Market Reaction To The Announcement Of The European Union Coal Embargo On Coal Import From Russia In Other Exporting Countries

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Abstract

European Union announced the fifth sanctions package against Russia in April 2022, a ban on coal imports from Russia to the EU. The EU seeks to find an alternative country to fulfill the country's demand for coal commodities. In this case, South Africa experienced the highest increase in coal supply volume to European countries compared to other coal suppliers. The increase in coal import volume makes South Africa the possible alternative to fulfill coal demand for European countries. Therefore, as there is a huge increase in supply volume, the author intends to investigate whether or not there is an impact on the stock market in the alternate country. This research analyses the market reaction to the EU coal embargo on coal stocks as reflected in abnormal return and trading volume activity in the alternative country, South Africa. The analysis uses the stock price and volume of listed coal companies in South Africa before and after the announcement of the EU coal embargo. The researcher used an event study approach with an event window of 10 days before and ten days after the announcement to calculate the abnormal return and trading volume activity, while the estimated period was set to be 100 days to calculate the expected return. The step analysis conducted in this study is to test the normality of the data first and then assess the hypothesis testing. This study's results show no significant difference in abnormal return and trading volume activity before and after the announcement. This result might happen because the EU had given a signal by proposing a far-reaching ban across Russia's energy sector through the fourth sanctions; thus, investors might have predicted the event in advance.

Keywords: embargo; market reaction; trading volume activity; alternative country.

A. INTRODUCTION

Investment is an instrument to develop wealth and assets, and the goal for investors to conduct an investment is to gain maximum profit without ignoring the investment risk. Return is a major factor that motivates investors to invest and a reward they get after taking risks on their investments. Investors gain profit in the form of expected returns. They expect an investment that gives the highest possible return with the lowest possible risk (Markowitz, 1952). Investors can choose which analysis they use to invest, fundamental or technical analysis. Investors do fundamental analysis for long-term investment to see the company's financial health, which can produce a fresh insight into which company is beneficial for them to invest in. Fundamental analysis uses financial reports, such as a company's balance sheets and income statements, to estimate future stock value. On the other hand, investors do technical analysis for short-term investments by using the past few hours or days' movements that can be used to predict future price movements. Technical analysis can be conducted by analyzing the historical stock chart or graph (Sulistio, 2020).

Investors can minimize investment risk by diversifying their portfolio, which means investors can combine different company shares and hold with expectations that if the price of one share falls while the other rises or remains the same, the investors can minimize loss (Jogiyanto, 2003). However, stock market conditions are influenced by many factors, such as the existence of an event. Regardless of whether the events are connected directly or not to the economic conditions if the event contains information that influences the market's response, then it is relevant. Relevant information can affect investors' decisions in stock market transactions as reflected in the stock price and volume change. The change in stock price can occur at any time; the main factor that causes the price to change is the existence of new events. Those events create a movement in the stock return, influencing the investor's decision (Pratiwi & Wirakusuma, 2018).

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The European Union announced the fifth sanctions package on Russia on April 8th, 2022, which banned imports of all forms of Russian coal (ec.europe.eu, 2022). European Union has announced another four sanctions packages before the fifth sanction since February 23rd. European Union did these sanctions as a response to Russia – the Ukraine invasion to cut their cash flow from funding the war that started in February 2022. The energy security crisis worsened due to the escalation of the Russia - Ukraine conflict, leading to an increased need for affordable energy sources such as coal (Zaywa, 2022).

