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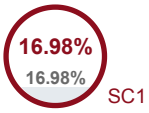

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The impact of Russia's invasion of Ukraine on agricultural stock prices on the IDX
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Abstract **The purpose of this study is to examine the** impact of Ukraine's Russian invasion on stock prices in the agricultural products industry **listed on the Indonesia Stock Exchange** and to analyze the differences before and during the invasion, measured using variable of abnormal return, trading volume activity, and security return variability. This study considers the time range between 2020 and 2024. This study employs **the Capital Asset Pricing Model (CAPM) and** event study methodology to analyze stock **price movements over** a four-year period. **The** dataset includes 24 months pre-invasion (February 2020 to January 2022), the event itself (March 2022), and 24 months post-invasion (February 2024). Statistical analyses were conducted using SPSS v.29, incorporating descriptive tests, normality testing via **the One-Sample Kolmogorov-Smirnov** test, and hypothesis **testing using the Wilcoxon Signed-Rank** test. Revealed significant changes in abnormal return and variability of security returns during the invasion, indicating an important impact on stock prices. However, trading volume activity had no significant effect. These results underline the sensitivity of stock prices in the agricultural sector to geopolitical events, particularly in terms of return variability and profitability. This study contributes to the literature on financial markets by exploring the implications of geopolitical risks such as Russia's invasion of Ukraine. It provides insights for investors and policymakers by measuring key variable such as **abnormal return, trading volume activity,** and security return variability, emphasizing the need for strategic responses during periods of global uncertainty.

Keywords: Abnormal return, tradig volume **activity, security return variability,** event study, signaling theory, efficient capital markets

1. Introduction

On February 24, 2022, Russia launched its "Special Military Operation" against Ukraine. While this marked the official beginning of the Russia-Ukraine war, there were clear indications that Russia had been plotting a military campaign in advance (International Crisis Group, 2022). Just days prior, on Monday, February 21st, President Putin recognized the Ukrainian rebel territories, and by Tuesday, February 22nd, Russian troops had entered the former Ukrainian Donetsk and Luhansk regions (Hassan & Mustafa, 2024).
The onset of the war significantly disrupted global markets, particularly affecting the prices of essential commodities such as wheat, corn, and sunflower oil-major exports of both Russia and Ukraine. Crude oil prices also experienced a sharp increase (Covachev & Fazakas, 2024). These disruptions raised immediate concerns regarding global grain supplies (Arndt et al., 2023). Ukraine's ports were blocked, preventing the export of millions of metric tons of grain. While alternative routes through Polish railways were explored, their effectiveness remained limited. At the same time, Russian exports also faced difficulties due to heightened uncertainty and rising insurance costs in the Black Sea region (Laborde et al., 2023).
These export disruptions created ripple effects throughout the global food market, intensifying concerns about food security (Behnassi & Haiba, 2022). The conflict directly affected global agri-food systems, impacting trade, production, and prices (FAO et al., 2022). The FAO predicted that reduced grain and sunflower seed exports from Ukraine and Russia could push global wheat prices up by 8.75% (in a moderate case) to 21.5% (in a severe case) by the 2022/2023 period. Notably, winter wheat-a major crop exported by both nations-accounted for nearly 30% of global wheat exports in 2021 (Lin et al., 2023). As a result, the conflict triggered a dramatic surge in global food prices, posing a significant threat to the United Nations' Sustainable Development Goal (SDG Target 2) of eradicating hunger and malnutrition by 2030 (World Bank Group, 2022).
Although the war is geographically distant, its economic reverberations reached far beyond Eastern Europe. Indonesia, for instance, is heavily reliant on wheat imports for processed foods such as instant noodles and bread. In 2021, the country **imported** 11,172 **tonnes of wheat and meslin, valued** at $3.45 billion, with **Ukraine** being its **second-largest** supplier, contributing **2,834 tonnes** worth $ 843.6 **million (Badan Pusat Statistik-BPS, 2022).** This reliance makes Indonesia vulnerable to global commodity price fluctuations and supply chain disruptions triggered by geopolitical conflicts. Beyond food security, geopolitical events such as the Russia-Ukraine conflict can have profound impacts on financial markets, often triggering strong investor reactions and heightened market volatility (Korsah et al., 2024). As part of the globally interconnected financial system, the Indonesia Stock Exchange (IDX) is not immune to such shocks (Sanoyo et al., 2024). The IDX plays a crucial role in attracting both domestic and foreign investment, making it sensitive to global uncertainties. Following the invasion, Indonesia's financial markets responded swiftly. Rising geopolitical tensions, surging commodity prices, and disrupted trade routes led to noticeable **fluctuations in stock prices, trading volumes, and overall market volatility** (Sari et al., 2023).
The impact of the war **on the IDX** became particularly evident **on** February 24, 2022, the **day of Russia's invasion.** Investor concerns escalated, prompting precautionary withdrawals from riskier assets such as equities (Dwijaya et al., 2023). This shift in sentiment directly affected the Jakarta Composite Index, which closed the trading day down by 102.24 points or 1.48% to 6,817.82 (www.idx.co.id). The Consumer Non-Cyclicals sector-specifically the Agricultural Products industry-also suffered, dropping by 1.37% to 652.763, signaling a direct impact on the agricultural sector (Syamlan, 2022).
This study aims to examine the impact of Russia's military attack on Ukraine on February 24, 2022, focusing on the Indonesian capital market. Previous research has analyzed abnormal returns and business activity surrounding the Russia-Ukraine conflict, with mixed findings. For instance, Emilia et al. (2022) studied the Japanese capital market and found differences in abnormal returns between the Russian-Ukrainian currency pair before and during

