گـۆڤـاری زانـکـۆی ڕاپـەڕیــن
Journal of University of Raparin.
مجلة جامعة رابرين

E-ISSN: 2522 – 7130 P-ISSN: 2410 – 1036

DOI: 10.26750/5fndcx72

Date Received: 10/03/2025
Date Accepted: 16/06/2025
Date Published: 29/08/2025

War-Induced Trade Shocks: A Statistical Analysis of Iraq-Ukraine Import-Export Dynamics in 2021 (Pre-War) and 2022 (Post-War)

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Abstract

This research aims to investigate the impact of the Russia-Ukrainian war on Iraq's import-export dynamics with Ukraine. The study employs statistical tools such as the Wilcoxon rank test, Kolmogorov-Smirnov test, and Shapiro-Wilk test to analyze variations in trade quantities, providing robust insights into trade shocks caused by the conflict. Using data from both pre- and post-conflict periods, the study captures the fluctuating trade patterns between the two nations and examines the extent to which geopolitical instability can influence economic interactions. The analysis highlights a peak in Iraqi imports from Ukraine in mid-2021, followed by a sharp decline at the onset of the war in early 2022, with intermittent spikes in trade observed during the post-conflict phases. This demonstrates the war's significant disruption to trade while emphasizing Iraq's economic resilience in navigating such challenges. The research contributes to a broader understanding of the implications of geopolitical conflicts on international trade, highlighting their destabilizing effects on supply chains and trade flows. Key recommendations for policymakers include the development of contingency strategies to mitigate the adverse effects of geopolitical instability on trade, the diversification of Iraq's trading partners to reduce overdependence on specific regions, and the enhancement of internal economic resilience through targeted investment in non-oil sectors, particularly those that foster economic diversification and sustainable growth.

Keywords: Russia-Ukrainian Conflict, Iraq-Ukraine, Trade dynamics, Statistical analysis, Wilcoxon Signed Rank Test.

شۆکی بازرگانی بەهۆی جەنگەوە: شیکارییەکی ئاماری بۆ جولەی هاوردەکردن وهەناردەکردنی عێراق-ئۆکرانیا لە ساڵی ٢٠٢١ (پێش جەنگ) و٢٠٢٢ (دوای جەنگ)

هیوا عوسمان ئیسماعیل

بەشی کارگێڕی کار، کۆلێژی تەکنیکی شەقڵاوە، زانکۆی تەکنیکی هەولێر ، هەرێمی کوردستان، عێراق.

پوختە

ئامانجی ئەم توێژینەوەیە لێکۆڵینەوەیە لە کاریگەری شەڕی ڕوسیا -ئۆکرانیا لەسەر جولەی هاوردەکردن وهەناردەکردنی عێراق لەگەڵ ئۆکرانیا. توێژینەوەکە ئامرازەکانی ئاماری وەک تاقیکردنەوەی ویلکۆکسۆن (Wilcoxon) وتاقیکردنەوەی کۆلمۆگۆرۆف-سمیرنۆف (Kolmogorov-Smirnov) وتاقیکردنەوەی شاپیرۆ-ویلک (Shapiro-Wilk) بەکاردەهێنێت بۆ شیکردنەوەی جیاوازی لە بڕی بازرگانی. توێژینەوەکە بە بەکارهێنانی داتاکانی سەردەمی پێش ودوای شەڕ، گۆڕانکاری لە شێوازەکانی بازرگانی نێوان هەردوو وڵات دەگرێتەوە وتاچەند ناسەقامگیری جیۆپۆلەتیک کاریگەری لەسەر کارلێکە ئابوورییەکان دەخاتەڕو. توێژینەوەکە ئاماژە بەوە دەکات کە لە ناوەڕاستی ساڵی 2021 دا هاوردەکردنی عێراق لە ئۆکرانیا بەرزبۆتەوە، و لەدوایدا لە سەرەتای شەڕدا لە ساڵی 2022 دابەزیوە. ئەمە کاریگەری گەورەی جەنگ لە جولەی بازرگانی دەردەخات ولە هەمان کاتدا جەخت لەسەر توانای ئابووری عێراق دەکاتەوە لە ڕوبەڕوبونەوەی ئەم جۆرە ئاستەنگانە. توێژینەوەکە یارمەتیدەرە بۆ تێگەیشتنێکی فراوانتر لە کاریگەرییەکانی ململانێی جیۆپۆلەتیک لەسەر بازرگانی نێودەوڵەتی وتیشک دەخاتە سەر کاریگەرییە ناسەقامگیرەکانیان لەسەر زنجیرەی دابینکردن ولێشاوی بازرگانی. پێشنیارە سەرەکییەکانی ئەم توێژینەوە بۆ سیاسەتمەداران بریتین لە پەرەپێدانی ستراتیجی لەناکاو بۆ کەمکردنەوەی کاریگەرییە نەرێنییەکانی ناسەقامگیری شەر لەسەر بازرگانی، هەمەجۆرکردنی هاوبەشە بازرگانییەکانی عێراق بۆ کەمکردنەوەی پشت بەستن بە ناوچە دیاریکراوەکان وبەهێزکردنی توانای ئابوری ناوخۆ لە ڕێگەی وەبەرهێنانی ئامانجدار لە کەرتەکانی تری جگە لە نەوت، بەتایبەتی ئەو کەرتانەی کەوا هەمەچەشنی ئابوری وگەشەی ئابوری بەهێز و مسۆگەر دەکەن.

کلیلە وشەکان: ململانێی ڕوسیا-ئۆکرانیا، عێراق -ئۆکراینا، جوڵەی بازرگانی، شیکردنەوەی ئاماری، تاقیکردنەوەی ویلکۆکسۆن.

1 Introduction

The interplay between geopolitical events and global economic dynamics is a critical area of study, especially in an increasingly interconnected world. Military conflicts, even those which are geographically distant, can cause significant disruptions that impact international markets and supply chains. The Russo-Ukrainian war, which escalated into a full-scale invasion in February 2022, is a recent and profound example of this disruption. Beyond the immediate humanitarian crisis, the conflict has caused widespread economic

