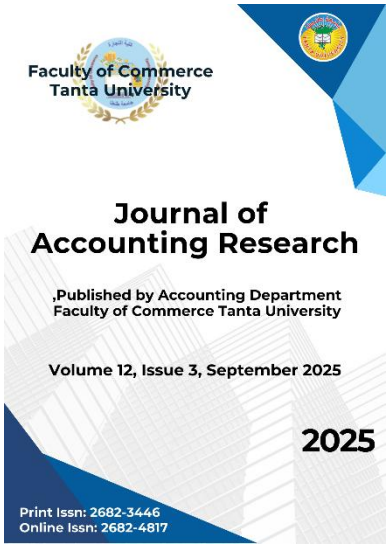

Journal of Accounting Research

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Russia-Ukraine Conflict and Operational Cost Dynamics of Agribusiness Firms: Empirical Evidence from Egyptian Listed Firms

Nayera Abdeldayem Eltamboly[a] , Magdy Abdel Elghany Hassanin[b], Maysa Ali M. Abdallah[a]

[a] Lecturer of Accounting، Accounting Department Faculty of Commerce،Tanta University،Egypt

[b]Teaching Assistant، Management Department Faculty of Commerce،Tanta University،Egypt

Published online: September 2025

To cite this article: Eltamboly، Nayera Abdeldayem. Hassanin، Magdy Abdel Elghany. Abdallah، Maysa Ali M(2025). Russia-Ukraine Conflict and Operational Cost Dynamics of Agribusiness Firms: Empirical Evidence from Egyptian Listed Firms ،**Journal of Accounting Research,** 12 (3) ،135-155

DOI: 10.21608/abj.2025.454099

***Corresponding author:**Nayra_dayem@commerce.tanta.edu.eg

Russia-Ukraine Conflict and Operational Cost Dynamics of Agribusiness Firms: Empirical Evidence from Egyptian Listed Firms

Nayera Abdeldayem Eltamboly[a]
[a] Lecturer of Accounting، Accounting Department Faculty of Commerce،Tanta University،Egypt
Magdy Abdel Elghany Hassanin[b]
[b]Teaching Assistant، Management Department Faculty of Commerce،Tanta University،Egypt
Maysa Ali M. Abdallah[a]
[a] Lecturer of Accounting، Accounting Department Faculty of Commerce،Tanta University، Egypt

Abstract

Purpose - This study aims to investigate the impact of the Russia-Ukraine conflict on operational cost dynamics within Egyptian agribusiness firms during heightened tensions from 2020 to 2025.

Methodology - The study employs a Unit Root Test to examine the behavior of variables over the study period and a fixed-effects regression model to assess the effect of disruptions caused by the Russia-Ukraine conflict on the internal cost structure of the Egyptian listed agribusiness firms.

Findings - The results reveal that, beyond technological constraints, surging global wheat, fuel prices, and exchange rate fluctuations, driven by the Russia-Ukraine conflict, significantly increase operating costs in agribusiness firms, contributing to notable cost distortions.

Limitations—Reliance on financial reports as the primary data source for obtaining operating costs presents a key limitation, which may not fully capture all relevant cost components. A more comprehensive analysis would require supplementary data from management through case studies or surveys. However, the study's reliability is bolstered by a rigorous methodology, including robust variable identification.

Practical Implications - Effective management of the disruptions caused by the Russia-Ukraine conflict is critical for mitigating their severe impact on the operations of Egyptian agribusiness firms, ensuring the resilience of this vital agribusiness sector.

Keywords: Russia-Ukraine Conflict; operational cost dynamics; internal cost structure; cost distortions; agribusiness firms.

1. Introduction

Geopolitical disruption, characterized by conflicts and tensions between nations, significantly impact global economic activities, supply chains, and regulatory environments (Noch, 2024). Among these, the Russia-Ukraine conflict, initiated in 2022, has emerged as a critical disruptor,

particularly for agribusiness firms reliant on the region for key inputs such as grains, fertilizers, and energy (Bednarski *et al.*, 2023; Park, 2023). This conflict has driven unprecedented increases in operational costs, stemming from supply chain interruptions, volatile commodity prices, and heightened regulatory pressures (Kalish & Wolf, 2021). For agribusiness firms, these disruptions necessitate robust risk mitigation strategies to address challenges such as input shortages, transportation bottlenecks, and fluctuating production costs (Moradlou *et al.*, 2021).

The Russia-Ukraine conflict has severely disrupted the security and international landscape (Cătălin, 2021). The conflict roots back to the invasion of the Crimean Peninsula and the intensification of interruptions in Southeast Ukraine. It is evident that Russia's strategic objective is to maintain its influence and control over the decisions and political directions of the former Soviet bloc (Dumitru, 2021). One of the main motives for Russia's mobilization of its forces on the borders of Ukraine is to prevent Ukraine from joining NATO (Hussain *et al.*, 2023). Therefore, this war has destabilized the geopolitical balance between Russia and NATO, triggering shifts in alliances, more focus on defense and challenges to globalization and international norms (Abay *et al.*, 2023; Roland, 2023).

