of agricultural production inputs and farmers have faced increases in prices of imported agricultural inputs, while they must pay for the dollar inputs. Sales amounts in Iraqi dinars that have not yet been adjusted are met by currency depreciation of the wheat crop, which is subsidized by the Government (FAO, 2021).

Price Impact: The overall price level in the Arab countries was affected during 2020-2021, including Iraq, as the effects of the outbreak of the pandemic and its direct impact on the global production, distribution and pricing chains of basic foodstuffs continued. This has raised the overall price level as a result of the pandemic, affecting the supply of goods and services, as well as political and economic developments, the most important of which is the exchange rate change and Iraq's impact on the political developments of neighboring countries, especially as Iraq is a net regional importer of agricultural products and significantly (Jubeir and Ajeel, 2022). With the depreciation of the Iraqi dinar, the cost of food in Iraq rose by 4.1% in 2021 (FAO, 2021)

Unemployment: Many economic sectors have laid off their employees and the number of applicants for unemployment allowances and social benefits has increased because of the loss of their jobs due to the precautionary measures taken by the State to prevent the outbreak of the virus. Noting that, after the pandemic, oil prices fell and Iraqi budget deficits increased, the government suspended appointments to state institutions in order to reduce occupational subordination. Many companies also dispensed with their jobs because of loss of employment or cessation of liquidity. The problem is exacerbated by the fact that free employment, daily wages, temporary employment and informal jobs have lost their jobs, exacerbating unemployment in societies and its unprecedented rise (AL-Harash, 2020). The International Labor Organization (ILO) estimated that total global job losses were (114) million in (2020) compared to (2019) due to high unemployment rates (Mohammad, 2021). According to the statistics of the Central Statistical Agency, the unemployment rate among young people in Iraq was 40% (Juma and Mahmoud, 2021). The FAO study showed that more than 90% of SMEs in the agricultural sector and food sector have been severely or moderately affected, as well as the temporary closure of 83%, and logistics services have lost about 33% due to the pandemic. In response to the decline in revenues, more than 50% of these companies have laid off their cadres or reduced their salaries, undermining their sources of income and weakening their ability to meet their food needs (FAO, 2022).

Inflation: Inflation is defined as a rise in the general level of prices from the normal level as opposed to a decrease in the purchasing power of money, which makes the real income of individuals below their monetary income (Mohammad and Thanoun, 2022). Inflation at abnormal rates is one of the most unwanted economic phenomena afflicting the world's nations. It is one of the most important economic indicators of the level of economic performance of countries. Most of the world's economies have been characterized by recession and inflation in view of the spread of the pandemic and the policy of total lockdowns. This requires appropriate monetary policy to correct that country's economic trajectory (Jado *et al*, 2021). Government salary inflation is estimated to be about 24% of GDP in 2020, one of the highest in the world. The Central Bank of Iraq estimated that inflation rose to about 5.6% in 2021 (FAO, 2021)

- **Budget deficit and debt ratio:** the government suffered a budget deficit in 2020 of about 20% and after its savings exhausted the face of severe funding constraints, the government delayed the payment of salaries and pensions. Most of the deficit was financed by borrowing from the concentrated bank by 13% of GDP Domestic debt rose from 47% in 2019 to 83% of gross domestic product for 2020 (FAO, 2021).

- **Poverty:** The United Nations Organization in Iraq defines poor families (vulnerable groups) as any category of society exposed to environmental disasters or economic difficulties.. Iraq has recorded food shortages and a sharp rise in prices due to disruption of the world's food supply. Because of its dependence on food imports, especially basic food, and the rise in food insecurity, leading to an increase in the number of poor. FAO estimates that the number of poor people in Iraq will increase and become 5.5 million poor, plus 6.9 million poor before the crisis, i.e. the country's poverty rate rises to 33% (FAO, 2020). In particular, Iraq relies on the import of wheat, reaching 38% in 2020 and 77% in rice (FAO, 2021).As Iraq's imports from neighboring countries fell at lower levels as a result of the closure and the Government's ban on the import of certain agricultural goods, the specific closure posed a challenge in the supply chain for certain food commodities. The Food and Agriculture Organization of the United Nations (FAO) explains that the Ministry of Commerce is behind schedule in distributing the ration system since the Ministry received only IQD 47 billion, representing 9% of the budget allocated to the ration system from the 2021 fiscal budget of the Food and Agriculture Organization of the United Nations (FAO, 2021).