shocks, impacting everything from energy markets to global food security. Developing countries, already reeling from the economic fallout of the COVID-19 pandemic, have been disproportionately affected by these new pressures, including rising commodity prices and inflation (Gruia, 2016). This study examines the specific impact of the Russo-Ukrainian war on import and export dynamics between Iraq and Ukraine. Despite the geographical distance between the two countries, the Iraqi economy, which is highly dependent on global trade and oil revenues, has been vulnerable to the repercussions of the conflict. Undoubtedly, the war has caused significant disruption to trade patterns. For example, Iraqi imports from Ukraine, which peaked in mid-2021 and stabilized by the end of the year, experienced a sharp decline immediately after the outbreak of the war in early 2022 (UNCTAD, 2022). Although there have been intermittent upticks in trade activity since then, overall levels have remained well below pre-war volumes. This turmoil highlights a fundamental research problem: understanding the magnitude and nature of trade shocks resulting from the Iraq-Ukraine war, and their implications for the resilience of the Iraqi economy and its need for trade diversification. Analyzing these specific bilateral dynamics provides a concrete case study of the broader effects of geopolitical instability on international trade, particularly for economies dependent on global markets (Haacker, 2023). The motivation for this study stems from the urgent need to understand how economies in countries such as Iraq, despite their geographical remoteness from conflict zones, are significantly affected by geopolitical instability. By clarifying the effects of the war on Iraq's trade with Ukraine, this research aims to fill a gap in the current literature regarding the specific economic consequences for Iraq. It also seeks to highlight Iraq's inherent economic weaknesses, particularly as a rentier economy based primarily on oil, exploring its resilience in the face of these challenges. The study also stimulates the possibility of informing policy makers about strategies to mitigate negative impacts and promote economic stability through measures such as trade diversification and strengthening non-oil sectors. Understanding these dynamics is essential for Iraq to improve its ability to withstand future global shocks (Haacker, 2023, p. 1). The research is based on a comparative methodology, analyzing the dynamics of trade between Iraq and Ukraine by comparing the data of different pre-and post-conflict periods, during the period from 2021 to 2023. The research assumes that a major geopolitical event such as a war will cause significant deviations from the prevailing trade patterns. The study demonstrates its logic by using precise statistical methods to identify and quantify these changes,

bypassing mere narrative descriptions to provide empirical evidence of the impact of war (Alnasrawi, 2023, p. 47). The research plan includes the collection and analysis of trade data for Iraq and Ukraine from 2021 to 2023. The analysis uses a combination of descriptive and heuristic statistical methods. Descriptive statistics, such as the study of changes in volumes and values over time, provide an overview. Heuristic statistics are then used to assess the significance of the observed changes. Specifically, the Kolmogorov-Smirnov and Shapiro-Wilk tests are used to assess the normality of trade data before and after the war. Since the data may not follow the normal distribution, the Wilcoxon signed rank test, a non-standard test, is applied to determine whether there are statistically significant differences in trade values between the pre-war and post-war periods. It also integrates the approach of studying events to the analysis of trade values specifically in the period around the start of the war. The analysis will focus in particular on the consequences of the war on Iraq's non-oil imports and exports, which are crucial for economic diversification (Faccarello, 2015). By conducting this analysis, the study contributes to the relevant academic literature in multiple ways. They promote a broader understanding of how geopolitical conflicts, specifically military wars, cause trade shocks and disrupt global supply chains. It also provides empirical data on specific bilateral trade impacts between a conflict-affected country (Ukraine) and a remote but vulnerable economy (Iraq), contributing to the literature on indirect impacts on non-conflict-affected economies. The study also provides relevant insights into the study of rentier economies and their vulnerability to external shocks. Moreover, the results provide valuable empirical support for such theoretical concepts as comparative advantage, the impact of economies of scale and policy changes on trade volumes in the context of turbulence. Ultimately, this study aims to provide robust and statistically supported insights into the economic consequences of geopolitical instability, providing practical recommendations for policymakers in Iraq and other similar economies to build resilience and adapt to future disruptions (Alnasrawi, 2023).

2 Literature Review

The complex relationship between the dynamics of World Trade and geopolitical conflicts has captured wide academic attention, especially in the wake of recent large-scale military confrontations, such as the war between Russia and Ukraine. While there are many studies dealing with the direct economic consequences faced by countries

involved in conflicts, few studies have dealt with the indirect and long-term consequences for geographically distant economies such as Iraq. This research seeks to bridge this gap by critically examining current empirical views and findings to place the analysis of trade between Iraq and Ukraine within the framework of broader academic research. Krpec and Hodulak (2019) emphasize that wars radically reshape international trade patterns by disrupting supply chains and changing financial networks. Their research shows that trade interruptions during major conflicts not only cause immediate losses, but also have lasting effects on the global financial structure. This is in line with the observations of Alnasrawi (2023) who highlights the multifaceted repercussions of the Russian-Ukrainian conflict on regional economies, including Iraq, by affecting not only trade flows but also financial policies and economic stability. Both agree on the importance of trade disruptions but differ slightly in their scope: Krpec and Hodulak focus on the lessons learned from the international trade system in general from conflicts, while Nasrawi draws attention specifically to how these disruptions manifest themselves in countries dependent on oil revenues, highlighting the unique vulnerabilities of rentier economies such as Iraq.

Studies consistently show that even countries that are not directly involved in the military zone, such as Iraq, are experiencing noticeable side effects due to their integration into world markets. Haacker (2023) discusses how commodity price shocks - especially in food, energy and Fertilizers caused by conflict - threaten food security and economic growth in regions such as the Middle East and North Africa. This view is reinforced by Glauber and Laborde Debucquet (2023), who detail the direct consequences for agricultural commodity markets, directly linking geopolitical instability with rising world prices and changing supply chains. These findings agree on the vulnerability of developing countries but differ somewhat on the extent to which these shocks can disrupt economic recovery in the medium term, revealing a delicate debate about resilience versus persistent economic difficulties.

The literature also seeks to explain and support Iraq’s economic policies using both classical and modern views on trade. According to Faccarello (2015), using David Ricardo’s approach, Iraq exported oil as most of its opportunities were lowest in oil production. Through the Heckscher-Ohlin model, this trade specialization is linked to the natural sources Iraq has, though the model mentions that insufficient capital and modern technology blocks the country from trading many other products. According

to Krugman's 1979 New Trade Theory, if Iraq reduced its dependence on oil and took advantage of economies of scale, it could expand and stabilize its economic relations. Even so, reports on the topic differ on how rapidly and realistically Iraq can diversify its economy in the event of geopolitical pressure which means Iraq may no longer be able to rely on its traditional strengths in such situations. AlJeburi et al. (2023) and similar recent studies have begun to reveal how the war between Russia and Ukraine impacts rentier economies, using Iraq as an illustration. They explain that Iraq faces greater economic problems due to its strong reliance on oil income and small non-oil economy during times of world uncertainty. This agrees with the findings from Kamel Hasan (2022), who links Iraq's geopolitics with the behavior of its foreign policy and the way its economy functions. Bednarski et al. (2023) show how changes in the global political situation disrupt supply networks and stress the need for logistics that can withstand disruptions and a mix of trading partners. All the studies agree that external factors affected Iraq but differ in their importance. Some stress policy failures within Iraq, whereas others point mainly to external factors. The literature gives good information on how geopolitical conflicts disturb the Iraqi economy, but it rarely examines the connections between these disruptions and Iraq's unique economic strategies or relationships with other nations. Few studies genuinely debate whether Iraq is meeting the economic changes needed to handle today's economic climate. In contrast to Alnasrawi's (2023) observation on Iraq's bad financial policies, other studies give more importance to outside events and less to governance. Furthermore, little research checks how accurate trade volume and trends are analyzed, thus this study looks at rigor by executing non-parametric tests such as the Wilcoxon signed-rank, along with incorporating concepts from theory and confirmed through practical observations.