Figure 1 demonstrates the European Union coal supplier by country. The data is calculated y-o-y (year over year) from 2022 to 2023. As Russia is banned from supplying coal to the European Union, the EU has increased coal imports from the USA, Colombia, Australia, South Africa, and Indonesia. In Q1 2023, the EU imported 7.4 million tons (mT) from the USA, surging +74.2% from 4.3 mT in Q1 2022. Australia's import volumes were up +97.6% in Q1 2023 to 6.6 mT, from 3.3 mT in Q1 2022. From Colombia, volumes to the EU went up by +58.6% to 5.5 mT in Q1 2023. Volumes from South Africa were +564.7% to 3.9 mT, from 0.6 mT in Q1 2022. Indonesia's import volumes are up +61.3% to 1.2 mT in Q2 from 0.6 mT in Q1 2023. The huge increase in import volume activity from South Africa indicates that the country is the alternative supplier of coal commodities after the EU reduced the import volume from Russia.
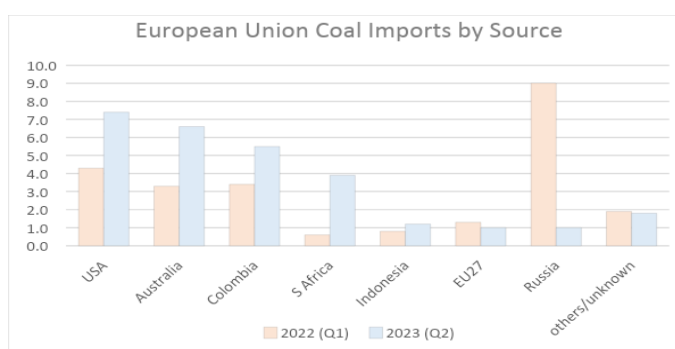
Figure 1: European Union coal import by countries

Geopolitical issues such as war, boycott, and embargo are often the main indicator that triggers dynamics in the capital market, which can create fluctuations in stock prices and trading volumes. These events are empirically proven to have implications for the stock's exchange sensitivity, directly or indirectly related to economic issues (Mulya & Ritonga, 2017). It has been shown, in general, major events such as wars, invasions, and terrorist attacks influence financial markets (Izzeldin et al., 2023). Furthermore, there is also a study examining the influence of the EU's crude palm oil boycott policy on producing countries' markets (Panjaitan, 2020) and a study investigating the effect of economic sanctions on targeted countries' stock markets (Biglaiser & Lektzian, 2020). Though several studies have already investigated the impact of geopolitical events on the stock market, the research that discussed the impact of a commodity embargo announcement on alternative countries — countries chosen to supply a commodity after other countries are banned from supplying — is very limited. Therefore, the results of the previous study can not be associated with whether or not the market reacts to the announcement of the European Union coal embargo.

This research aims to examine whether there is an impact from the announcement of the European Union coal embargo on other exporting countries focused on the alternative country. The research contributes to the embargo effects on stock market literature; while previous studies are limited to the embargo's impact on targeted countries, the research extends it to investigate the market reaction in alternative countries. This research is important as it can be the input and consideration for the market participants, such as investors, in making their investment decision.

B. LITERATURE REVIEW

Capital Market

The capital market is where any trading activity occurs between parties who need long-term funds (issuer) and those who can give the fund (investor). The trading activity includes selling or buying securities — financial assets issued by the issuer (businesses, government, or individuals) in bonds, stocks, commercial paper, and warrants. The stock market transaction is called the trading floor, where any trading activities in the capital market

occur, such as Indonesia Stock Exchange (IDX) or New York Stock Exchange (NYSE). The role of the capital market as a financial function provides opportunities to obtain returns for investors according to their investment characteristics.

Investors can choose in which market they want to buy or sell the securities; this kind of capital market can be divided into four categories (Wardoyo, 2012): 1) Primary Market: The primary market, commonly called the new issue market, is a market where new securities are issued for the first time by the issuer, in this case, the company or government that needs the capital. The company can sell its shares directly to investors at a fixed price in the primary market. The company issues new securities to the general public through Initial Public Offerings (IPO) or Further Public Offerings (FPO). Before going public, the company needs Investment Banking to underwrite the securities and act as an advisor to help them grow the shares. The investors that purchase the shares on the primary market usually aim to get a 'gain on sales.' 2) Secondary Market: A market where any trading activities between investors occur after new security is issued. Once the securities are sold for the first time in the primary market, other investors can buy the existing securities in the secondary market. The price in the secondary market is determined by supply and demand. Supply and demand are influenced by internal factors, such as the company's performance, and external factors, such as the government's monetary policy. The trading activity in the secondary market is generally larger, and the proceeds from the transaction will be directly credited to the relevant shareholders. 3) Third Market: The market where transactions occur outside the stock exchange or over-the-counter (OTC). In the third market, the securities are not traded in widely-recognized stock exchanges, such as IDX, NYSE, or NASDAQ. Securities in the third market are traded among market makers and investors, where the market maker determines the price of the securities. A market maker is an individual or company that buys and sells securities for its account. Securities are sold relatively at a lower cost because there is no third-party cost. 4) Forth Market: A trading activity between investors occurred without the involvement of intermediaries. Large institutional investors, such as hedge funds, mutual funds, and pension funds, are more interested in doing transactions in the fourth market because it bypasses intermediaries and makes the trading activity more quick and efficient. The transactions are usually traded between institutions and conducted in large quantities (block sales).