Table (2): Evolution of some prices and total variables in the Iraqi economy for the period 2000-2021

Years	Oil Prices \$.barrel ⁻¹ (1)	Exchange Rates IQD.\$ ⁻¹ (2)	Prices Basic Food \$.ton ⁻¹ (4)	Grain prices \$.ton ⁻¹ (3)	World Prices for Wheat Crop \$/ton (4)	Local Prices for Wheat Crop \$/ton (5)	World rice crop prices \$/ton (6)	Local Prices For Rice Crop \$/ton (7)	Unemploy ment rate% (8)	Inflation rate% (9)
2000	28.50	1930	90.4	85.2	121	74	206	108	17.03	19.63
2001	24.44	1929	93.4	86.5	129	68	216	77	16.89	25.48
2002	25.02	1919	89.9	94.4	127	75	248	130	16.78	26.62
2003	28.85	1936	97.7	98.1	127	82	198	154	28.10	28.24
2004	38.26	1453	112.4	107.5	139	120	238	309	25.44	26.31
2005	54.57	1472	117.3	103.5	143	152	286	441	17.96	17.90
2006	65.16	1475	126.7	121.7	247	305	305	508	17.70	17.10
2007	72.44	1267	158.7	166.9	299	269	326	710	16.90	14.40
2008	97.37	1203	199.8	227.8	205	380	650	798	15.34	30.20
2009	61.74	1182	156.9	173.7	227	412	555	592	15.22	19.50
2010	77.4	1185	182.6	188.3	301	506	489	604	12.3	16.6
2011	107.5	1218	246.8	227.6	304	656	543	610	11.2	24.7
2012	109.5	1222	201.0	190.9	295	654	563	612	11.9	2.7
2013	105.9	1222	210.1	202.2	265	654	506	612	12.1	2.1
2014	96.2	1205	219.3	206.9	205	674	423	549	10.6	2.8
2015	49.5	1216	210.1	200.0	172	663	386	536	13.1	30.2
2016	43.67	1182	213.1	112.8	172	680	396	516	10.8	11.1
2017	55.12	1184	214.1	97.1	207	472	399	508	13.8	14.7
2018	76.18	1182	212.4	136.6	206	473	421	575	13.5	18.2
2019	67.01	1183	221.3	107.7	230	546	418	676	13.6	2.5
2020	48.44	1192	223.5	114.1	299	469	497	673	15.1	15.2
2021	51.48	1146	230.1	132.5	406	489	385	682	14.7	9.6
lowest value	24.44	1146	89.9	85.2	121	68	198	77	10.6	2.1
highest value	109.50	1936	227.6	246.8	406	680	650	798	28.1	30.2
Average	62.92	1368.32	143.623	174.986	219.364	403.318	393.364	499.091	15.457	17.080
CAGR*	3.4%	-2.4%	1.4%	5%	3.5%	10.6	3.55	7.5%	-2.3%	-6.2%

Source:- Columns 1, 3 and 4 (League of Arab States, 2000-2021).

- Columns 2, 5, 9 and 10 (World Bank data, 2000-2021).

- Columns 6 and 8 of the researcher's preparation according to the following formula:

Local price of wheat or rice crop in dollars = local price (dinars/tons) / exchange rate (dinars/dollars)

* CAGR : Composite annual growth rate.