Many experts agree that the conflicts on the geopolitical stage result in major changes to trade and increase risks for nations like Iraq. On the other hand, there are conflicting views on whether the problems these countries face will linger and how quickly they can adjust. Krpec and Hodulak (2019) maintain that trade conduct may be permanently influenced by conflicts, but AlJeburi et al. (2023) explain that acting effectively and implying needed reforms can help manage and limit the difficulties. In addition, there is uncertainty about the role played by the world's leading institutions and the use of sanctions. In some studies, sanctions are seen as major causes that hinder exports

(Manelli et al., 2024) , yet others (Balbaa et al. 2022) place more importance on instability and poor government functions.

The reviewed studies emphasize the need for countries such as Iraq to diversify their trade partnerships, invest in non-oil sectors, and develop contingency strategies to mitigate the impact of geopolitical shocks. However, there is still a dearth of detailed policy prescriptions based on empirical evidence. This gap points to a critical area on which future research should focus, particularly on how trade diversification strategies can be effectively operationalized in politically volatile environments. In addition, a more detailed analysis of the dynamics of bilateral trade between Iraq and Ukraine, with the integration of modern high-frequency trade data and the application of accurate statistical methods, is needed to fill the existing knowledge gaps.

3 Methodology

This study is based on a quantitative research design to analyze the impact of the Russian-Ukrainian conflict on the dynamics of import and export in Iraq. The methodology is designed to ensure clarity, repeatability, systematic investigation of the research problem. Using descriptive and deductive statistical methods, the study examines pre-and post-conflict trade patterns to determine the extent of disruptions. The study specifically compares pre-war (2021) and post-war (2022) trade data, providing a comprehensive understanding of the economic consequences of war.

The data used in this research were obtained from reliable secondary sources, including World Bank databases, the United Nations Commodity Trade Database (Comtrade), and data from the Economic Cooperation Organization (OEC). These sources provided the volumes and values of monthly trade (imports and exports) between Iraq and Ukraine, covering the period from January 2021 to February 2023. This schedule was divided into three stages: the pre-war period (January 2021 to January 2022), the stage of the beginning of the war (February 2022), and the post-war period (March 2022 to February 2023). These divisions allowed to make an accurate comparison of the dynamics of trade under normal and conflict conditions.

The research followed a systematic protocol. First, trade data were divided into pre-war and post-war categories. Secondly, the raw data have undergone a thorough cleaning process to address discrepancies, missing values and anomalous values, ensuring accuracy and reliability. Finally, the main variables of the analysis were

identified: monthly import volumes from Ukraine to Iraq and monthly export volumes from Iraq to Ukraine. These variables were measured in terms of quantity (total trade volume in metric tons) and value (trade value in US dollars).

Statistical analysis combined descriptive statistics, normal distribution tests, and heuristic statistics to study fluctuations in trade dynamics. Descriptive statistics summarized the data in terms of arithmetic averages, mediums, standard deviations, trends, while graphs and tables presented the results. To evaluate the distribution of the data, the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk tests were applied. The results of these tests determined whether the data followed the normal distribution, and guided the choice of other statistical methods.

For heuristic analysis, the study used parametric and non-parametric tests. The T test was applied to test for significant differences in trade values when the data met the assumptions of the normal distribution. When the data did not follow the normal distribution, the Wilcoxon test of the signed rank was used to compare paired samples from the pre-war and post-war periods. Additionally, the event study approach to analyze the immediate and long-term effects of the war was used, focusing on changes in trade volumes before and after the outbreak of the conflict in February 2022.

All statistical calculations and tests were carried out using the IBM SPSS Statistics program. Descriptive statistics provided a summary of the data, while normal distribution tests (K-S and Shapiro-Wilk) evaluated the distribution of the data. Hypothesis testing followed a structured framework: the null hypothesis (H0) assumed that there were no fundamental differences in trade values before and after the war, while the alternative hypothesis (Ha) assumed that there were fundamental differences. A statistical significance threshold of 0.05 was used. If the probabilistic value is greater than 0.05, it did not reject H0, which indicates that there is no fundamental difference. Conversely, if the probabilistic value is less than or equal to 0.05, rejecting H0, which indicates a fundamental difference.

4 Analysis and Interpretation

4.1 Iraqi export and import:

In terms of GDP (current US$), Iraq ranks 48th globally in 2022 in terms of economic size. The country ranked 36th in terms of total exports, 54th in terms of total imports, 104th in terms of GDP per capita (in current US dollars), and 103rd in terms of the Economic

Complexity Index (ECI). The primary exports from Iraq consisted of crude oil ($111 billion), refined petroleum ($9.19 billion), gold ($1.03 billion), petroleum coke ($770 million), and petroleum gas ($388 million).

4.2 Iraq-Ukraine Trade

Regarding trade with Ukraine in 2022, Iraq exported $173k to Ukraine, with the top exports being petroleum coke ($149k), tropical fruits ($18.6k), and other electrical machinery ($5.08k). Over the past five years, Iraq's exports to Ukraine have increased at an annual rate of 23.1%, from $61.1k in 2017 to $173k in 2022. Conversely, Ukraine exported $479m to Iraq in 2022 were primarily seed oils ($195m), hot-rolled iron ($30.5m), and packaged medicaments ($11.6m). Ukrainian exports to Iraq grew at an annual rate of 185%, from $2.55 million in 2017 to $479 million in 2022. These data points provide a foundation for analyzing the impact of the Russia-Ukrainian war on Iraq's trade patterns (*Trade between Iraq and Ukraine*, 2022).