the conflict, though trading volume remained unchanged. In contrast, Priyambodo & Yunita (2023), using a market-adjusted model, found no significant abnormal return differences but noted notable changes in business activity among oil and gas subcontractors listed on the IDX.
Similarly, Febriandika et al. (2023) analyzed the Sharia Stock Exchange and reported significant differences in average stock returns before and after the invasion, with average abnormal returns showing little change. Conversely, Tambunan et al. (2023), who examined abnormal returns, trading volume activity, and market capitalization over a 5-day window around the invasion date, found significant differences in all three variables within the IDX energy sector.
Building upon this literature, the present study employs an event study methodology to investigate the differences in abnormal return, trading volume activity, and security return variability before and during the Russia-Ukraine conflict. The analysis is underpinned by signaling theory and the efficient capital market hypothesis, offering insights into how international geopolitical shocks are transmitted to emerging markets like Indonesia.

2. Literature review and hypothesis

1. Signaling theory

Signaling theory, originally proposed by (Spence, 1973) explains interactions between parties with asymmetric information. In this context, signaling involves deliberate actions by a signaler aimed at influencing the perceptions and behaviors of receivers. The theory addresses information imbalances in competitive environments (Taj, 2016). It elucidates how management signals to the market, stakeholders, and society, emphasizing the signal giver, the transmitted signal, the receiver, and the feedback.
From a business perspective, signaling theory emphasizes how management conveys information through financial performance. These signals are interpreted by various stakeholders, including investors, employees, communities, and governments, whose feedback reflects their responses to the signals (Haryanto & Syarif, 2024). Management often utilizes financial information to communicate company performance to investors. When investors perceive positive profit potential in company announcements, they may decide to purchase shares. Financial reports, as an essential form of signaling, efficiently demonstrate a company's capacity to generate and maximize shareholder wealth (Fiordelisi et al., 2023). This dynamic underscores the critical role of transparent and strategic communication in bridging informational gaps and influencing stakeholder decision-making.

2.2. Efficient capital markets

According to (Fama, 1970) introduced the concept of efficient markets, proposing that in an efficient market, the price of every traded security reflects all available information. This implies that as new information enters the market, security prices adjust to reach equilibrium, allowing investors to fully assess the implications of the information.
Market efficiency can be categorized into three forms: (1) in the weak form, stock prices reflect historical data, allowing investors to respond to geopolitical events and industry-specific factors, such as the Russian invasion of Ukraine, which impacts stock prices in sensitive sectors such as agriculture (Huka & Kelen, 2022); (2) the semi-strong form, which occurs when prices incorporate all public information, including company data, allowing investors to identify mispriced stocks through event studies (Asness, 2024); and (3) the strong form posits that markets fully absorb all public and private information, making it impossible for investors to earn abnormal return, although this is the hardest to test empirically (Brown, 2020).