The study is motivated by the growing number of studies on how the Russia-Ukraine Conflict affects global agribusiness firms and their supply chains (Solingen, 2025; Šebeňa, 2024; Dadush, 2023; Park, 2023; Alves *et al.*, 2022). However, few studies explore how this conflict impacts the local manufacturing costs of agribusiness firms. Researchers have called for further research on how the conflict affects local supply chains (Rasshyvalov *et al.*, 2024; Bednarski *et al.*, 2023; Boschma, 2022). This study addresses this gap by focusing on the Russia-Ukraine Conflict as a major geopolitical challenge disrupting the operational cost of agribusiness firms, enhancing their efficiency, competitiveness, and sustainability.

This study provides empirical evidence from the Egyptian context to examine how the Russia-Ukraine war affects the operating costs of agribusiness. The focus on Egypt is driven by three key factors. First, Egypt is the largest importer of wheat in Africa (Maitah *et al.*, 2023; Yigezu *et al.*, 2021). Second, about 86.01% of Egypt's wheat imports outsourced from Russia and Ukraine (Maitah *et al.*, 2023). Third and last, wheat is a critical cereal crop, as wheat-based products like bread, Macaroni, and baked goods are essentials to Egyptian diets (Yigezu *et al.*, 2021).

By considering the Russia-Ukraine geopolitical layer in the operating costs analysis, this research aims to analyze the structure of the internal operating costs across Egyptian agribusiness firms. It investigates how geopolitical factors influence these costs and identifies weakness in firms' operations. Finally, based on the results, firms will be able to gain a clear picture of the current situation so they can better manage their costs, improve their performance, and build resilience in their operations against the evolving geopolitical landscapes.

This study makes several important contributions. First, it analyzes the internal cost structure of firms in a vital agribusiness sector, offering insights to develop various strategies to mitigate risks and enhance performance. Second, choosing the Russia-Ukraine war as the geopolitical disruption is important since this war has significant consequences on the energy supply, fuel prices, minerals, and food supply worldwide. Third, the choice of the Egyptian context is crucial, since Egypt is considered one of the most vulnerable countries to this disruption.

The rest of this study is organized as follows: Section 2, frames our theoretical background presented in the literature review and hypothesis development. Section 3 explains the research method and model specification. Section 4 shows data sources and the research sample. Lastly, we conclude in section six with spotlights on practical implications, research limitations, and suggestions for future research.

2. Literature Review and Hypotheses Development

Agribusiness operations face complex challenges due to biological forces, buffer stocks, and diverse market structures, which significantly influence operational costs (Clay & Feeney, 2019). Effective management requires robust coordination and information sharing among stakeholders to mitigate issues such as delays, information gaps, and power imbalances, particularly during disruptions like the Russia-Ukraine Conflict (Eltamboly & Abdallah, 2022; Thakur *et al.*, 2024). While prior studies, such as De Figueiredo *et al.* (2017) and Howieson *et al.* (2016), explore strategic analysis, and Fearne *et al.* (2012) and Liedtke *et al.* (2010) address sustainability in agribusiness, this research offers a novel perspective by analyzing the impact of the Russia-Ukraine Conflict on the internal operating costs of agribusiness firms, a critical focus for enhancing their efficiency, competitiveness, and sustainability.

Existing literature on agribusiness operations explores diverse perspectives. For instance, De Figueiredo *et al.* (2017) and Howieson *et al.* (2016) examine strategic analysis to optimize agribusiness performance, while Fearne et al. (2012) and Liedtke *et al.* (2010) focus on social and environmental sustainability to enhance competitive advantage. Meanwhile, Donovan *et al.* (2015) and D. Ricketts *et al.* (2014) highlight operational strategies to redistribute risks and foster economic growth. This research introduces a novel perspective by analyzing the impact of the Russia-Ukraine Conflict on the internal operating costs of agribusiness firms, a critical focus for enhancing their efficiency, competitiveness, and sustainability.

Geopolitical shifts have an impact on different industries, ranging from manufacturing and technology to energy and agriculture. These shifts entangle global trade with political issues and power struggles among nations (Zhuang, 2024). In 2022, the world witnessed the Russia-Ukraine war, which interrupted the supply of energy, minerals, and food worldwide (Dadush, 2023), as well as cut a vital artery of trade among countries (Bednarski *et al.*, 2023). Moreover, the sanctions imposed on Russia led to a rise in the energy and transportation costs, limiting the export of fertilizers and causing further disruptions in wheat markets (Bentley *et al.*, 2022). Furthermore, Umar *et al.* (2022) confirmed that this war has a considerable impact on the prices of precious metals such as gold, silver, platinum, and nickel. Therefore, this conflict has boosted an environment of uncertainty, as well as severe socio-political consequences, distressing trade relations, the flow of investments, and the financial markets globally (Noy & Dabamona, 2024).

Despite these disruptions, Egypt's import of wheat continues to increase, even with the rise in its prices (Maitah *et al.*, 2023). Moreover, this cereal crop is essential for Egyptians as it constitutes about 30% of the energy they derive from food (Yigezu *et al.*, 2021). Furthermore, the dramatic and uncontrollable rise in the prices of agriculture causes vulnerability in agricultural operating costs to meet the current demand and requires a huge investment in agriculture at all echelons (Pal & Sharma, 2018). Hence, this research sheds light on the impact of the Russia-Ukraine war on the operating costs of one of the highly impacted sectors in Egypt, which is the wheat agricultural crop.

The following figure (1) introduces the various operating activities associated with transforming wheat into flour. It highlights the impact of the Russia-Ukraine Conflict on the different operational activities performed across agribusiness firms.