Internal and external factors influence investment in the stock market (Alwi, 2008). Internal factors are directly related to the company and its operations. This includes the process of marketing, financing, and management. Changes in any of these areas can significantly impact the price of a company's securities. For example, changes in product prices can affect a company's revenue and profitability. External factors affecting the stock market include government announcements, international issues, and global events such as invasions and embargoes. Understanding and monitoring these factors can provide valuable insights for investors and traders in making informed investment decisions.
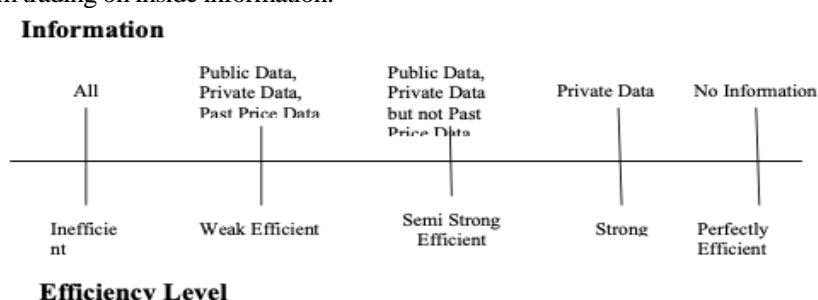
Efficient Market Hypothesis

(Fama, 1970) constructed a theory of efficient markets which focused on whether a stock price at any time "fully reflects" available information. Stock price changes indicate new information that investors learn and act on. New information, in terms of this, is unpredictable. It is the information where the market does not expect this to happen and deviates from what investors had already expected. The arrival of new information leads to swift reactions in the stock market, causing price movements that occur at random. An indicator that a stock market is considered efficient is that the stock prices are hard to predict, even by professional investors (Gitman & Zutter, 2014).

More deeply, the theory is categorized by how fast market price can be influenced by all available information. The purpose of categorizing is to facilitate research conducted on market efficiency. The category is explained as follows (Fama, 1970): 1) The weak form of efficiency asserts that all historical prices, events, and trading volume data are reflected in current market prices. Stock prices in the market tend to react slowly to available information; the information is not distributed equally to everyone and is not received equally by the public. This means that some people might receive inside information within the market, then the technical analysis is not useful in weak form conditions because it cannot predict future prices, as any patterns found in historical data are already priced into the market; 2) The semi-strong form of efficiency explains a condition where all stock market prices completely reflect all publicly available information about the company, such as financial reports, public announcements, news, and macroeconomic data. This means that any information that becomes publicly available rapidly and accurately reflects the stock price, making it impossible for investors to consistently achieve abnormal returns by using publicly available information since the information is already incorporated

into stock prices; and 3) A strong form of efficiency is a condition where publicly available and private information is already reflected in stock prices. This means that even insider information cannot be used to outperform the market consistently, as it is already reflected in the market price. The strong form describes that all information is immediately disseminated in the market simultaneously, and stock prices quickly react to the available information. This means that fundamental analysis cannot be used to earn abnormal returns consistently.

(Levy, 1996) discussed the relationship between information and efficiency level in Figure 2. It is said that the level of information and efficiency can be divided into five categories. A condition where all information can be used to obtain excess profit means the market is inefficient; in this case, the insiders would profit from trading on their information. Insiders who know about forthcoming takeovers or acquisitions have the potential to generate substantial profits; for example, a member of the board of directors knows that the corporation has decided to take over another company. Then before the takeover information is disclosed publicly, the board's relatives buy the shares because of the information they received from insiders. This would be considered inefficient market conditions because all information can be useful to attain abnormal returns. In contrast, a market is considered perfectly efficient when no information can be used to obtain excess profit, and there is no money to be gained from trading on inside information.

Information

All	Public Data, Private Data, Past Price Data	Public Data, Private Data but not Past Price Data	Private Data	No Information
Inefficient	Weak Efficient	Semi Strong Efficient	Strong	Perfectly Efficient

Efficiency Level

Figure 2: Relationship between information and the efficiency level

Studies often try to test the efficiency of the market in each country, as is observed by Heymans & Santana (2018), who examined the South African market, which indicated that the JSE all share index is weak-form efficient. Thus, investors in South Africa could not outperform the market just by seeing past information and conducting technical analysis because historical prices and public data are readily accessible and already reflect the stock price.