Table (2) shows that the composite annual growth rate of oil prices in Iraq during the period 2000-2021 was 3.4%, the composite annual growth rate of Iraqi dinars against the United States dollar was -2.4%, the composite annual growth rate of basic food prices was 1.4%, while the annual growth rate of grain prices in Iraq was about 5%, The annual growth rate for the harvest of wheat in Iraq was about 10.6%, the annual growth rate for the rice crop in Iraq was about 7.5%, while the combined annual growth rate for unemployment in Iraq was about -2.3%, and the combined annual growth rate for inflation was about -6.2%.

Government economic measures taken in Iraq due to coronavirus epidemic:

The World Bank confirms that the epidemic has significantly affected the poor and vulnerable groups in Iraq and the crisis has affected the economic well-being of the Iraqi family, as well as unemployment pressures among informal workers and private sector workers, prompting the Iraqi Government to take a range of measures: Through the Cooperative Agricultural Bank, the government met 50% of the loans owed by farmers and farmers during 2020 only. The Central Bank of Iraq has frozen interest and major payments from SMEs. The Iraqi Government borrowed \$18 billion to fill the country's fiscal deficit. The rate of external borrowing was \$5 billion and internally \$13 billion (Abdullah and Kazem, 2023). It reduced government and investment expenditures to continue providing public services, including the public distribution system for rations (ration card). Most of the

available resources focused on paying the wages of public sector workers and pensions, providing emergency grants to families affected by the lockdown in 2020. According to statistics from the Ministry of Planning, the families covered were 2.4 million, the rent was exempted from the tenants of State-owned businesses and industries. (Hussein, 2021). The Government, through the Ministry of Agriculture, has also initiated major economic reforms in the agro-food sector with a view to increasing production and participation in the agro-sector, and developing the economy through increased private sector participation and agro-food exports, in cooperation with the Ministry of Commerce, with its support for the export of agricultural production, including rapid export licensing and infrastructure investments (FAO, 2021).

Results and Discussion

Results of quantitative analysis of the impact of independent variables on Iraqi food security during the Corona pandemic for the period 2019-2021:

1-Wheat crop: The dual logarithmic formula gave the best results in estimating the impact of independent variables in the food gap of wheat in Iraq during the period of research. Table (3) shows the unit root test for the dormancy of variables in the wheat crop.

Table (3): Results of the unit root test (PP) for the economic variables included in the model

Rank	P.P. stability test of the original level of the data				P.P. stability test of the original level of the data				Variants				
	The First Difference				The Level								
	Without categorical and general direction	categorical and general direction	Categorical	Prob.	Without categorical and general direction	categorical and general direction	Categorical	Prob.					
(1)1	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	Y1		
(1)1	***	0.0000	No	0.4385	***	0.0000	***	0.0032	***	0.0003	**	0.0394	X1
(1)1	***	0.0000	No	0.5685	***	0.0000	No	0.8266	No	0.7132	No	0.7848	X2
(1)1	***	0.0000	***	0.0001	***	0.0000	No	0.9566	No	0.3279	No	0.7620	X3
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.8728	No	0.5905	No	0.8382	X4
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.5685	**	0.0395	***	0.0043	X5
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.9161	No	0.5087	No	0.8483	X6

Note:(*) Significant at the (10%) (**) Significant at the (5%) (***) Significant at the (1%).

Source: Prepared by the researcher based on the outputs of the Eviews10 program

It is observed from the result of the stationary test (unit root of the variables) that the variables: (LOGY, LOGX1, LOGX2) are stationary at the level and at the first difference. With regard to the diagnostic tests, it is noted that the model has exceeded the standard problems. The results show that the model is free of the problem of non-stationarity of variance according to the autoregressive conditional heterogeneity of variance test (ARCH), as shown in Table (4).