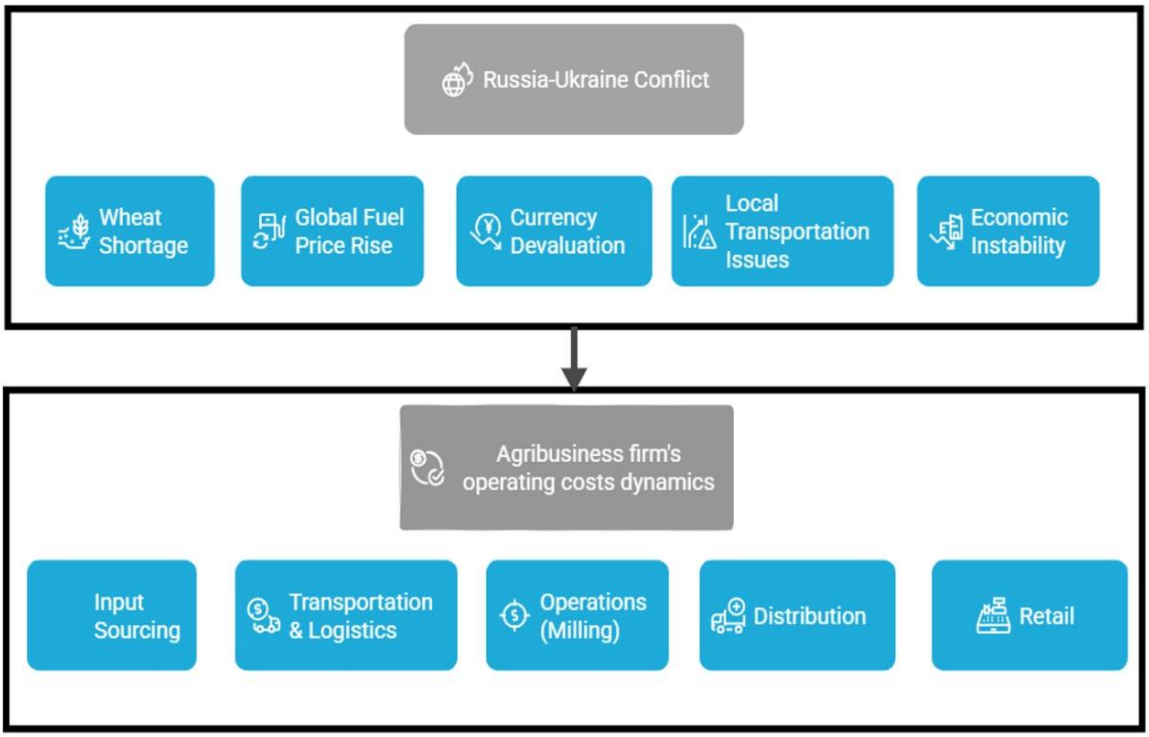

Figure 1: The impact of the Russia-Ukraine Conflict on the operating costs of agribusiness firms.

From the above figure, first, the firm level activities start with an input sourcing activity, and this activity is largely affected by a major shortage of wheat imports, which is the main input alongside the flour operating process. Second, the transport and logistics activities are mainly influenced by the global rise in fuel prices. Third, the operations, principally the milling activity, are exaggerated by both energy shortage and the dependency on importing spare parts responsible for the continuity of production. Fourth, the distribution activity is essentially affected by fluctuations in the local prices of Gasoline. Finally, retail activity is primarily

influenced by economic uncertainty associated with inflation. Hence, this framework offers a comprehensive picture about the various operating activities, which is responsible for transformation of wheat to flour and each of these activities is affected by a turbulence due to the disruptions caused by Russia-Ukraine conflict which has aggravated impact on the prices of the final product provided to customers. Therefore, it provides stakeholders with the operating cost structure of agribusiness firms to get more visibility about the impact of this conflict and enables them to search for ways to reduce the costs, enhance their performance, and regain resilience in their operating process during these extraordinary times.

To sum up, in the realm of accounting, this war introduces various encounters and considerations in examining its impact on the operating costs of agribusiness firms, which urges the need for investigation. Therefore, our main research hypothesis is proposed as follows.

> **H_1:** The Russia-Ukraine Conflict has a significant impact on the operating costs across Egyptian agribusiness firms.

3. Research Design

3.1 Research Sample and Data Collection

Our data sets consist of seven companies covering the manufacturing sector of the Egyptian listed companies to explore the impact of the geopolitical disruption associated with the Russia-Ukraine war on the operating costs related to the transformation of wheat to flour. Hence, the final research sample consists of seven companies, with quarterly data collected from 2020 through the first quarter of 2025, yielding 144 observations. The following table shows the final research sample.

Table 1: summary of research sample

Company Name	2020 (Q1-Q4)	2021 (Q1-Q4)	2022 (Q1-Q4)	2023 (Q1-Q4)	2024 (Q1-Q4)	2025 (Q1)	Total Observations
Middle and West Flour Mills.	✓	✓	✓	✓	✓	✓	21
Upper Egypt Flour Mills.	✓	✓	✓	✓	✓	✓	21
Alexandria Flour Mills and Bakeries.	✓	✓	✓	✓	✓	✓	21
North Cairo Flour Mills and Bakeries.	✓	✓	✓	✓	✓	✓	21
South Cairo and Giza Flour Mills and Bakeries.	✓	✓	✓	✓	✓	✓	21
Middle Egypt Flour Mills.	✓	✓	✓	✓	✓	✓	21
East Delta Flour Mills and Bakeries.	✓	✓	✓	✓	✓	✓	21
Total							144

Financial data has been collected from multiple official and reliable websites. Mainly, the financial reports are published on the official websites of the Egyptian listed companies. Also,

the financial data published in the Egyptian Stock Exchange and Mubasher Corporation databases. In addition, the global wheat prices are collected from the US Department of Agriculture (https://www.ers.usda.gov/data-products/wheat-data/wheat-data-visualization), and the global gasoline prices are gathered from Trading Economics (https://tradingeconomics.com/commodity/gasoline).