From the discussion about the efficient market hypothesis above, the influence of information on market price behavior can be measured using two proxies. The first one is abnormal return, which is used as the parameter of stock return. If the events influenced the security significantly, the investors would change their investment plan in response to the information they received to get an abnormal return. In the stock market, trading volume activity can be used as a parameter that becomes the material to see the market reaction toward information. If the events proved to influence the investor's decision in the stock market, the investors would either sell or buy their stocks, and their transaction will result in a change in total stock volume traded during the events. Both indicators are largely used to assess market reaction to events by the previous study as they can portray well how the market reacts to information from stock price and stock volume perspectives.

Abnormal Return

The term abnormal return has been largely used to describe the difference between the actual return gained by investors from certain financial assets and the return that investors expected. Abnormal return can happen due to certain events, such as mergers and acquisitions, corporate announcements, stock split, political atmosphere, and geopolitical events. The return gap can be positive if the return gained by investors is higher than the predicted return, and vice versa; the gap can be negative if the investors gain a smaller return than expected (Hartono, 2003). Abnormal return is a proxy to determine a market reaction. If an event contains valuable information, it may generate abnormal returns.

In contrast, if an event does not contain any valuable information, then the event will not generate abnormal returns (Wirajaya, 2011). According to (Brown & Warner, 1985), The price performance of a stock is considered abnormal only when compared to a specific benchmark. Thus, conducting a model that measures the normal return is important to assess the abnormal return.

(Tandelilin, 2010) stated that there is 3 statistics model that can be used to determine the expected return: The mean-Adjusted Model, Market, and Market-Adjusted Model. The details of those three models are explained as follows: 1) Mean Adjusted Model: This model assumes that expected returns have a constant value equal to the average return during the estimated period. The advantage of using this model is that it does not require much data, and the calculation is relatively simple, but this model does not identify abnormal returns compared to the other two models; 2) Market Model: In the Market Model, the expected return is calculated using two steps. The first step is to create an expectation model using actual data during the estimation period. The second step uses the expectation model created in the previous step to estimate the expected return during the window event. This model has been used for previous studies as it gives more accurate results of generating abnormal returns. This model also considered the risk related to the stock. Despite its benefits, this model has a complex calculation and needs to gather more data compared to other models; and 3) Market-Adjusted Model: The market-adjusted model assumes that the best way to estimate the return of a security is to utilize the market return index at the time of the event; therefore, it is unnecessary to use the estimation period in calculating the expected return because the return of a security is considered the same as market return index. Even though this model only requires a relatively small amount of data, the accuracy of this model is below the marker model.

In calculating expected return, the author will use the Market Model, one of the three statistics models proposed by (Tandelilin, 2010). The reason for this decision is, according to Brown and Warner (1985), the Market Model outperforms both model Mean Adjusted and Market Adjusted models under a wide variety of conditions. The market model is a highly flexible tool because it can be generalized to include richer models of benchmark returns, for example, by including industry and broad market returns. In addition, this model broadly represents the market circumstances by considering the presence of risk. Previous studies found by the author also prefer to use the Market model as it depicts the market condition while also considering the possible error of each security.

Volume Trading Activity

Trading Volume Activity (TVA) indicates a stock market response to new information happening in the stock market through movements in TVA. Information is valuable if the number of shares traded is more or less during the specific event period. This indicator can also measure whether the information released by the corporation or a country makes the individual investors sell or buy their shares. Unpredictable information can trigger stock movements that will influence the supply and demand of the shares (Suganda, 2019).

According to (Tandelilin, 2010), Trading Volume Activity (TVA) is the ratio between the number of shares traded by a company at a certain time to the number of outstanding shares of that company in the same observation period. TVA is calculated to identify the stock market reaction through changes in trading volume (Mahendra & Rasmini, 2019). A movement in the trading volume activity provides insight into the market's reaction to an event. A shift in trading volume activity before and after or during an event indicates a reaction from the market by comparing two periods of time.