3. Capital asset pricing model (CAPM)

The CAPM is an equilibrium model that helps us understand investor behavior and the mechanisms of price formation and market returns in a simplified manner (Hasmalini & Heikal, 2023). This model also assists in determining the relevant risk for an asset and clarifying the relationship between risk and expected return when the market is in equilibrium (Randl et al., 2023). Below are the steps and formulas for calculating abnormal returns using the CAPM method.
Calculating realized return
Ri,t = (1) Where Ri,t is the realized return of security i at time t; Pi,t is the monthly stock price of agricultural product industry security i during the study period; and Pi,t−1 is the monthly stock price of agricultural product industry security i during the study period. Index t is the stock price of the first month, and index t-1 is the price of the last month's stock in the research period minus the price of the first month's stock.
Calculating market return
Rm,t = (2)

Where Rm,t is the realized return from market i at time t; Pi,t is the monthly Jakarta composite index for security i during the research period; and Pi,t−1 is the monthly Jakarta composite index for security i during the research period. This study uses the Jakarta Composite Index, as the market return is adjusted for the study period. Index t is the Jakarta Composite Index in the first month, and index t-1 is the Jakarta Composite Index in the last month's stock in the research period minus the price of the first month's stock.
Calculating risk-free return
Rf = (3)
Where Rf is the average rate of return generated by a risk-free asset or investment. In the CAPM method, this is obtained from the Bank Indonesia Interest Rate (SBI) (HYPERLINK "http://www.bi.go.id"www.bi.go.id) and is divided by N, which is the number of periods.
Calculating systematic risk (Beta)
β= (4)
Risk is a form of uncertainty about a situation that will occur later, based on the decisions made, considering various current factors. In CAPM, risk is beta (β). This can be explained using the following formula:
β= (4)

Where β is the stock beta obtained from Ri,t is the realized return, which is the calculation in the first formula; while it is the average of the realized return during the research period before and during the Russian invasion of Ukraine. Rm,t is the market return based on the second formula, and is also the average market return during the research period.

Calculating the expected return

E=Rf+β [Rm, t- Rf] (5)

Where **E(Ri,t) is the expected return of security i at time t,** is obtained from Rf is the risk-free return, then which is derived from the calculation of the third formula; then β which represents the systematic risk or the stock's beta obtained from the calculation of the fourth formula, and Rm,t which represents the market return rate obtained from the calculation of the second formula.

4. Abnormal return

Abnormal return refers to the difference between actual and predicted returns. Realized returns are calculated based on historical data, while expected returns are projections derived from past performance and other relevant factors (Yudhistira & Purbawangsa, 2023). **A positive abnormal return occurs when the realized** return exceeds **the** expected return, while a negative abnormal return arises when it falls short. These deviations indicate how the market reacts to new information (Juniantara et al., 2023).

Company size is determined by metrics such as sales, capital, or total assets. Total assets are a common measure for evaluating firm size. Some studies suggest a positive and significant relationship between total assets and abnormal return, indicating that larger companies tend to exhibit stronger market reactions (Nawangsari & Iswajuni, 2019). However, other findings indicate no significant relationship between company size and abnormal return, underscoring the complexity of this interaction.

In an inefficient market, return can exceed the expected levels. Global events with new information, such as Russia's invasion of Ukraine, often lead to abnormal return, while events lacking new information usually do not (Suroto, 2023). Abnormal return are characterized by an excess of actual return compared to normal return (Dzar et al., 2023).

H1: **There is a difference in** abnormal return on the stock prices of companies in the agricultural product industry before and **during the Russian invasion of** Ukraine.

Calculating abnormal **return**

ARi,t=Ri,t- E(Ri,t) (6)

Where **ARi,t is the abnormal return of security i at time t; Ri,t, is the realized return,** which is the calculation in the first formula; **and E(Ri,t) is the expected return of security i at time t,** which is the calculation in the fourth formula.

5. **Trading volume activity Trading volume** activity is **the ratio of the total number of shares traded to the total number of shares outstanding (or available for trading) in the market over a** specific period (Hartono, 2018). It plays a crucial role in technical analysis, as it indicates the supply and demand balance, showing the strength or weakness of investor interest in a stock. Published information can affect investor confidence, as evidenced by changes in stock trading volume (Ardana et al., 2024).