Moreover, the local price of Diesel is derived from resources published by the Egyptian Ministry of Petroleum and Mineral Resources. Finally, the inflation and interest rates are obtained from the Central Bank of Egypt website. All the data collected is verified to ensure accuracy across the sample period from 2020-2025.

3.2 Empirical Model

To investigate the key political factors that influence the operating costs, a fixed effect model is used on a quarterly data set that covers seven companies over the years 2020-2025.

model (1) examines the impact of the Russia-Ukraine Conflict presented in wheat shortage, global fuel prices, currency devaluation, local transportation issues, and economic instability on the total operating costs. Therefore, the following regression model is developed to test H_1.

$$TOC = \alpha 0 + \beta 1\ WP + \beta 2\ GFP + \beta 3\ EexR\_Dev + \beta 4\ LFP + \beta 5\ Inf + \beta 6\ FSize + \beta 7\ Rev\_Grow + \beta 8\ ROA + \beta 9\ IR + \beta 10\ GDP + \varepsilon$$

Where TOC is the total operating costs across agribusiness firm's processes. While WP is calculated based on the global wheat prices converted into the Egyptian currency. Meanwhile, GP is measured by the global fuel prices translated into Egyptian currency. Whereas EexR_Dev is computed by the standard deviation of the logarithmic returns of exchange rates, on a quarter basis. Moreover, LFP is assessed by the standard deviation of the quarterly changes in the Diesel price. Furthermore, Inf is calculated by the standard deviation of consumer price index percentage changes over time. Finally, the other control variables are explained in Table (2).

Table 2: Variable definition and measurement

Variables	Definition and measurement
Dependent Variable	
TOC	Total operating cost of the agribusiness operations, measured as a summation of the operating costs associated with all agribusiness processes.
Independent variables	
GPR	The geopolitical risk index of Caldara and Iacoviello (2021) consists of eight indicators: War Threats, Peace Threats, Military Buildups, Nuclear Threats, Terror Threats, Beginning of War, Escalation of War, Terror Acts.
WP	Global wheat prices, measured based on the global wheat prices converted into the Egyptian currency

GFP	Global Fuel Prices, measured by the global prices of gasoline, are translated into Egyptian currency.
EexR_Dev	Exchange rate devaluation, computed as a standard deviation of the logarithmic returns of exchange rates, on a quarter basis.
LFP	Local fuel prices, calculated by the standard deviation of the quarterly changes in the Diesel price.
Inf	Inflation is calculated by the standard deviation of consumer price index percentage changes over time
Control variables	
Firm-level characteristics	
FSize	Firm size, measured as the natural log of total assets.
ROA	Return on assets = (Net Income / Total Assets) x 100.
Rev_Grow	Revenue growth = Revenue growth = (current period revenue – previous period revenue) / previous period revenue.
Economic-level characteristics	
IR	Interest rate, measured as the weighted average interest rate for outstanding deposits and loans, offered by Egyptian banks.
GDP	Gross Domestic Product, measured as the total value of goods and services produced in a country in a given period.

4.Findings and discussion

This section presents the findings of empirical analysis, including descriptive statistics, hypothesis tests, and additional analysis.

4.1 Descriptive Statistics and Multicollinearity Analysis

Table 1 provides descriptive statistics for the sample, regarding key economic variables, which are Commodity Prices and Market Stability, Macroeconomic Volatility, Monetary Policy, and Economic Growth, in addition to other firm-level variables in Egypt.

Table 3: Summary of descriptive statistics

Variables	Mean	Minimum	Maximum	Std. Dev.	Obs.
TOC	0.906922	0.000949	7.627494	1.056324	144
GPR	0.272857	0.08	1.256667	0.299383	144
WP	3.765111	3.43728	4.006437	0.192966	144
GFP	26.81504	10.47915	48.6875	13.34574	144
EexR_Dev	4.137518	0.16	23.8	5.812057	144
LFP	9.738683	7.4495	14.9346	2.32284	144
Inf	1.146993	0.084	5.064	1.163017	144
FSize	8.510225	5.413992	10.77495	1.290449	144
ROA	0.319391	0	1.868242	0.373181	144
Rev_Grow	13.34035	-0.99609	15.10635	12.8397	144
IR	16.05496	8.25	27.25	7.425529	144
GDP	2.619292	2.584128	2.678291	0.032714	144

As indicated in Table 3, the average wheat price (WP) is 3.765111 EGP per kilogram, with a minimum of 3.43728 EGP/kg, a maximum of 4.006437 EGP/kg, and a standard deviation of 0.192966 EGP/kg, indicating high stability. This narrow range from 3.43728 to 4.006437 EGP/kg suggests effective government subsidies, which maintain affordable wheat prices despite global volatility, such as the Ukraine war's impact on supply (World Economic Forum, 2022). However, current retail prices are approximately 30.24 EGP/kg in February 2025, indicating the dataset captures historical data from earlier years (e.g., 2020–2021) when exchange rates were lower (around 15.75 EGP/USD), and import prices were less affected by devaluation (Selina Wamucii, 2025). Egypt's strategic procurement of 1.267 million tons through June 2025 supports this stability (Reuters, 2023, 2024), aligning with food security strategies (Timmer, 1989).