Hypothesis Development

Several studies have discussed geopolitical events, such as boycotts, invasions, or sanctions, that can be used to help develop the hypothesis. Another study that discussed an event in the energy industry was also provided as this research was carried out about event study in the energy industry. (Wahyudi, et.al., 2018) The research examined the effect of domestic market obligation (DMO) regulation, which is KepMen ESDM Number 1410 K/30/MEM/2018, regarding the change of date in implementing the regulation from January 1st to March 12th, 2018. This research assessed listed coal supplier companies to the National Electricity Company (PLN) through an event study approach. Two indicators are used to identify the market response to this event, such as abnormal return and volume trading activity. (Amelya, 2022) research investigates the effect of the Russia-Ukraine invasion on Oil and Gas stocks in 7 countries. The authors sub-sampling oil exporters' countries by market capitalization to see how the market responded to the event's announcement. This research examined a total of 29 stocks of oil and gas from listed companies in over seven countries. The methodology used in this study is an Event Study to assess the significant differences in abnormal return and volume trading activity before and after the invasion. (Panjaitan, 2020) research is conducted to examine the market reactions of companies in crude palm oil-producing countries. The research chose listed agriculture companies in Indonesia and Malaysia. Abnormal return and trading volume activity are used as indicators to assess the market reaction. The event study approach is the methodology with ten days of observation day, five days prior, and five days after. A study

(Naidenova, 2018) this study aims to investigate the market reaction of USA sanctions to Russian public companies' stock prices. This research analyzes the stock price changes in Russian-listed companies of the MICEX index in response to sanctions against Russia during 2014- 2016. The methodology is based on an event study approach to examine the short-term response of the stock price to information release. The sanctions influenced financially dependent companies to a greater extent. A study (Kollias et al., 2011). This study analyzes the impacts of two terrorist incidents on the market equities sectors: the bomb attacks that occurred on March 11th, 2004, in Madrid and July 7th, 2005, in London. This study was carried out by an event study approach in assessing the abnormal return and GARCH model in volatility.

Previous research shows a mixed result in abnormal return; several events produce a significant difference in abnormal return, and others do not. However, it is suspected that the European Union coal embargo announcement on Russia has information that can influence the market as it is supported by the significant increase in coal import volume from South Africa to European Union from Q1 2022 to Q1 2023 compared to other coal exporter countries. The alternative country's market will probably benefit and react to the announcement. Since the announcement is assumed to influence the market, the first hypothesis would be testing the existence of a significant difference in abnormal returns. Therefore, the hypothesis that will be used is formulated as follows:

H0: There are no significant differences in abnormal returns before and after the announcement of the European Union Coal Embargo in the alternative country
H1: There are significant differences in abnormal returns before and after the announcement of the European Union Coal Embargo in alternative country

The findings from previous research show diverse results in trading volume activity. Though most events show no significant difference, the announcement is assumed to impact trading volume activity. This is due to the surge in coal supply from South Africa to European Union that might influence the investors to make a stock transaction by buying more in South African coal stocks. Therefore, the second hypothesis should test the significant difference that will be formulated as follows:

H0: There are no significant differences in trading volume activity before and after the announcement of the European Union Coal Embargo in the alternative country
H2: There are significant differences in trading volume activity before and after the announcement of the European Union Coal Embargo in the alternative country

C. METHODS

The author identifies the impact of the coal embargo announcement on the alternative country's stock market. This research design is established to achieve the objective of this research. The research design comprises several steps to be followed in conducting the analysis. This research will use data from the stock price and stock volume of listed coal companies in South Africa before and after the embargo announcement. Then calculate abnormal return and trading volume activity for stocks observed. The data analysis will first be presented by descriptive statistics from abnormal returns before and after the announcement, testing the data set's normality and hypothesis based on the normality of the data. Data sets that follow normal distribution will use Paired T-test, and those that are not will use Wilcoxon Signed Rank test.

The sample to be analyzed in this research is coal companies listed on Johannesburg Stock Exchange (JSE). The sample selection in this research was carried out using a purposive sampling method. In the purposive method, the sample was chosen based on the researcher's discretion using several criteria. The determined criteria are: 1) The company should be listed on Johannesburg Stock Exchange (JSE) before the event; and 2) The company's shares are actively traded before the event period.