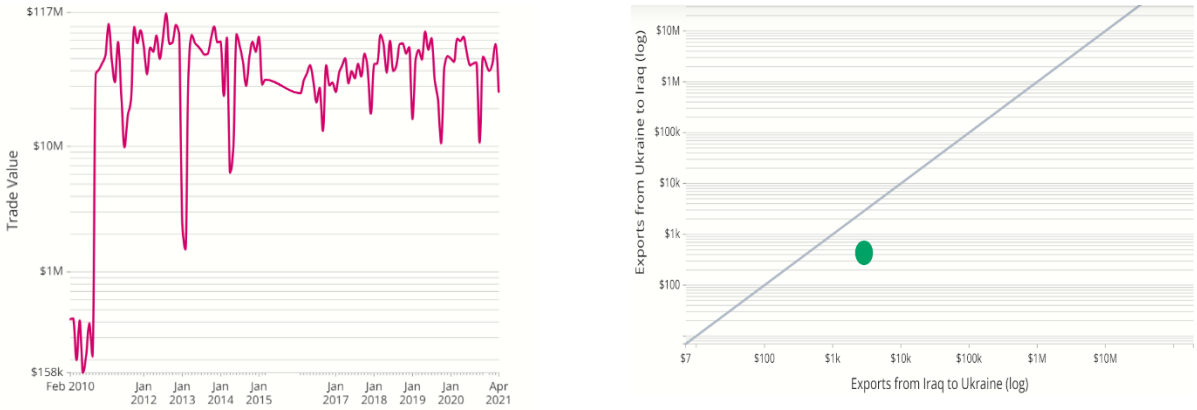


Figure 1: Trade between Iraq and Ukraine.

source :- (*Trade between Iraq and Ukraine*, 2022)

In 2022, Iraq ranked 103rd in the Economic Complexity Index (ECI -0.84) and 36th in total exports ($123B). In contrast, Ukraine ranked 44th in the Economic Complexity Index (ECI 0.5) and 61st in total exports ($47.1B). This comparison highlights the trade dynamics between Iraq and Ukraine, focusing on the products traded by both countries. In 2022, Iraq had a significant net trade surplus with Ukraine in mineral products ($149K), vegetable products ($18.6K), and machinery ($5.08K). Conversely, in 2017, Ukraine had a substantial net trade surplus with Iraq in animal and vegetable by-products ($197M), metals ($43.6M),

and foodstuffs ($18.7M). These insights, derived from BACI HS6 data (1995–2022), provide a detailed comparison of trade patterns between Iraq and Ukraine, illustrating shifts in trade balances and the impact of different economic factors over time (*Trade between Iraq and Ukraine*, 2022; Data, 2021; Database, 2021).

4.3 Iraq's Imports from Ukraine in 2021

The following figure shows the monthly Iraq's imports from January 2021 to January 2022. Each data point on the graph corresponds to the volume of imports in that month, measured on the y-axis in units (presumably currency or quantity) up to 12,000,000. Here's an analysis of the graph from January to February 2021:

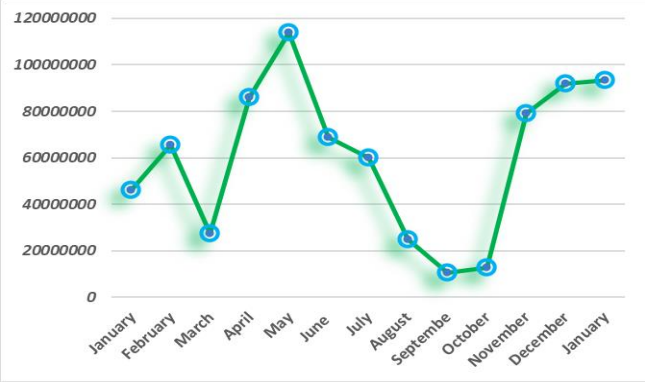


Figure 2: Imports before the war in 2021

source: Preparation of the researcher's work based on the collected data (Trade between Iraq and Ukraine, 2022) (Data, 2021). (Database, 2021)

Imports saw a steady rise from around 4 million to 6 million between January and February 2021. However, in February to March 2021, imports dropped sharply back to 4 million. From March to May 2021, imports surged, reaching the highest point of the year, slightly above 11 million in May. Following this peak, imports fell dramatically in June, dropping to around 6 million.

From June to August 2021, imports remained stable with only small changes near the 6 million marks. In August to September 2021, there was a steep decline, hitting the lowest point of the year at 2 million. After this, imports gradually recovered between September and November, rising back to 4 million. The period from November 2021 to January 2022 saw a steady increase, reaching just over 6 million by January.

These figures show a lot of volatility, with frequent increases and decreases in short periods. This could indicate unstable trade relations or external factors affecting imports.

- Peak in May 2021: The high import rate in May could be due to seasonal demands, policy changes, or economic factors.
- Lowest Point in September 2021: The drop in September might have been caused by disruptions in trade, likely due to geopolitical tensions, sanctions, or supply chain issues.

The data cover the period before the war and reflect normal trade patterns that may have been impacted by pre-existing economic conditions. These fluctuations could also suggest that Iraq was stockpiling in anticipation of the war.

4.4 Iraq's Imports from Ukraine in 2021

The following figure displays monthly imports from Ukraine to Iraq from February 2022 to February 2023, showing changes in import volumes after the conflict began. The y-axis measures volumes up to 8 million, and each data point reflects the import levels for each month.

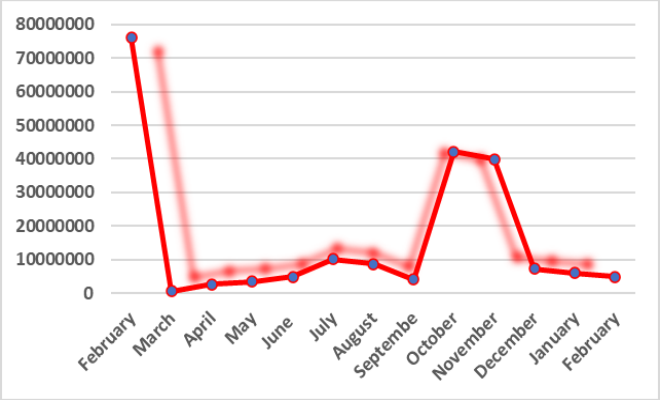


Figure 3: Imports before the war in 2022

source : Preparation of the researcher's work based on the collected data)*Trade between Iraq and Ukraine*, 2022 ((Data, 2021). (Database, 2021)

From February to March 2022, imports dropped sharply from about 7.5 million to nearly zero, signaling a major disruption likely caused by the war. Between March and September 2022, imports remained very low, close to zero, reflecting the ongoing impact of the conflict on trade.

In September to October 2022, imports suddenly spiked to around 3.5 million, and by November, they increased further, reaching about 7 million—similar to pre-war levels. However, from November to December 2022, imports declined again, falling to around 4

million, and from December to February 2023, they continued to decrease, stabilizing at around 1 million by the end of the year.

The early months of the war saw a severe decline in imports, showing the immediate and harsh impact of the conflict on trade between Ukraine and Iraq. The temporary recovery in October and November 2022 might be due to stabilization efforts or adjustments to trade patterns during the war, but the following decrease highlights continued instability. Overall, imports remained much lower than before the war, signaling ongoing challenges in trade. This decrease has long-term economic effects for both countries, especially Iraq, affecting the supply of goods and its economic situation. The graph clearly illustrates how the war caused a sharp drop in trade, followed by a brief recovery, and then a stabilization at much lower levels than before the conflict.

4.5 Iraq's Exports to Ukraine in 2021

The below graph illustrates the monthly exports from Iraq to Ukraine from January 2021 to January 2022. The y-axis represents the export volume, presumably in units of currency or quantity, up to 80,000.