Stocks with high trading volumes demonstrates strong investor demand and frequent trades. In such conditions, dealers often increase profits by widening the spread between bid and ask prices (Putri & Gultom, 2024). According to (Lukman et al., 2023), market reactions signal how an event impacts a company's value, as shown through changes in stock prices and trading volume. The event study method can test these reactions, with global **events such as Russia's invasion of Ukraine,** potentially influencing capital market responses.

H2: There is a difference in the trading volume activity **on the stock prices of companies in** the agricultural products industry before and **during the Russian invasion of Ukraine.**

Calculating trading volume activity

TVA= **The number of shares traded** (7)

Trading volume activity or **the number of shares traded can** be accessed through **the official website of the Indonesia Stock** Exchange (HYPERLINK "http://www.idx.co.id" www.idx.co.id).

6. Security return variability

Market reacts to information from an event (Indriani & Mariana, 2021). The advantage of SRV is that its heterogeneity can be eliminated, making all SRV values positive owing to squaring in the analysis. However, its weakness is that it does not indicate the direction of movement, making it difficult to distinguish between positive and negative information (Laili et al., 2022).

In addition to previously mentioned variables, SRV during the event period can also assess the market's aggregate response to information. This concept is supported by signaling theory, which suggests that if the market reacts to an event, then that event is considered informative and capable of influencing the capital market.

H3: There is a difference **in** security return variability **in the stock prices of** companies on the agricultural products industry before and **during the Russian invasion of** Ukraine.

Calculating security return variability

SRVi, t= (8)

Where SRVi, t **is** the security return variability of security i at time t; ARi,t2 is the squared abnormal return, which is the calculation in the sixth formula, because squaring eliminates the heterogeneity in SRV, which means that the SRV value becomes positive. V(ARi,t) is a variation in the abnormal return, which can be described using the following formula:

V= (9)

Where SD (ARi,t) is the standard deviation of the squared abnormal return which is the calculation in the sixth formula

7. Conceptual framework

The conceptual framework in this compares the periods before and during the Russian invasion of Ukraine, examining its impact on stock prices in the agricultural products industry, with the Jakarta Composite Index serving as the market return benchmark. This analysis involves three key variables. The first variable is abnormal return, defined as the difference between realized and expected returns. The second variable, trading volume activity, measures the number of shares traded over a specified period. Lastly, security return variability assesses the level of variation in stock profit levels, providing valuable insights for evaluation. Three variables will be analyzed using the event study method and compared to determine whether there is a difference between before and during the Russian invasion of Ukraine (Figure 1).

Figure 1 Conceptual framework

3. Data and research methodology

1. Aprroached and data

This type of research uses quantitative comparative methods. The market model event study methodology of (Brown & Warner, 1985). This methodology has been successfully applied to a large variety of events (Benninga, 2008) (See Figure 2). A common feature is that the events considered were rarely unexpected. We defined "day 0" as the day of the announcement of the Russian invasion of Ukraine, specifically on February 24, 2022. Then, the estimation and the event windows were determined.
The interval T0− T1 is the estimation window that provides the information needed to specify the normal return (i.e., prior to the occurrence of the event). The interval T2 − T1 + 1 is the event window, and the interval T3 − T2 is the post-event window. To investigate the stock behavior in the agricultural product industry on the Indonesia Stock Exchange after the event. This study considers a time window of four years, consisting of two years or twenty-four months before the date of the event, specifically from the closing stock prices in February 2020 to the closing stock prices in January 2022; and two years or twenty-four months after the event, as well as the day of the event itself, specifically from the closing stock prices in March 2022 to the closing stock prices in February 2024.

Figure 2 Event study methodology time frame

2. Population and Sample

The population in this study is the agricultural product industry **on the Indonesia Stock Exchange,** categorized within **the Consumer Non-Cyclical sector. The samples were selected using the purposive sampling** method, where the **selected samples** met the following criteria:
1. The agricultural product industries were listed agricultural product industry that was conducting an Initial Public Offering (IPO) before February 2020
2. The agricultural product industries were not delisted during the periode 2020 until 2024

3. Data analysis

Data were statistically analyzed using the SPPS program v.29. The collected underwent several testing stges. A normality test was conducted to identify **whether the data used** in this study were normally **distributed** (Fiona & Trenggana, 2020). **A good regression model is one that** has a normal or nearly normal distribution, making it suitable for statistical testing. **The one-sample Kolmogorov-Smirnov test** was employed as a normality test to measure the significance of the stock price distribution.
1. If the significance value (asymp. **sig)** was > 0.05, the data were considered normally distributed, and conversely
2. If the significance value (asymp.sig) was < **0.05,** the data were considered not normally distributed.