Also, the mean of global fuel prices (GFP) is 26.81504 EGP per liter, with a minimum of 10.47915 EGP/liter, a maximum of 48.6875 EGP/liter, and a standard deviation of 13.34574 EGP/liter, reflecting significant fluctuations. The wide range from 10.47915 to 48.6875 EGP/liter captures the impact of Egypt's currency devaluation over the period, with higher prices in later years (e.g., 2024–2025) when the exchange rate reached 48.50 EGP/USD. This variability aligns with global oil market fluctuations, such as those driven by OPEC policies and geopolitical events (Hamilton, 2009). The World Bank's *Commodity Markets Outlook* (2024) predicts a 5% decline in global commodity prices in 2025, which could lower Egypt's fuel import costs (World Bank, 2024).

On the other hand, Local fuel prices (LFP) average 9.738683 EGP per liter, with a minimum of 7.4495 EGP/liter, a maximum of 14.9346 EGP/liter, and a standard deviation of 2.32284 EGP/liter, indicating greater stability compared to global prices. The narrower range (7.4495 to 14.9346 EGP/liter) reflects Egypt's fuel subsidy policies, which maintain domestic prices below global levels, with recent prices at approximately 16 EGP/liter for 95-octane gasoline in April 2025 (Reuters, 2025). The lower mean and standard deviation underscore the effectiveness of subsidies in shielding consumers from international volatility (Sdralevich *et al.*, 2014).

In terms of macroeconomic volatility, the results show that the average Egyptian EexR_Dev is 4.137518, with a minimum of 0.16, a maximum of 23.8, and a standard deviation of 5.812057, indicating significant volatility. The wide range from 0.16 to 23.8 reflects Egypt's currency fluctuations, particularly post-2016 floatation and sharp devaluations in 2022 and 2024, impacting the EGP-converted values of wheat and fuel prices (Calvo & Reinhart, 2002). Inf averages 1.146993 and a standard deviation of 1.163017, showing moderate variability consistent with Egypt's inflation of 13.60% in March 2025. Table (4) indicates the initial correlation for the tested variables. The results reveal that *WP* moderately correlates with *LFP* correlation coefficient of 0.6789, at $p<0.01$, *GDP* (0.4993, $p<0.01$), and *IR* (0.6035, $p<0.01$), reflecting its association with economic factors moderated by Egypt's long-term contracts and subsidies (Timmer, 1989). GFP shows significant correlations with LFP (0.6431, $p<0.01$), EexR_Dev (0.6387, $p<0.01$), and Inf (0.7145, $p<0.01$), indicating global fuel price effects on

Egypt's economy through exchange rate volatility (Calvo & Reinhart, 2002). Rev_Grow remains weakly correlated (e.g., 0.0494 with ROA, p=0.5596), suggesting firm-specific influences (Aghion & Howitt, 1992; Abdallah, 2023). While correlations like LFP with IR (0.7061, p<0.01) and Inf with GFuel_Pric (0.7145, p<0.01) are high, multicollinearity risks are moderate.

Table 4: Summary of correlation matrix

Variables		1	2	3	4	5	6	7	8	9	10	11
TOC	1	1										

WP	2	0.651529	1									
		(0.000)	-----									
GFP	3	0.619253	0.482003	1								
		(0.000)	(0.000)	-----								
EexR_Dev	4	0.327444	0.591329	0.638693	1							
		(0.0001)	(0.000)	(0.000)	-----							
LFP	5	0.654883	0.678944	0.64311	0.527498	1						
		(0.000)	(0.000)	(0.000)	(0.000)	-----						
Inf	6	0.44677	0.701544	0.714499	0.650343	0.59996	1					
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----					
FSize	7	0.653785	0.68772	0.563663	0.575119	0.66639	0.692931	1				
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----				
ROA	8	0.412724	0.651569	0.649916	0.319588	0.63678	0.360983	0.638645	1			
		(0.000)	(0.000)	(0.000)	(0.0001)	(0.000)	(0.000)	(0.000)	-----			
Rev_Grow	9	0.049776	0.097923	0.079889	0.034382	0.11188	0.059721	0.108733	0.049373	1		
		(0.5563)	(0.2463)	(0.3446)	(0.6846)	(0.185)	(0.4802)	(0.1977)	(0.5596)	-----		
IR	10	0.553741	0.603496	0.618873	0.640486	0.70609	0.609229	0.697168	0.610598	0.069402	1	
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.4118)	-----	
GDP	11	0.651681	0.499285	0.67682	0.584256	0.67806	0.702634	0.688712	0.651605	0.102462	0.607631	1
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.225)	(0.000)	-----

Note: Values are Significant at: *** p<0.01, ** p<0.05, * p<0.1

4.2 Trend Analysis: Stationary Assessment

4.2.1 Graphical Analysis and Variance Stationarity

To test whether our time series is stationary in terms of variance or not, we apply the unit root test at level and first difference, then the Augmented Dickey-Fuller (ADF) test at level and first differences. The initial step involves plotting the time series data for WP, GFP, LFP, EexR_Dev, and Inf over the period from Q1 2020 to Q1 2025.