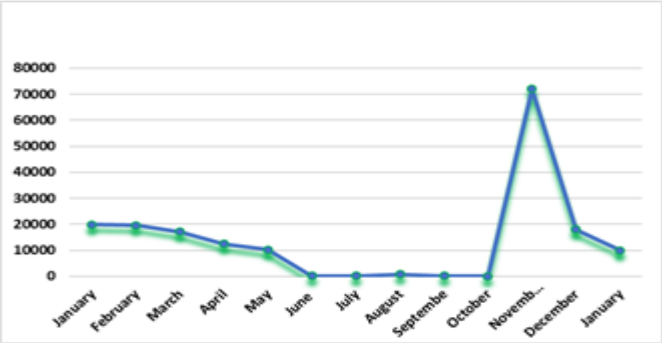


Figure 4: Iraq's Exports from Ukraine in 2021 (Before War)

source : Preparation of the researcher's work based on the collected data)*Trade between Iraq and Ukraine*, 2022 ((Data, 2021). (Database, 2021)

From January to April 2021, exports remained stable, ranging between 10,000 and 20,000, showing steady trade during this period. From April to June 2021, exports gradually dropped from around 15,000 to nearly 5,000. Between June and September 2021, exports were extremely low, close to zero, indicating very little trade activity. In October to November 2021, exports spiked dramatically, peaking at around 70,000 in November, possibly due to a large shipment or a sudden increase in demand. However, after this peak, exports quickly fell again, stabilizing at around 10,000 by January 2022, which was lower than the levels at the start of the year.

- **Stable start in 2021:** The early months showed steady export levels, reflecting stable trade.
- **Mid-year decline:** The drop in exports from April to June and the low levels through September could be due to seasonal factors, logistical issues, or economic reasons affecting trade.
- **November spike:** The sharp rise in exports in November may have been caused by a temporary increase in demand or a one-time event, but it was short-lived as exports dropped again by January 2022.

Before the war, the trade between Iraq and Ukraine was relatively stable, with normal fluctuations in export levels. Economic factors like market demand and seasonal effects likely played a role in these trends, such as lower exports in the summer and a surge in late autumn.

The above graph provides a clear overview of Iraqi exports to Ukraine before the war, showing periods of stability, a mid-year decline, and a brief peak in November, reflecting typical changes in international trade.

4.6 Iraq's Exports to Ukraine in 2021

The below figure illustrates the monthly export volumes from Iraq to Ukraine throughout 2022.February to May: Exports remained consistently low, around 10,000 units, indicating minimal trade activity during the initial months of 2022. June to July: There was a sharp increase in exports, peaking at approximately 70,000 units in July. This significant rise suggests a temporary surge in trade activity. August to October: Export volumes experienced a decline, dropping from the July peak but showing another notable rise in October, reaching around 70,000 units. This indicates intermittent spikes in trade activity. November to February (following year): A significant drop in exports occurred post-October, with volumes decreasing steadily and stabilizing around zero by February of the following year.

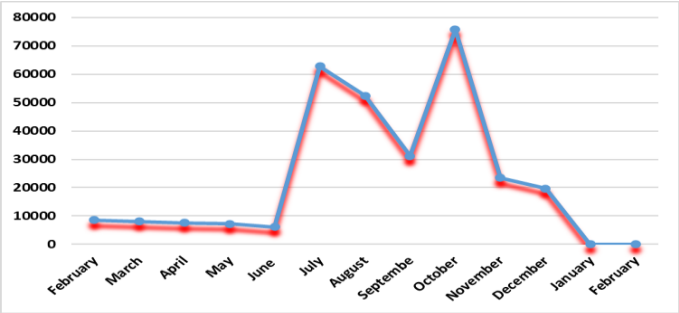


Figure 5: Iraq's Exports from Ukraine in 2022 (After War)

source : Preparation of the researcher's work based on the collected data)*Trade between Iraq and Ukraine*, 2022 ((Data, 2021). (Database, 2021)

5 Results and Discussion:

5.1 Interpretation of Tests of Normality Results:

5.1.1 Iraq's Imports from Ukraine before and after the war

The study uses both parametric and non-parametric statistical tests to assess the impact of the Russian-Ukrainian war on trade dynamics in Iraq. The t-test identifies significant differences in the average values of exports and imports before and after the conflict. Meanwhile, the Wilcoxon signed-rank test is used for double samples where the data do not follow the normal distribution, focusing on differences in averages to assess the effects of war on trade metrics. The normal state of the data is assessed using the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk tests. The analysis of normal state tests of Iraqi imports from pre- and post-war Ukraine is presented in Table 1.

Table 1: Normality Tests for Iraqi Imports from Ukraine Before and After the Russian-Ukrainian War.

test	Sample Group	Statistic	(df)	(Sig.)
Kolmogorov-Smirnov	Before the War (1)	0.144	13	0.200
	After the War (2)	0.375	13	.001

Source: Researcher, depending on the SPSS Program

- Before the War (Sample Group 1), the Kolmogorov-Smirnov test yielded a statistic of 0.144 with a significance value (Sig.) of 0.200, which is greater than the 0.05 threshold. This indicates that the null hypothesis, which posits that the data are normally distributed, cannot be rejected. Similarly, the Shapiro-Wilk test returned a statistic of 0.947 with a significance value (Sig.) of 0.553. This further confirms that the data followed a normal distribution before the war.
- After the war (Sample Group 2), the Kolmogorov-Smirnov test produced a statistic of 0.375 with a significance value (Sig.) of 0.000, indicating a clear rejection of the null hypothesis. This means the data do not follow a normal distribution after the war. The Shapiro-Wilk test also showed a significant deviation from normality, with a statistic of 0.672 and a significance value (Sig.) of 0.000.

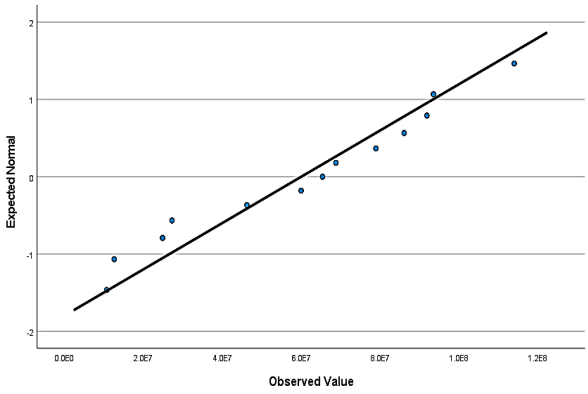


Figure 6: Normal Q-Q Plot of Imports Before the Russian -Ukrainian War in 2021 (G1)