Table (4): Test of heterogeneity (consistency) of variance for wheat crop

Heteroskedasticity Test: ARCH			
F-statistic	0.002534	Prob. F(1,32)	0.9602
Obs*R-squared	0.002692	Prob. Chi-Square(1)	0.9586

Source: Prepared by researchers based on study data and using the Eviews10 program)

It was also clear from the (Q) test that the model is free from the problem of autocorrelation in errors, because all the probability values corresponding to the (Q) test values were greater than (5%). Here, the number of lag units is chosen as the number of one-fourth of the data, i.e. (36/4=9), as shown in Table (5):

Table (5): Q test for autocorrelation in errors for wheat crop

Sample (adjusted): 2019M02 2021M12						
Included observations: 35 after adjustments						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
. .	. .	1	0.006	0.006	0.0014	0.970
. .	. .	2	-0.045	-0.045	0.0799	0.961
. * .	. * .	3	0.174	0.174	1.2988	0.729
. * .	. * .	4	0.173	0.173	2.5521	0.635
. .	. .	5	0.016	0.034	2.5630	0.767
.* .	.* .	6	-0.131	-0.155	3.3248	0.767
.* .	.* .	7	-0.122	-0.203	4.0158	0.778
. .	.* .	8	-0.010	-0.077	4.0203	0.855
. .	. * .	9	0.041	0.087	4.1044	0.904

Source: Prepared by researchers based on study data and using the Eviews10 program)

On this basis alone, the following model was chosen to explain the economic variables affecting Iraqi food security during the period of the Corona pandemic for the wheat crop, as in Table (6).

The results of Table (6) indicate that the independent variables explained about (99%) of the changes in the value of the food gap. While the F test showed the significance of the assumed linear relationship between the independent variables and the dependent variable, and when testing the extent to which the independent variables can explain the changes occurring in the dependent variable, it is clear from the value of (t) that all variables are significant. In it, the inverse relationship is observed between (produced quantities of wheat Cultivation of this crop will thus reduce the food gap from it. In it, the inverse relationship is observed between (produced quantities of wheat X_1) with the dependent variable (food gap y), which is consistent with the logic of economic theory. The flexibility of the parameter indicates that if (X_1) increases by (1%), the food gap will decrease by 0.253%, and this increase will encourage investments in cultivating this crop and thus the food gap will decrease. As for (quantities of imported wheat X_2), it appeared with a positive sign and indicates the direct relationship between it and the dependent variable. By increasing imported quantities by (1%), the food gap will increase by (3.786%). The explanation for this is that when imports increase and economic openness will work to fill the shortfall in local production due to the inability of local crops to meet local needs.

Table (6): Monthly wheat crop analysis results for the years 2019-2021

Dependent Variable: LOGY				
Method: Least Squares				
Sample (adjusted): 2019M02 2021M12				
Included observations: 35 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	63.57544	0.524909	121.1170	0.0000
LOGX1	-0.253045	0.014497	-17.45492	0.0000
D(LOGX2)	3.786120	0.710586	5.328169	0.0000
D(LOGX3)	30.38970	2.669842	11.38259	0.0000
D(LOGX4)	-1.764910	0.325233	-5.426600	0.0000
LOGX5	-4.525879	0.047058	-96.17645	0.0000
D(LOGX6)	-2.696249	0.799905	-3.370712	0.0022
R-squared	0.999789	Mean dependent var		12.09907
Adjusted R-squared	0.999744	S.D. dependent var		0.075542
S.E. of regression	0.001208	Akaike info criterion		-10.42209
Sum squared reside	4.09E-05	Schwarz criterion		-10.11102
Log likelihood	189.3866	Hannan-Quinn critter.		-10.31471
F-statistic	22138.49	Durbin-Watson stat		0.771212
Prob(F-statistic)	0.000000			

Source: Prepared by researchers based on study data and using the Eviews10 program)