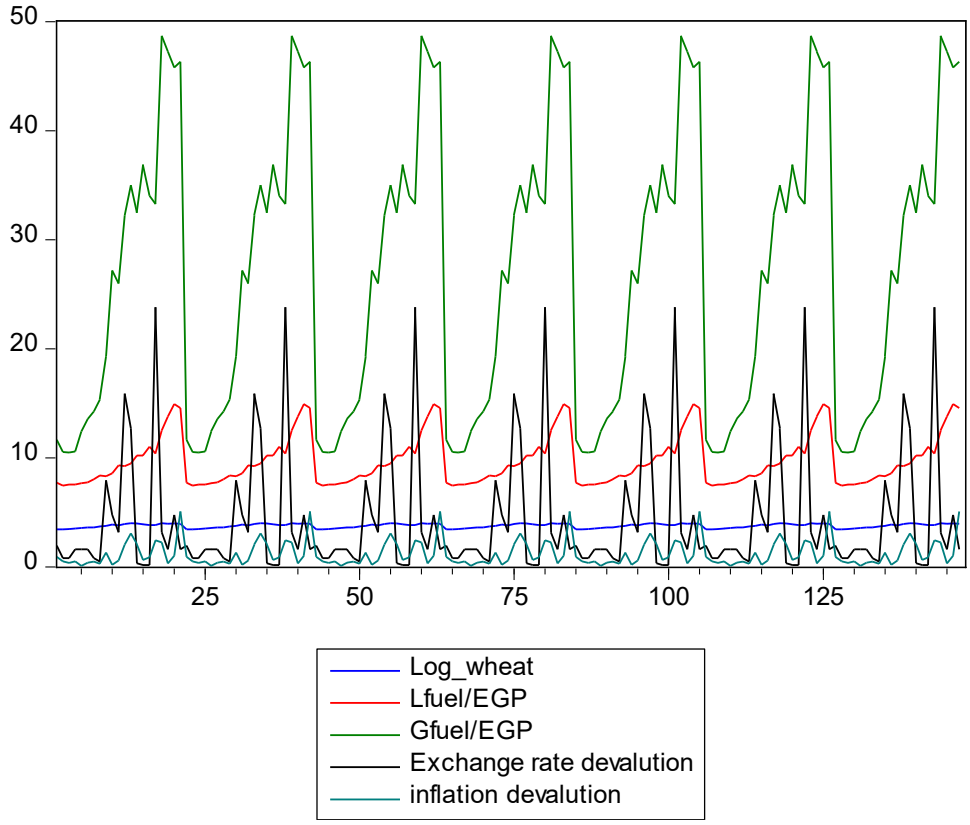

Figure 2: Plot graph for data behavior

As shown Figure (2), WP and LFP exhibit relatively stable fluctuations between 2 and 5, suggesting potential variance stationarity, likely due to Egypt's interferences, such as wheat import contracts or fuel price controls through subsidy policies, which mitigated volatility in these variables. In contrast, GFP and EexR_Dev display significant fluctuations, with peaks at 50 and 23.8, respectively, indicating possible non-stationarity in variance driven by global price shocks and currency fluctuations (Calvo & Reinhart, 2002). As indicated in the previous figure, we conclude that each variable has a different behavior, which requires additional analysis..

4.2.2 Unit Root Test at Level, First, and Second Differences.

Since the visual inspection indicates the difference in the behavior of the variables, the unit root tests are conducted at level and first differences using the Augmented Dickey-Fuller (ADF) test to confirm the stationarity of the data. To check if the data is stationary in the mean or not, the null hypothesis (H0) of the ADF test states that the series contains a unit root (non-stationary time series), while the alternative hypothesis (H1) indicates a stationary time series.

Table 5: Summary of the results of the unit root test

Augmented Dickey-Fuller test statistic		
Variables	**Level (log-transformed)**	**First Difference**
WP	-7.612442 (0.0000)	-11.96039 (0.0000)
GFP	-7.348546 (0.0000)	-7.989983 -7.989983
LFP	-5.126864 (0.0000)	-10.60149 (0.0000)
EexR_Dev	-8.485032 (0.0000)	-12.73325 (0.0000)
Inflation Deviations	-7.072502 (0.0000)	-13.72296 (0.0000)

Note: The ADF test was conducted at a 5% significance level (critical value ≈ -2.88). Logarithmic transformations were applied to address variance non-stationarity (Jarque-Bera $p < 0.05$).

As indicated in table (5), at the level, the log-transformed series were stationary, as their ADF statistics were well below the critical value (e.g., log (WP) ADF = -7.612442, p = 0.0000; log (GFP) ADF = -7.348546, p = 0.0000). The first difference between further confirmed stationarity (e.g., D(log(Wheat_Pric)) ADF = -11.96039, p = 0.0000), but was unnecessary since stationarity was achieved at level. This finding is unexpected given the Russia-Ukraine Conflict during the study period (e.g., the Russia-Ukraine conflict starting in 2022), which typically induce trends or stochastic processes in economic variables (Hamilton, 1994). The stationarity at the level may reflect Egypt's government interventions, such as wheat import contracts or fuel price controls, which mitigated volatility in these variables (Timmer, 1989). Consequently, the log-transformed series were used directly in the regression analysis (Wooldridge, 2010)

4.3 Multivariate analysis

Table (6) shows the fixed effects regression results of the impact of Russia-Ukraine Conflict on the total operating costs of agribusiness firms in Egyptian, controlling for economic factors and firm-level performance.