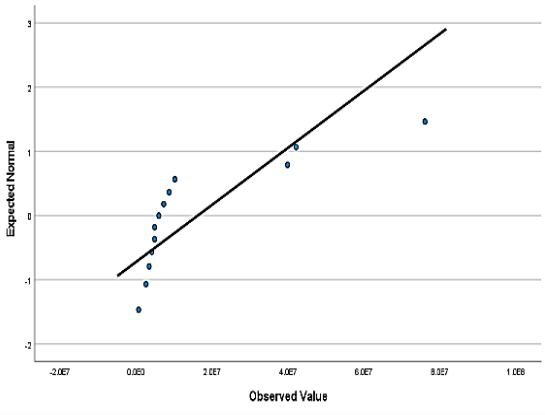


Figure 7: Normal Q-Q Plot of Imports After the Russian -Ukrainian War in 2022 (G2)

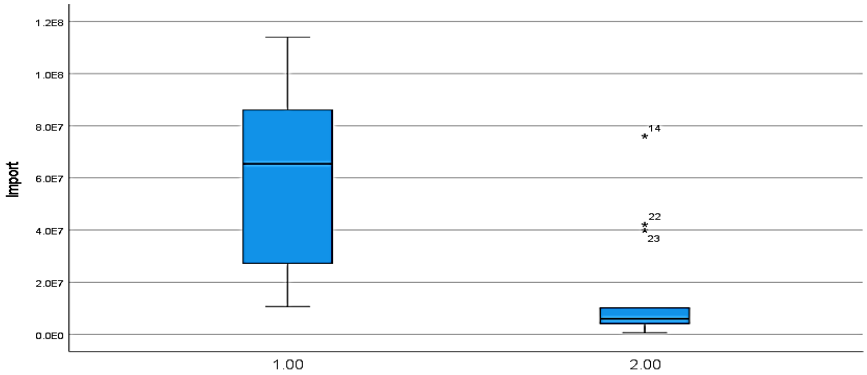


Figure 8: Box Plot of Iraq's Imports from Ukraine Before and After the Russian- War in 2012-2022

- Source: Researcher, depending on the SPSS program.

The representation indicates a significant impact of the war on Iraqi import volumes from Ukraine. Before the war, the import data were normally distributed and relatively stable, with high average volumes. In post-war era, which the imports dropped drastically, the data showed a significant deviation from normality, highlighting the disruptions caused by the conflict. These findings provide a clear understanding of how external factors like war can drastically affect economic activities and trade patterns.

Given that the data after the war are not normally distributed, non-parametric tests are appropriate. The Wilcoxon signed rank test, a non-parametric statistical approach, is used to study associated samples or repeated measurements on an unmarried sample to evaluate whether or not or no longer their population mean rank variety. Unlike parametric checks collectively with the t-take-a-look at, the Wilcoxon signed rank take-look-at does no

longer anticipate that the variations amongst pairs are typically distributed. This makes it particularly beneficial when the facts no longer meet the normality assumption required for parametric checks. The Wilcoxon signed-rank check is vital in fields like economics, social sciences, and clinical studies for assessing big variations between paired samples. It specializes in differences among paired observations in the vicinity in their absolute values, imparting a robust opportunity in instances of skewed or not normally allotted records. This check determines if there may be a massive distinction in values in advance and after an occasion or treatment, even as the statistics are not usually dispensed.

For instance, in reading the impact of the Russia-Ukrainian struggle on exports and imports, the null hypothesis (H0) states that there can be no difference in alternate values before and after the warfare, and it is acquainted if t depends < t desk or Sig. > 0.05. Conversely, the alternative hypothesis (Ha) indicates a significant difference and is accepted if t count > t table or Sig. < 0.05. (Newbold et al., 2013).

Table 2: Results of Wilcoxon Signed Ranks Test for Import Data.

Test Type	Test Statistics	Rank Statistics
Wilcoxon Signed Ranks Test (Imports)	Z = -2.341	Negative Ranks
	Asymp. Sig. (2-tailed) = 0.019	N = 10, Mean Rank = 7.90, Sum of Ranks = 79.00
		Positive Ranks
		N = 3, Mean Rank = 4.00, Sum of Ranks = 12.00

Source: Researcher, depending on the SPSS Program

- The Wilcoxon signed rank test for import data indicates a significant difference between import values before and after the war (Z = -2.341, p = 0.019), with post-war imports generally being lower than pre-war imports based on observed ranks.
- Negative Ranks: Pairs where post-war imports are lower than pre-war imports.
- Positive Ranks: Pairs where post-war imports are higher than pre-war imports.
- Ties: No ties were observed between pre-war and post-war import values.

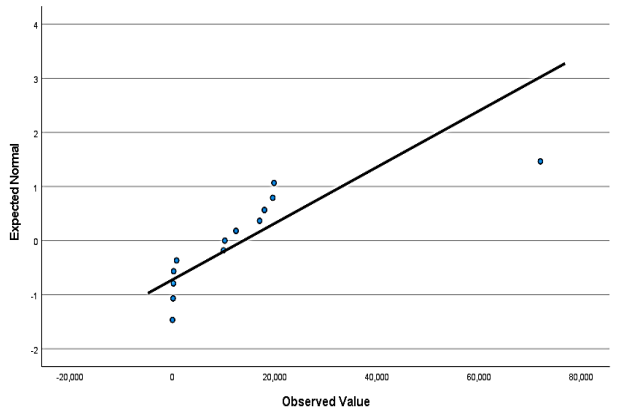
5.1.2 Iraq's Exports to Ukraine before and after the war

The analysis of the normality tests reveals a clear distinction between the two periods under study. Below is the analysis of normal state tests of Iraqi imports from pre- and post-war Ukraine, as presented in the table below.

Table 3: Normality Tests for Iraqi Imports to Ukraine Before and After the Russia-Ukrainian War

test	Sample Group	Statistic	(df)	(Sig.)
Kolmogorov-Smirnov	Before the War (1)	0.301	13	0.002
	After the War (2)	0.260	13	.017

Source: Researcher, depending on the SPSS program.



- Kolmogorov-Smirnov Test:

Before the War (1.00): The statistic is 0.301 with a significance value (Sig.) of 0.002. Since the sig. value is less than the 0.05 threshold, the null hypothesis is rejected, indicating that the export data before the war did not follow a normal distribution.

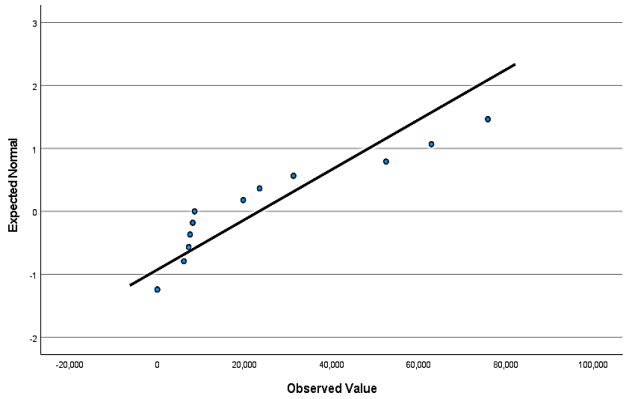
After the War (2.00): The statistic is 0.260 with a significance value (Sig.) of 0.017. This value is also less than 0.05, indicating that the export data after the war do not follow a normal distribution.