After the criteria are applied, here are the selected coal company from South Africa that is set to be the sample:

Table 1: List of Companies That Meet Sample Criteria

No.	Company Name	Stock Code
1.	Exxaro Resources Limited	EXX.JO
2.	South32 Limited	S32.JO

No.	Company Name	Stock Code
3.	Sasol Limited	SOL.JO
4.	Anglo American plc	AGL.JO
5.	Glencore plc	GLN.JO
6.	MC Mining Limited	MCZ.JO
7.	Afrimat Limited	AFT.JO
8.	Wesizwe Platinum Limited	WEZ.JO
9.	African Rainbow Minerals Limited	ARI.JO
10.	Thunglea Resources	TGA.JO

Source: research data, 2023

This research is conducted using secondary data as the major sources, which contains the following data: 1) the information about the main event, European Union Coal Embargo in Russia, is collected from news articles, both national and international media (Reuters, Euronews, Africanews); 2) The daily prices of the stocks that are listed during the research period. This data is obtained from yahoo finance; 3) the trading volume of stocks listed during the window period. This data is collected from yahoo finance; 4) a number of shares outstanding of the listed stocks. This data is collected from Bloomberg and Refinitiv; and 5) JSE Financials Index. This data is collected from investing.com to calculate the shares of the South African market.

Event Study

In this study, the author uses an event study to assess the effect of information arrival on stock prices (Campbell et al., 2010). An event study, especially in the stock market field, is conducted empirically to examine if a specific event has or will impact a country's capital market. Event study gives a clear overview of how the market reacts to information and how much information can influence the movement of stock prices that form. This study aims to see the relationship between events and financial markets, allowing a better understanding of how information takes into the stock price and helps investors decide. Event studies can provide insights into market efficiency by analyzing the timing and magnitude of market reactions to specific events. This method helps assess the speed and accuracy of markets incorporating new information.

According to McWilliams & Siegel (1997), three assumptions construct the basic fundamental of event study, and the first assumption is market efficiency. Market efficiency suggests that stock prices reflect all pertinent information accessible to market participants. If this holds, then any financially significant information newly unveiled to investors will be swiftly integrated into stock prices. Therefore, an event refers to any occurrence that results in new information. Researchers can identify whether or not there are significant events by their influence on companies' stock prices.

The second assumption is an unanticipated event. This assumption is based on the notion that an event is publicly announced in the media. The market previously did not own any information on the event, and the investors gained the information from the announcement. Abnormal returns can be assumed to be the stock market's response to new information. However, it is also possible if the event has been anticipated or the information leaked to the market before the press announcement is released. If the event were anticipated in advance or leaked information existed before the formal press, the stock price would reflect this information.

The third assumption hinges on the claim that a researcher has successfully isolated the effect of a specific event from other events. This assumption is considered crucial in this methodology. It is presumed that no other events are confounding factors, meaning it does not interfere with the analysis. Confounding events can include several occurrences, for example, dividend declaration, merger and acquisition announcement, government contract, the introduction of new products, and change in the key executive. The longer the event window, the more challenging it becomes for researchers to assert that they have effectively controlled for confounding effects.

Research Period

Based on (MacKinlay, 1997), the primary task of conducting an event study involves determining the event of interest and identifying the period over which the stocks involved in specific events will be observed, known as the event window. This study's event is the European Union Coal Embargo

announcement in Russia. The selection of the event window is common to be larger than the period of interest. While there is no specific measurement to determine the event window, the time frame for the event is still based on the requirements of the study. In reality, the period of interest is often expanded to several days, including at least the day of the announcement and the following day after the announcement. A study has empirically evidenced that a short event window will usually depict the significant effect of an event (Ryngaert & Netter, 1990). Because it is much more difficult to control that there is no other event that will influence the impact of the event when the long window is used. The duration of the event window used for the event study typically starts from 3 to 121 days for the daily data, and the estimation period usually ranges from 100 to 300 days.
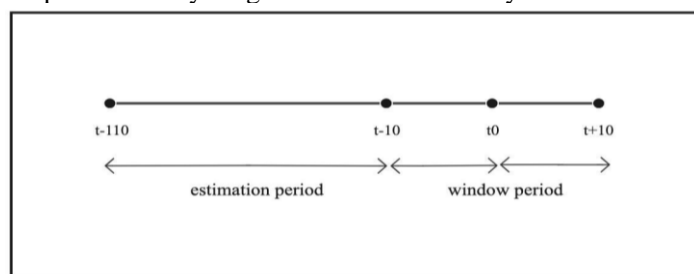
Figure 4: Research Period