Table 6: Summary of the regression analysis using the Fixed effects model

	Model (1)	
Variable	Coefficient	t-Statistic
C	38.81757	3.148967**
WP	-5.494.01	-1.67546*
GFP	0.029466	5.24074***
EexR_Dev	1.205877	10.31367***
LFP	35.4353	2.09638**

Inf	-0.0903	-4.0855***
FSize	0.130165	0.259764
ROA	0.000484	3.770454**
Rev_Grow	-6.63436	-2.48225**
IR	-0.02612	-1.11252
GDP	14.23768	2.057051**
R-squared	0.358456	
F-statistic	7.040107	
Prob(F-statistic)	0.000	
VIF	1.55874	

Note: Values are Significant at: *** p<0.01, ** p<0.05, * p<0.1

As indicated in Model 1, *WP* are negative and significant with coefficient of -5.49401 and t = -1.67546 ($p < 0.10$), which is unexpected. Given Egypt's reliance on imported wheat (85% from Russia and Ukraine pre-2022), a positive relationship with *TOC* is anticipated due to price shocks post-conflict. The negative sign may indicate the long-term contracts or government subsidies on wheat, which mitigate cost impacts. *GFP* significantly increased *TOC* (β = 0.029466, t = 5.2407), with a 1% rise increasing TOC by 0.029%, reflecting the influence of logistics costs. *EexR_Dev* also significantly raises *TOC,* with a coefficient of 1.205877 and t = 10.31367, with a 1% devaluation increasing *TOC* by 1.21%, highlighting Egypt's reliance on imported wheat (Miranda-Agrippino & Rey, 2021). *LFP* exhibits a significant positive effect with a coefficient of 35.4353 and t = 2.09638, likely due to unsubsidized fuel cost fluctuations. *Inf* has a significant negative effect (β = -0.0903, t = -4.085), suggesting that a 1% increase in inflation deviations reduces TOC by 0.09%, possibly due to price controls in Egypt. The model explains 35.8% of the variation in *TOC* ($R^2 = 0.358$).

4.3 Additional analysis

To robust the results of the baseline analysis, we use an alternative measure of Russia-Ukraine Conflict, using the Geopolitical Risk Index (GPR) of Caldara and Iacoviello (2021). This index consists of eight categories, including War Threats, Peace Threats, Military Buildups, Nuclear Threats, Terror Threats, Beginning of War, Escalation of War, Terror Acts (Caldara & Iacoviello, 2021).

Table 7: Summary of additional analysis

	Model 2	
Variable	Coefficient	t-Statistic
C	2.460486	5.122452***
GPR	0.006718	3.659017**
WP		
GFP		

EexR_Dev		
LFP		
Inf		
FSize	-0.025102	-0.937876
ROA	-0.06986	-9.099059***
Rev_Grow	-0.590374	-2.797976**
IR	0.004053	0.268642
GDP	0.209348	3.212795**
R-squared	0.621894	
F-statistic	35.91054	
Prob(F-statistic)	0000	
VIF	2.644761	

Note: Values are Significant at: *** p<0.01, ** p<0.05, * p<0.1

Model (2) in Table (7) presents the results of the additional analysis, examining the impact of Russia-Ukraine Conflict on the *TOC* of Egyptian listed milling firms. The results indicate that *GPR* has a significant effect with a coefficient of 0.006718 and t = 3.659017 (p > 0.05), indicating that geopolitical risk increases *TOC*, aligning with expectations that geopolitical tensions (e.g., the Russia-Ukraine conflict, 2022–2025) elevate costs in import-dependent sectors like milling (Caldara & Iacoviello, 2021). This contrasts with Model 1, suggesting the GPR index captures broader risk dimensions. Model 2 explains 62.2% of the variation in *TOC* ($R^2 = 0.622$).

5. Conclusion and Implications

5.1 Summary

This study aims to investigate the impact of Russia-Ukraine Conflict on the total operating costs of Egyptian listed milling firms from Q1 2020 to Q1 2025, a period characterized by significant global shocks, including the Russia-Ukraine conflict (2022–2025). Using the Unit Root Test to check the behavior of variables during the study period and the fixed effects regression model to test the association between geopolitical conflicts and the operating costs of flour industry. The results of the unit root test confirm that all variables are stationary at the level after logarithmic transformation, enabling their direct use in regression analysis. Moreover, using fixed effects regression, the findings reveal nuanced dynamics in cost management within this critical sector.

Also, the results indicate that global fuel prices, exchange rate devaluation, and local fuel prices significantly increase TOC, highlighting the sector's vulnerability to external economic shocks and Egypt's reliance on imported wheat. Conversely, wheat prices and inflation deviations exhibit significant negative effects, potentially reflecting government interventions (e.g., price controls, subsidies) that mitigate cost pressures. However, the robustness test in Model 2, using the Geopolitical Risk Index (GPR) by Caldara and Iacoviello (2021), reveals a significant positive effect, suggesting that broader geopolitical risks increase TOC, contrasting with Model 1 and highlighting the importance of comprehensive risk measures.