- Shapiro-Wilk Test:

Before the War (1.00): The statistic is 0.677 with a significance value (Sig.) of 0.000. This value is less than 0.05, confirming that the data did not follow a normal distribution before the war.

After the War (2.00): The statistic is 0.826 with a significance value (Sig.) of 0.014. This value is less than 0.05, indicating that the data do not follow a normal distribution after the war.

Figure 9: Normal Q-Q Plot of Exports Before **Figure 10**: Normal Q-Q Plot of Exports After the Russian -Ukrainian War in 2021 (G1) the Russian - Ukrainian War in 2022 (G2)



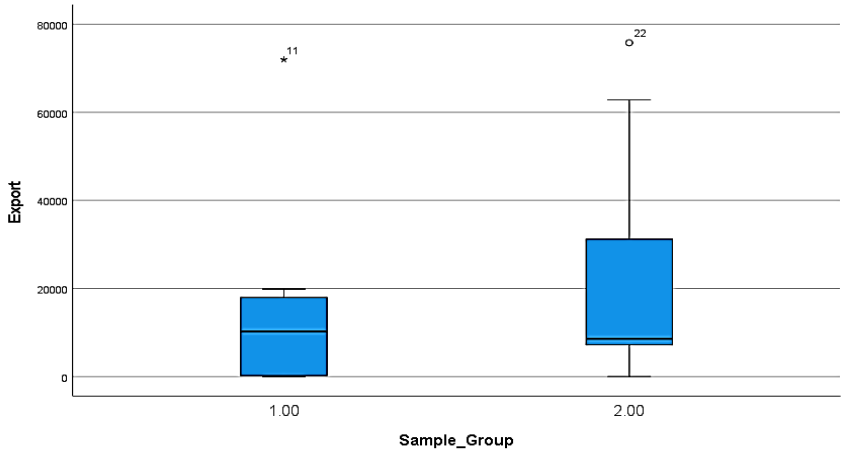


Figure 11: Box Plot of Exports Before and After the Russia-Ukrainian War in 2012-2022

Source: Researcher, depending on the SPSS program

The normality tests indicate that Iraqi export data from pre- and post-war Ukraine do not follow a normal distribution. Specifically, the Kolmogorov-Smirnov and Shapiro-Wilk tests confirm significant deviations from normality. This necessitates the use of non-parametric tests, such as the Wilcoxon signed rank test, to assess differences in trade measures before and after the conflict. The Wilcoxon Signed-Rank Test is particularly suited for this analysis as it does not assume a normal distribution and instead evaluates differences based on the ranks of paired observations.

The table below summarizes the Wilcoxon Signed-Rank Test results for Iraqi export data before and after the Russia-Ukrainian war.

Table 4: Results of Wilcoxon Signed Ranks Test for Export's Data

Test Type	Test Statistics	Rank Statistics
Wilcoxon Signed Ranks Test (Exports)	Z = -0.524	Negative Ranks
	Asymp. Sig. (2-tailed) = 0.600	N = 8, Mean Rank = 4,75 Sum of Ranks = 38.00
		Positive Ranks
		N = 5, Mean Rank = 10.60, Sum of Ranks = 53.00

Source: Researcher, depending on the SPSS program

The Wilcoxon Signed-Rank Test's Z value of -0.524 and a significance level (Asymp. Sig.) of 0.600 indicate that there is no significant difference between the export values before and after the war. Since the p-value (0.600) is greater than the significance threshold of 0.05, we fail to reject the null hypothesis, suggesting that the observed differences in export values before and after the war are not statistically significant.

The analysis using the Wilcoxon Signed-Rank Test shows no significant difference in Iraq's export values before and after the Russia-Ukrainian war, indicating that the changes observed in the data are not statistically significant.

6 Discussion

The study demonstrates using statistics that the Russia-Ukraine conflict greatly affected Iraq's import of goods from Ukraine, but Ukraine's imports from Iraq did not change much. Results from statistical analyses reveal that there was a noticeable drop in imports from Ukraine after the conflict began, but the exports remained relatively unchanged. These studies match and improve the results of earlier research on how geopolitical tensions shape the economies of rentier and developing countries such as Iraq. Consistently, our study and the work of Krpec and Hodulak (2019) confirm that major conflicts have a quick and major impact on trade. The decline in Iraqi imports after the start of the hostilities which we measured, matches up with what Bednarski et al. (2023) pointed out, that geopolitical shocks cause supply chain disruptions and bring about unsteadiness in export figures and prices. This proves that nations entirely reliant on selected trading partners

face risks, making Iraq's situation especially susceptible, since it relies on Ukraine for needed seed oils, building supplies and medicines (Kamel Hasan, 2022, p. 3785).

Our study is in agreement with other international macroeconomic assessments such as Haacker (2023) and Glauber and Laborde Debucquet (2023) who point out the Russia-Ukraine war has helped create more food security problems and price hikes, shown by the changes in Iraq's import data. During late 2022, the country's imports spiked several times which suggests that Iraq was finding quick solutions to new challenges caused by ongoing international conflicts. According to Manelli et al. (2024), these patterns can be found in how trade recovers in regions after large impacts from conflicts, indicating that stability is only temporary during ongoing disruptions.

In contrast to what AlJeburi et al. (2023) found about Iraq's imports and exports, our study found no significant change in Iraq's exports after the war. The gap could be due to most Iraqi exports which are oil and petroleum, being unrelated to Ukraine. Additionally, this finding relates to Paul Krugman's New Trade Theory (1979) which points out that if economies have different sectors and rely on economies of scale, some trade sectors may be hit harder than others during crises as in the Iraq case, where oil lead trade. The explanation is also supported by the frameworks put forward by David Ricardo's theory and the Heckscher-Ohlin model. Being focused on oil production and because of its resource-based advantage (Faccarello, 2015), it protects Iraq's export sector from disruptions in its other trade, as opposed to its import sector that largely depends on exports from Ukraine. Therefore, our research bridges an important research gap by measuring how conflict impacts international imports and exports differently.