4. Hypothetical test

In this study, the results of the data normality test serve as a guideline for determining which hypothesis testing method will be used. If the **normality test** results indicated **that the** data **were not normally distributed, the Wilcoxon signed-rank** test **was** used. However, **if the data is normally distributed,** the difference **test used is** the **paired sample t-test.** In the **paired sample t-test and** the Wilcoxon sign rank test, decision-making is based on the significance value;
1. **If** the sig. (2-tailed) **value <0.05, the** hypothesis is accepted
2. **If** the sig. **(2-tailed) value >0.05, the** hypothesis is rejected

4. Result and discussion

1. Description of the research object

A total of 19 agricultural product industries samples were selected using the purposive sampling technique

Table SEQ Table * ARABIC 1 Sample criteria of research

No	Criteria	2020	2021	2022	2023	2024
1	Listed agritcultral product industries	(21)	6	10	4	3
2	Delisted agricultural product industries	-	-	(2)	-	-
3	Overall samples	(19)				

2. Description of the research object

Based on the Table 2 the value of the realized return before the Russian invasion of Ukraine was almost entirely positive, except for the stock codes BEEF, BWPT, and SGRO. Beta was overall positive. In Table 3, during the event, the value of the realized return was almost entirely negative except for the stock codes ANDI, BEEF, BISI, and SSMS, and there were several negative Beta values, namely for the stock codes BWPT, JAWA, MGRO, and SSMS. Market return is obtained based on the Jakarta Composite Index adjusted for the event period, as well as the risk-free values obtained from the Bank Indonesia Interest Rate (SBI).

Table SEQ Table * ARABIC 2 CAPM before the event Russia's invasion of Ukraine

Code Name	Realized return (Ri,t)	Market return (Rm)	Risk free (Rf)	Beta (β)
Jakarta Composite Index	0.2161	0.2161	0.0382	1
AALI	0.0102	0.2161	0.0382	2.0503
ANDI	0.0000	0.2161	0.0382	0.0254
ANJT	0.4375	0.2161	0.0382	3.1056

BEEF	-0.788	0.2161	0.0382	1.2950
BISI	0.0372	0.2161	0.0382	1.1940
BWPT	-0.1511	0.2161	0.0382	2.0721
CSRA	0.0438	0.2161	0.0382	1.3875
DSFI	0.2676	0.2161	0.0382	0.5382
DSNG	0.5384	0.2161	0.0382	0.9837
GZCO	0.4	0.2161	0.0382	0.6643
JAWA	1.8837	0.2161	0.0382	0.4777
LSIP	0.2989	0.2161	0.0382	1.4017
MGRO	0.1533	0.2161	0.0382	0.6858
PALM	2.9583	0.2161	0.0382	0.2848
SGRO	-0.09	0.2161	0.0382	0.0277
SIMP	0.6521	0.2161	0.0382	1.7873
SMAR	0.3313	0.2161	0.0382	1.2505
SSMS	0.2407	0.2161	0.0382	0.5273
UNSP	0.6231	0.2161	0.0382	1.3294