5.2 Implications

This study offers several theoretical and practical implications. Theoretically, it contributes to the literature on geopolitical disruptions by demonstrating their varying impact on TOC, depending on the risk measure used. The significant effect of GPR in Model 2 supports the relevance of multidimensional risk indices in capturing the cost implications of geopolitical tensions, extending prior work of Caldara & Iacoviello (2021). The negative effects of wheat prices and inflation deviations highlight the role of institutional factors presented in Egyptian government policies. In practice, the findings pay milling firms and policymakers in Egypt attention to the key cost drivers to consider. The significant impact of global fuel prices and exchange rate devaluation suggests that firms should explore strategies to mitigate logistics and import costs, such as depending on diverse supply chains or adopting renewable energy for transportation. Policymakers should consider stable fuel prices and exchange rates to secure the smooth operation of milling firms, which represent a crucial sector to food security.

The results also raise important concerns for stakeholders. The increase in TOC due to Russia-Ukraine Conflict shifted to consumers, worsening food insecurity among citizens in Egypt, where access to bread is a societal priority (Harrison & McKinnon, 1999). The negative effect of inflation deviations, likely driven by government interventions, suggests a trade-off where firms are shielded at the expense of taxpayers, which raises concerns about the fairness of resource allocation. Therefore, milling firms must adopt more cost management practices, such as absorbing some cost increases or investing in social responsibility initiatives to support low-income citizens, considering profitability with social responsibility (Abdallah, 2025; Eltamboly, 2025).

5.3 recommendations

Based on the findings, this research proposes various recommendations for regulators, policymakers, and firm management to enhance their resilience against geopolitical shocks. First, according to Egypt's historical reliance on Russian and Ukrainian wheat (85% pre-2022), regulators should increase strategic reserves to secure at least six months of consumption. Simultaneously, trade partnerships with alternative suppliers such as Argentina, Romania, and India must be considered to mitigate supply chain disruptions (Glauber *et al.*, 2022).

Second, Policymakers should implement exchange rate equilibrium mechanisms, such as currency swap agreements with trading partners, to reduce exchange rate devaluation on imports. Third, Egypt's reliance on imports makes it susceptible to geopolitical shocks. Hence, heavy Investment in agricultural innovations, such as drought-resistant wheat varieties, and expanding agricultural land through irrigation projects (e.g., Toshka Project).

Fourth, Egyptian milling firms should adopt lean supply chain practices, such as just-in-time inventory for non-critical inputs and invest in renewable energy innovations to reduce operational costs. Fifth and finally, firms can expand into alternative grains like maize or sorghum, so they will be less affected by the Russia-Ukraine disrupted supply chains.

5.4 limitations

This research acknowledges some limitations. First, the focus on the Egyptian market restricts the generalizability of the findings. Future research could extend this study to include various African countries impacted by the Russia-Ukraine Conflict, such as Tanzania, Kenya, and Nigeria. Second, the study highlights the significant influence of external shifts, particularly global fuel prices and exchange rate devaluation, on only TOC category. Future research may develop a more comprehensive cross-country comparative analysis, which could explain the impact of government interventions across different environments in shaping firms' resilience to geopolitical risks across different contexts and also focus on the lagged impact of political shocks on the tested variables. Finally, while the study suggests various cost management strategies under these risky conditions, future research can delve deeper into these strategies.

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المستخلص

الغرض – يستهدف هذا البحث دراسة تأثير الصراع الروسي الأوكراني على ديناميكيات تكاليف التشغيل في الشركات الزراعية المصرية المقيدة في البورصة في ظل التوترات الجيوسياسية المتصاعدة في الفترة من 2020–2025.

المنهجية – وقد اعتمد البحث على أسلوب جذر الوحدة لاختبار استقرار السلسلة الزمنية للفترة من الربع الأول 2020 الي الربع الأول لسنة 2025، ونموذج الانحدار ذو التأثيرات الثابتة لتقييم تأثير الاضطرابات الناجمة عن الصراع الروسي–الأوكراني على هيكل التكاليف الداخلية للشركات الزراعية المصرية المدرجة في البورصة.

النتائج – وتشير النتائج الرئيسية لهذا البحث إلى أن ارتفاع أسعار القمح العالمية، وأسعار الوقود، وتقلبات سعر الصرف، الناتجة عن الصراع الروسي–الأوكراني، تزيد بشكل كبير من تكاليف التشغيل في الشركات الزراعية، مما يساهم في تشوهات التكاليف بشكل ملحوظ، بالإضافة إلى القيود التكنولوجية.

القيود – يعتبر الاعتماد على التقارير المالية كمصدر أساسي للحصول على تكاليف التشغيل قيدًا رئيسيًا، قد لا يعكس بالكامل جميع مكونات التكلفة ذات الصلة. يتطلب تحليل أكثر شمولية بيانات تكميلية من الإدارة من خلال دراسات حالة أو استطلاعات. ومع ذلك، تعزز موثوقية الدراسة منهجية صارمة، بما في ذلك تحديد المتغيرات بدقة.

الإضافة العلمية: تعد الإدارة الفعالة للاضطرابات الناتجة عن الصراع بين روسيا وأوكرانيا أمرا ضروري لتخفيف تأثيرها الشديد على عمليات الشركات الزراعية المصرية، مما يضمن مرونة هذا القطاع الحيوي في الأعمال الزراعية.

الكلمات المفتاحية: الصراع الروسي الأوكراني، تكاليف التشغيل، هيكل التكاليف الداخلية، تشوهات التكاليف، الشركات الزراعية.