Furthermore, Balbaa et al. (2022) and Zaid and Khan (2022) investigated how the war affected broad-level economies and commodity prices and our statistics on Iraq-Ukraine trade reveal these patterns at the country level, toward which geopolitical-economic analysis rarely turns its attention. Our study statistical analysis using the Wilcoxon signed-rank test ($Z = -2.341$, $p = 0.019$) provides empirical validation of their theoretical framework, showing that the disruption was not merely temporary but represented a fundamental shift in trade relationships. Analysis of the distribution of post-war data reveals that it differs from a regular pattern (with Kolmogorov-Smirnov $p < 0.001$), indicating a need to revise existing theories. Traditional trade theories rely on steady and continuous trading, but with geopolitical shocks, trade becomes much less predictable

which our findings indicate calls for different ways of looking at trade. The work demonstrated the immediate reactions and temporary restorations in trade, underlining Iraq's ability to handle international shocks and recover. Our findings show that it is essential to study conflicts by sector and timeframe. While major organizations make broad predictions about the world economy, our monthly trading information reveals that fluctuations in trade highlight how complex trade can be. The rise and fall of import numbers in late 2022 and subsequently a decline again suggest that supply chains changed, which companies stockpiled goods before the conflict and that trading policies reacted to the crisis (Сінгх et al., 2022),all of which influenced volumes of imports.

This research confirms that because of the Russia-Ukraine war, import flows from Ukraine to Iraq declined, as expected and only export flows from Iraq were found to be relatively stable. Iraq is clearly an oil-dependent rentier, yet its trade partners have varied, thus it needs to find alternative trade partners and change its economy to become more independent. The results from our study guide policies that improve financial stability following geopolitical shocks which is a significant problem left out in current studies on trade and conflict.

7 conclusions:

This study examines the Russia-Ukraine war's impact on Iraq's imports and exports to Ukraine using strong statistical measures such as the Wilcoxon signed-rank test, Kolmogorov-Smirnov and Shapiro-Wilk tests. Identifying that warfare greatly reduces the exchange of goods across borders, most often by hindering supply chains and making trade volumes lower. Our analysis demonstrates that Iraq's imports from Ukraine dropped sharply when the conflict began which correlates with the knowledge that conflicts and turbulence lead to big disruptions. This study also offers new perspectives by presenting numbers that highlight the changing trends in trade relationships during the ongoing conflict, including sudden hikes and shorter periods of recovery that other studies often ignore. Thanks to this fine study, Iraq's economy is shown to bounce back steadily even as international politics are unpredictable. They indicate that while trade drops sharply during war, some trade still happens, suggesting that the economy is not always hit by shock events in the same manner. These results are significant because they point out the risks faced by oil-dependent countries like Iraq, whose limited diversification makes them especially vulnerable. The findings make it clear that the country should focus on

expanding partners for trade and investing in non-oil industries so that its economy becomes more stable. Besides, this study points out that a strong and modernized supply network and infrastructure could help Iraq face future challenges from geopolitical upheavals.

However, the work faces some problems. Since the data used are limited to early 2023, the analysis may fail to catch market trends seen in the long period since the conflict. It is also possible that choosing secondary data and leaving out qualitative aspects such as policy adjustments or informal trading can make it difficult to notice key details of the situation. Future researchers may wish to expand their period of study to know the continual consequences of the conflict on Iraq's trade sector and make use of qualitative research to explore both government strategies and how the private sector deals with economic disruptions. More research could involve examining how rentier societies with geopolitical issues are comparable to what has been discovered here.

In conclusion, this study not only confirms the well-documented disruptive effect of geopolitical conflicts on international trade, but also enriches the discourse by illustrating Iraq's selective trade resilience during the Russian-Ukrainian war. Bridging empirical data and strategic policy recommendations, the research provides a comprehensive framework for understanding and mitigating economic vulnerabilities caused by wartime trade shocks.

8 Recommendations:

To mitigate the economic vulnerabilities exacerbated by the Russia-Ukraine conflict, Iraq must adopt a structured and actionable approach to trade policy reforms. Below are refined, sector-specific recommendations:

1. Diversify Trade Partnerships Through Strategic Engagement

- Market analysis and partner selection: conducting a comprehensive assessment to identify stable alternative suppliers, giving priority to neighboring countries (Turkey, Iran) and regional blocs (GCC, EU).
- Bilateral trade committees: establishing ad hoc committees to negotiate and strengthen trade agreements, focusing on sectors with high dependence (e.g. seed oils, machinery, pharmaceuticals).

-Trade diversification roadmap: developing a 3-5-year phased plan with measurable milestones to increase imports from a variety of sources.

- Trade promotion initiatives: prioritizing participation in sector-specific trade fairs and missions to secure new supply chains.

- Trade promotion initiatives: prioritizing participation in sector-specific trade fairs and missions to secure new supply chains.

- Bilateral trade committees: establishment of specialized committees to negotiate and promote trade agreements, focusing on sectors with high dependence (e.g. seed oils, machinery, pharmaceuticals).

- Trade diversification roadmap: developing a 3-5-year phased plan with measurable milestones to increase imports from a variety of sources.

- Trade promotion initiatives: prioritizing participation in sector-specific trade fairs and missions to secure new supply chains.

2. Strengthen Regional Supply Chains via Infrastructure and Policy Reforms

- Infrastructure modernization: improving the efficiency of border logistics, warehousing, customs to reduce delays.

- Industrial capacity building: supporting local production in vital sectors (such as electronics and pharmaceuticals) to reduce dependence on imports.

- Public-private partnerships: strengthening local supply chains through collaborative investment models.

- Regulatory harmonization: harmonization of standards with regional partners to facilitate cross-border trade smoothly.

- Digital Supply Chain Management: the introduction of real-time tracking systems to enhance the response to disruptions.

3. Enhance Trade Agreements with Contingency Provisions

- Review and reform agreements: evaluating existing trade agreements to include clauses dealing with force majeure, sanctions, and conflict-related disruptions.

- Crisis Trade Management Task Force: establishment of a government body to negotiate temporary trade adjustments during geopolitical shocks.

- Unified response protocols: establishing standard operating procedures for rapid adjustments in trade policies, including communication frameworks with stakeholders.

- Preparedness training: conducting simulations with commercial entities to ensure operational readiness for future disruptions.

4. Develop Strategic Stockpiles for Critical Goods

- Import dependence analysis: identification of essential commodities (e.g. basic foodstuffs, medicines) vulnerable to supply shocks.
- Inventory guidelines: determining Reserve quotas, storage conditions, and recycling procedures to prevent deterioration.
- Inter-ministerial supervision: formation of a specialized committee to manage procurement, maintenance and distribution.
- System integration: linking inventory data with national trade monitoring to improve the timing of release during crises.

5. Invest in Resilient and Adaptive Infrastructure

- Infrastructure audit: assessment of vulnerabilities in ports, logistics centers and transport networks.
- ICT modernization: expansion of digital trade facilitation platforms to simplify customs procedures and reduce bottlenecks.
- Development of multimodal transport: diversification of routes (road, rail, river) to reduce dependence on geopolitically sensitive corridors.
- Sustainable financing models: leveraging public-private partnerships, international grants, and development funds to enhance infrastructure resilience.
- Performance metrics: developing indicators to assess the resilience of infrastructure under pressure.

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