Table SEQ Table * ARABIC 3 CAPM during the event Russia's invasion of Ukraine

Code Name	Realized return (Ri,t)	Market return (Rm)	Risk free (Rf)	Beta (β)
Jakarta Composite Index	0.0363	0.0363	0.0511	1
AALI	-0.4621	0.0363	0.0511	1.4764
ANDI	0.0000	0.0363	0.0511	1.4444
ANJT	-0.3137	0.0363	0.0511	1.2534
BEEF	3.2456	0.0363	0.0511	3.9958
BISI	0.2819	0.0363	0.0511	0.9307
BWPT	-0.4137	0.0363	0.0511	-0.6451
CSRA	-0.3449	0.0363	0.0511	0.8534
DSFI	-0.4040	0.0363	0.0511	0.2931
DSNG	-0.2031	0.0363	0.0511	0.8591
GZCO	-0.3014	0.0363	0.0511	2.9942
JAWA	-0.3494	0.0363	0.0511	-5.7115
LSIP	-0.4098	0.0363	0.0511	1.0952
MGRO	-0.3052	0.0363	0.0511	-0.3323
PALM	-0.421	0.0363	0.0511	2.7644
SGRO	-0.1111	0.0363	0.0511	0.4996
SIMP	-0.28	0.0363	0.0511	0.9193
SMAR	-0.202	0.0363	0.0511	0.8305
SSMS	0.0187	0.0363	0.0511	-0.2357
UNSP	-0.042	0.0363	0.0511	1.3589

3. **Description of the research object**

Below is the **descriptive** statistical analysis of **each** variable in **this research** using the SPSS **program** v. 29. Based **on** Table 4, each **variable can be described as follows:**

1. The abnormal return variable before the event has an average of 0.1684 **and a standard deviation** of 0.8241. **This** indicated that **the** average was smaller than the standard deviation, indicating potential issues with the result. he high standard deviation reflects considerable variability, which may lead to biased outcomes. The minimum value recorded was -1.0574, while the maximum was 2.8694, indicating a relatively close range between the minimum and maximum values. Therefore, these results indicate a relatively close range between minimum and maximum values.

Meanwhile, the abnormal return variable during the event had an average of -0.0897 and a standard deviation of 0.8116. This indicates **that the** average is **smaller than the standard deviation,** suggesting that the results are not good. Since **the standard deviation reflects a very high deviation, the data distribution shows abnormal results,** which can lead to bias. The minimum value is -0.4914 and maximum value is 3.2535. Therefore, these results indicate a relatively close range between the minimum and maximum values.

2. The trading volume activity variable before the event had an average of 897,707 and a standard deviation of 3,937,345. This indicates that the average is smaller than the standard deviation, suggesting that the results are not good. The minimum value was 15,617 and the maximum value was 17,625,061. Therefore, these results indicate a significant range between the minimum and maximum values. Meanwhile, the trading volume activity variable during the event had an average of 1,236,476 and a standard deviation of 5,491,287. This indicates that the average is smaller than the standard deviation, suggesting that the results are not good. The minimum value was 27,767 and the maximum value was 24,566,310. Therefore, these results indicate a relatively close range between the minimum and maximum values.

3. The security return variability variable before the event had an **average** of 1.3859 **and standard deviation** of 3.0558. **This** indicates **that the** average is smaller than the standard deviation, indicating potential issueswith the rsults. The minimum value was 0.000 and the maximum value was 12.135, emonstrating **a significant range between the minimum and maximum values.** Meanwhile, the security return variability variable before the event had an average of 2.9895 and a standard deviation of 4.4301. This indicates that the average is smaller than the standard deviation, suggesting that the results are not good. The minimum value was 0.000 and the maximum value was 18.977. Therefore, these results show a significant range between the minimum and maximum values.

Table SEQ Table * ARABIC 4 Descriptive statistical analysis

N	Minimum	Maximum	Mean	Std. Deviation

AR_Before	20	-1.05749246	2.86942323	0.1684179525	0.8241725162
AR_During	20	-0.49148430	3.25350409	-0.0897232155	0.8116369419
TVA_Before	20	15617	17625061928	897707631.15	3937345399.2
TVA_During	20	27767	24566310004	1236476176.9	5491287845.0
SRV_Before	20	0.00000000	12.13502270	1.3859183195	3.0558382946
SRV_During	20	0.00000000	18.97783684	2.9895450995	4.4301407835
Valid N (listwise)	20				

4. The one-sample kolmogrov-smirnov test analysis

Below are the One-Sample Kolmogrov-Smirnov test of each variable in this research was performed using the SPSS program v.29. Based on Table V, each variable can be described as follows:

1. The One-sample Kolmogorov-Smirnov test on the abnormal return variable before the event was (asymp.sig) 0.000 < 0.05. This indicates that **the data are not normally distributed,** and the value is the same as the abnormal return variable during the event

2. The One-sample Kolmogorov-Smirnov test on the trading volume activity variable before the event was (asymp.sig) 0.000 < 0.05. This indicates **that the data is not normally distributed,** and the value is the same as the trading volume activity variable during the event.