As for (population X_3), its positive sign indicates a smooth relationship with the dependent variable, which is the food gap, as its elasticity reached 30.389% Which means when the population increases by (1%), the food gap rate will increase with the same elasticity rate mentioned above, and this is logical in terms of economic theory. As for (average income per capita X_4), the sign of its parameter was negative, consistent with the logic of economic theory The elasticity of the parameter indicates that with an increase of (X_4) by (1%), the food gap will decrease by (1.764%). This means that as the average income of an individual increases, that is, his purchasing power increases, his consumption of food commodities with higher nutritional value increases, and his preference for types of better value increases. The negative sign of the variable (agricultural support X_5) indicates that whenever the amount of support increases by (1%), agricultural production of wheat will increase, which reduces the amount of the food gap by (4.525%). This indicates the importance of agricultural support, both inputs and outputs Joaani and AL-Douri, also explained in their study on the impact of government support on the production of wheat in Iraq in (2021) that government support for the agricultural sector in Iraq played a significant role in increasing production and supply of the crop and stimulating the production process until it did not reach the level of satisfaction of domestic demand (Joaani and AL-Douri , 2021). Finally, the negative sign of the deficit in the state's general budget (X_6) indicates that if this deficit decreases by (1%), the food gap will decrease by (2.696%) This indicates the importance of providing financial support that enables farmers to provide production inputs through which they can increase the volume of production.

2 - Rice crop:

The double logarithmic formula gave the best results in estimating the effect of independent variables on the food gap for rice in Iraq and during the research period, as in the following table:

Table (7): Results of the unit root test (PP) for the economic variables included in the model

Rank	P.P. stability test of the original level of the data				P.P. stability test of the original level of the data				Variants		
	The First Difference				The Level						
	Without categorical and general direction	categorical and general direction	Categorical	Prob.	Without categorical and general direction	categorical and general direction	Categorical	Prob.			
(1)1	***	0.0000	***	0.0002	***	0.0000	***	0.0000	***	0.0012	Y1
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.7756	No	0.8414	X1
(1)1	***	0.0000	**	0.0432	***	0.0000	No	0.5407	No	0.8286	X2
(1)1	***	0.0000	***	0.0001	***	0.0000	No	0.9566	No	0.3279	X3
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.8728	No	0.5905	X4
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.5685	No	0.8395	X5
(1)1	***	0.0000	***	0.0002	***	0.0000	No	0.9161	No	0.5087	X6

Note:(*) Significant at the (10%) (**) Significant at the(5%)(***) Significant at the(1%)
 Source: Prepared by researchers based on study data and using the Eviews10 program)

It is observed from the results of the unit root (rest) that the variable (LOGY) stabilized at the initial level of the data only, while the rest of the variables stabilized at the first difference, and as shown in Table (7), With regard to diagnostic tests, it is noted that the model has overcome the standard problems, as it was shown through the results that the model is free of the problem of non-stationarity of variance. According to the (ARCH) autoregressive conditional heterogeneity test, as in Table (8).

Table (8): Test of heterogeneity (consistency) of variance for rice crop

Heteroskedasticity Test: ARCH			
F-statistic	2.923959	Prob. F(1,32)	0.0970
Obs*R-squared	2.846602	Prob. Chi-Square(1)	0.0916

Source: Prepared by researchers based on study data and using the Eviews10 program)

The (Q) test showed that the model is free of the autocorrelation problem, because all the probability values corresponding to the (Q) test values were greater than (5%), as in Table (9).

Table (9): Q test for autocorrelation in errors for rice crop

Sample (adjusted): 2019M02 2021M12							
Included observations: 35 after adjustments							
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob		
. **	. **	1	0.288	0.288	3.1574	0.076	
. .	. * .	2	-0.032	-0.125	3.1965	0.202	
. * .	. * .	3	0.111	0.174	3.6934	0.297	
. **	. **	4	0.310	0.246	7.6967	0.103	
. **	. * .	5	0.276	0.158	10.993	0.052	
. .	. .	6	0.044	-0.042	11.079	0.086	
. * .	. * .	7	-0.142	-0.192	12.006	0.100	
. * .	. * .	8	-0.111	-0.178	12.599	0.126	
. .	. .	9	0.025	-0.063	12.630	0.180	

Source: Prepared by researchers based on study data and using the Eviews10 program)

On this basis alone, the following model was chosen to explain the economic variables affecting Iraqi food security during the Corona pandemic period for the rice crop, as follows:

Table (10): Results of rice crop analysis for monthly observations for the years (2019-2021)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.76808	0.928451	-11.59789	0.0000
LOGX1	1.603580	0.011050	145.1182	0.0000
LOGX2	0.176590	0.006257	28.22106	0.0000
D(LOGX3)	-0.560492	1.399425	-0.400516	0.6918
D(LOGX4)	0.086751	0.036334	2.387582	0.0239
LOGX5	0.309108	0.070257	4.399713	0.0001
D(LOGX6)	-0.641721	0.094102	-6.819382	0.0000
R-squared	0.999991	Mean dependent var		11.98854
Adjusted R-squared	0.999990	S.D. dependent var		0.163927
S.E. of regression	0.000530	Akaike info criterion		-12.06941
Sum squared residue	7.87E-06	Schwarz criterion		-11.75834
Log likelihood	218.2147	Hannan-Quinn critter.		-11.96203
F-statistic	541482.4	Durbin-Watson stat		0.555478
Prob(F-statistic)	0.000000	Wald F-statistic		3004617.
Prob(Wald F-statistic)	0.000000			

Source: Prepared by researchers based on study data and using the Eviews10 program)

After conducting statistical and measurement tests, the changes occurring in the value of the nutritional gap for the rice crop through the changes occurring in the independent variables included in the model, The (F) test showed the significance of the assumed linear relationship between the independent variables and the dependent variable, and when testing the extent to which the independent variables can explain the changes occurring in the dependent variable, the significance of all variables is revealed from the (t) value. With the exception of the variable (population X_3), in which a direct relationship is observed between (the quantities produced for the rice crop x_1) with the dependent variable (the food gap for the rice crop y), the sign of its parameter was positive, inconsistent with the logic of economic theory. The elasticity of the parameter indicates that by increasing (X_1) by (1%), the food gap will rise by (1.603%). This is due to the fact that rice is one of the most important food crops that is consumed on a large scale in Iraq, so any increase in the quantities produced from it will not contribute to closing the gap. This is accompanied by the limited areas cultivated with rice in Iraq, as they are limited to Najaf Governorate in central Iraq and Acre District in northern Iraq only. As for (imported rice quantities X_2), it showed a positive sign, meaning that by increasing the imported quantities by (1%), the food gap will increase by (0.176%). The explanation for this is that when imports and trade openness increase, it will fill the shortfall in local production due to the inability of local crops to meet local needs. The average per capita income X_3 showed a positive sign, which indicates an increase in the purchasing power of the individual and the state alike, especially after (2003).

The increase in national income at high rates and the tendency to consume imported types of rice, especially of high quality. The flexibility of the parameter indicates that by increasing (X_4) by (1%), the food gap will increase by 0.086. The positive sign of the parameter (agricultural support X_5) means that whenever the amount of support increases by (1%), the food gap for rice will increase by 0.309%. Which indicates the importance of agricultural support, both inputs and outputs. Finally, the negative sign also for the deficit in the state's general budget (X_6) indicates that whenever this variable increases by (1%), the dependent variable will decrease by 0.641%. This indicates the importance of providing financial support, through which it works to provide what is necessary for the production of the rice crop, and the variable population x_3 did not appear significant in affecting the size of the food gap from the crop being studied

CONCLUSION

The structural imbalance in Iraq's agricultural sector is one of the most important factors that led to the inability of the agricultural sector to achieve food security during the period of the coronavirus pandemic. Agricultural government support is one of the most important factors contributing to Iraq's food security through its impact on a number of economic and social variables and consumer and producer inputs. The results of the practical aspect illustrated the morale of the variable in the quantities produced by wheat and the inverse relationship with the value of the food gap, and the morale of the variable in the quantities produced by rice and an exclusive relationship with its food gap. The import of wheat and rice showed morale and a positive signal with its food gap, while the deficit in the State's general budget was a correlation with the food gap in both crops.

CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

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