3. The One-sample Kolmogorov-Smirnov test on the security return variability variable before the event was (asymp.sig) 0.000 < 0.05 and also during the event was (asymp.sig) 0.002 < 0.005. This confirms that the data on the security return variability variable is not normally distributed

Table SEQ Table * ARABIC 5 The one-sample kolmogrov-smirnov test analysis

	N	Asymp. Sig. (2-tailed)
AR_Before	20	0.000
AR_During	20	0.000
TVA_Before	20	0.000
TVA_During	20	0.000
SRV_Before	20	0.000
SRV_During	20	0.002

5. Wilcoxon signed ranks test analysis

Below are Wilcoxon signed ranks test **of each variable of this research using SPSS program** v. 29. **Based on** Table VI, each **variable can be described as follows:**

1. The abnormal return variable indicates that there are 16 negative ranks, **with** a **mean rank of** 9.75 and **a sum of ranks** of 156.00. **This** signifies **that** 16 samples **experienced a decrease in** abnormal return. Meanwhile, **the number of positive ranks** is three samples, indicating no increase in abnormal return before and during the event, **with a mean rank** of 11.33, and **a sum of ranks** of 34.00. **This** means that three samples experienced **an increase in abnormal return.** Ties are similarities in values before **and during the Russian invasion of Ukraine.** The value of ties is one, meaning that there are no similarities **in** values before and during **the Russian invasion of Ukraine.** a Z value of -2.455, and an asymp.sig. (2-tailed) value of 0.014 < 0.05 were obtained, thus H1 is accepted. This indicates that the announcement of Russia's invasion of Ukraine on February 24, 2022, **had a significant impact on the** stock prices of the agricultural products industry, as the announcement contained information that influenced investors decisions to invest.

2. The trading volume activity variable shows 12 **negative** ranks, with **a mean rank** of 10.62 and **a sum of ranks** of 138.00, indicating **that** 12 samples **experienced a decrease in trading volume activity.** In contrast, there are seven positive ranks, suggesting **no increase in trading volume activity** before and during the event, **with a mean rank** of 10.29 and **a sum of ranks** of 72.00. **This means** that seven **samples** experience **an increase in trading volume activity.** Ties are equal **before and during the Russian invasion of Ukraine.** The value of ties is zero, which means that there are equal values before and during the event. **It can be concluded that there** was no **difference in trading volume** activity before and during **the Russian invasion of Ukraine. the** result obtained was a Z value of -1.232 and **an asymp.sig. (2-tailed) value** of 0.218 > 0.05, thus H2 was rejected. This means that the **announcement** of Russia's invasion **of Ukraine on February 24, 2022,** did not affect investors in making investment decisions, as seen from the trading volume activity variable.

3. The security return variability variable shows five negative ranks, **with a mean rank** of 8.80 and **a sum of ranks** of 44.00, indicating **that** five samples **experienced a decrease in** security return variability. Meanwhile, **the number of positive ranks is** 14, indicating **an increase in abnormal return** before and during the event, **with a mean rank** of 10.43 and **a sum of ranks** of 146.00. This means that the 14 samples experienced an increase in security return variability. The number of ties is one, meaning that there are no identical values before and during the event. The result obtained was a Z value of -2.052 and an asymp.sig. (2-tailed) value of 0.04 < 0.05, thus H3 was accepted. This means that the announcement of the Russian invasion of Ukraine on February 24, 2022, had a significant impact on the stock prices of the agricultural products industry, as the announcement contained information that influenced investors decisions to invest.

Table SEQ Table * ARABIC 6 Wilcoxon signed ranks test analysis

	N	Mean Rank	Sum of Ranks	z	Asymp.sig (2-tailed)
AR_Before - AR_During	Negative Ranks	16	9.75	156.00	-2.455	0.014
Positive Ranks	3	11.33	34.00		
Ties	1				
Total	20				
TVA_Before - TVA_During	Negative Ranks	13	10.62	138.00	-1.232	0.218
Positive Ranks	7	10.29	72.00		
Ties	0				
Total	20				
SRV_Before -SRV_During	Negative Ranks	5	8.80	44.00	-2.052	0.040
Positive Ranks	14	10.43	146.00		
Ties	1				

Total	20

There is a difference in abnormal return on the stock prices of companies in the agricultural products industry before and during the Russian invasion of Ukraine.

There was a significant difference in the impact on the abnormal return variable before and during the event. The event provided information that can influence investors decision making, in accordance with the signaling theory, which states that when an event carries information that can affect investors decision making. If observed, the abnormal return values before the event period mostly yield positive values, whereas during the event period, they mostly yield negative values. This indicates that Russia's invasion of Ukraine resulted in losses for investors, or it can also be interpreted that the event provided negative signals or bad news for investors. Ideally, the invasion event is considered negative news by the market. The ability of investors to obtain abnormal returns depends on the level of market efficiency, according to the efficient market hypothesis. In an efficient market, stock prices reflect all available information accurately and quickly, making it difficult for investors to achieve abnormal return. The existence of differences in abnormal returns before and during the Russian invasion of Ukraine indicates that the market reaction was semi-strong, as the event brought information that influenced the capital market reaction. The results of this study are consistent with those of (Fajarwati & Nurasik, 2020) and (Andriansyah & Irwandi, 2023).

There is a difference in trading volume activity on the stock prices of companies in the agricultural products industry before and during the Russian invasion of Ukraine.

There is no significant difference in the impact on the trading volume activity variable before and during an event. This indicates that there was no informational content from the Russian invasion of Ukraine. This indicates that there is no trading volume activity approaching normal returns as a result of stock price changes in the capital market, because there is no difference in trading volume activity. The absence of this difference implies that the information stemming from the Russian invasion of Ukraine did not significantly affect market participants. It also indicates that no meaningful signals were provided for investors in their decision-making processes. The lack of significant difference in trading volume activity before and during the invasion suggests that the market reaction was weak, as the event did not introduce information that impacted the capital market. The finding are consistent with studies by (Muhammad & Sulistyowati, 2023) and (Sahputra et al., 2022).

There is a difference in security return variability on the stock prices of companies in the agricultural products industry before and during the Russian invasion of Ukraine.

There was a significant difference in the impact on the security return variability variable before and during the event. This provides information that impacts and investors stock trading decisions. The increase in security return variability over time indicates that this result is in line with signaling theory, suggesting that the news of the Russian invasion was perceived as a positive signal. One reason for this positive perception may be the sanctions imposed on Russia by the European Union, the United States, and several Asian countries. The difference in security return variability before and during the Russian invasion of Ukraine indicates that the market reaction was semi-strong, as the events conveyed information that significantly affected the capital market.These findings are consistent with research conducted by (Surnyani & Wiarta, 2022)

5. Conclusions

Several conclusions were drawn from this study. Significant differences were observed in the abnormal return and security return variability variables on stock prices in the agricultural products industry before and during the Russian invasion of Ukraine. This indicates that the event provided signals for investors in their decision-making processes. The difference in abnormal return and security return variability before and during the Russian invasion of Ukraine indicates that the market reaction was in a semi-strong state, as the event brought information that influenced the capital market reaction. In contrast, the absence of a significant difference suggests that the information from the Russian invasion of Ukraine does not have a significant impact on market participants, and it also indicates that there is no information providing signals for investors in making investment decisions. The lack of difference in trading volume activity before and during the Russian invasion of Ukraine indicates that the market reaction was weak, as the event did not bring information that affected the capital market reaction.

The study focuses exclusively on Indonesia’s agricultural sector, limiting its scope. Future research could explore global impacts and include additional variables, such as Return on Assets (ROA) and Current Ratio (CR), to provide deeper insights into market reactions. This study contributes to financial literature by highlighting the role of geopolitical events in shaping market behavior, offering valuable insights for investors and policymakers during periods of global uncertainty.

Acknowledgment

The authors would like to thank Assoc. Prof. Wisnu Panggah Setiyono, S.E., M.Si., Ph.D., Prof. Dr. Drs. Sriyono, M.M., and the anonymous reviewers for their helpful suggestions

Ethical considerations

Not applicable

Conflict of Interest

We have no conflicts of interest to disclose

Funding

This research was supported by Muhammadiyah University of Sidoarjo