In this study, the author selected 100 days before the window period as the estimation period that will be used to calculate the expected return in the market model. Meanwhile, the window period is established between -10 to +10 trading days to see the market reaction before and after the announcement. The reason behind this selection is that since the data observed in this study is the alternative country for coal import, the implication towards the stocks would take slightly more time; thus, the window period of 10 days before and after the event date should be sufficient to get a clear result of this event under study. Reuters reported the announcement of the European Union ban on Russian coal on April 8th, 2022. Thus, April 8th would be the event date or t0. The research period is split into the estimation period and the window period. This observation period is only included when the market is open, dates when the market is closed, such as public holidays and weekends, are excluded and continue to the next day of the open market.

Data Analysis
Calculating Abnormal Return
The calculation for abnormal return is conducted through the following formula:
$$AR_{i,t} = R_{i,t} - E(R_{i,t})$$

Equation 1

$AR_{i,t}$ = Abnormal return of stock i at period t
$R_{i,t}$ = Actual return of stock i at period d
$E(R_{i,t})$ = Expected return of stock i at period t

To get the actual return, the author uses daily stock price obtained from the secondary data and calculates it using:
$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

Equation 2

$R_{i,t}$ = Actual return of stock i at period t
$P_{i,t}$ = Price of stock i at period t
$P_{i,t-1}$ = Price of stock i at period t-1

As the expected return is a component of calculating abnormal return, the calculation of expected return using the market model is obtained as follows:

$$E(R_{i,t}) = \alpha_i + \beta_i(Rm_{i,t}) + \varepsilon_{i,t}$$

Equation 1

$E(R_{i,t})$ = Expected return of stock i at period t
α_i = Intercept of stock i
β_i = Slope coefficient, which is the beta of stock i
$(Rm_{i,t})$ = Market return of stock i at period t

After getting the actual and abnormal return data, the author can calculate the abnormal return to know whether or not a significant difference in abnormal return is found in this research to answer the research question. In addition, this research analyzes the significant difference before and after the announcement of the European Union embargo by calculating using Average Abnormal Return (AAR) before and after the event. The formula is stated below:

$$AAR_i \, before = \frac{\sum_{j=-10}^{t=-1} AR_{i,j} \, before}{N}$$

Equation 2

$$AAR_i \, after = \frac{\sum_{j=+1}^{t=+10} AR_{i,j} \, before}{N}$$

Equation 3

AAR_i = Average abnormal return of all shares
$AR_{i,j}$ = Abnormal return of stock i for event j
T = number of samples observed

Calculating Trading Volume Activity

The calculation of trading volume activity is provided in this research to see how the market responds from a stock volume traded perspective. (Charles P, 1986) proposed a formula to calculate the trading volume of shares as follows:

$$TVA_{i,t} = \frac{Shares \, of \, i \, traded \, at \, period \, t}{Number \, of \, Outstanding \, shares \, at \, period \, t}$$
Equation 6

To estimate the difference in stock volume traded before and after the event, Average Trading Volume Activity (ATVA) takes place using the following calculation:

$$ATVA_i \, before = \frac{\sum_{j=-10}^{t=-1} TVA_{i,j} \, before}{N}$$

Equation 4

$$ATVA_{i,} \, bafter = \frac{\sum_{j=+1}^{t=+10} TVA_{i,j} \, before}{N}$$

Equation 5

$ATVA_i$ = Average trading volume activity of all stocks
$TVA_{i,j}$ = Trading volume activity stock i for event j
N = number of samples observed

Conducting Statistical Analysis

Normality Test

In performing the statistical analysis, the normality test should be first calculated to determine the appropriate test for the next stage. The normality test conducted in this research is used to assess whether or not the data is normally distributed. A parametric test is more proper if the data follow the normal distribution. On the other hand, if the data does not follow the normal distribution, then a non-parametric test is more desirable to be carried out (Kim, 2015).

Taking into more deep understanding, there are several methods to check the normality of the data, such as the Shapiro-Wilk (SW) test, Lilliefors (LF) test, Kolmogorov-Smirnov (KS) test, and Anderson Darling (AD) test. This research uses the Shapiro-Wilk test because this method outperforms others and is more suitable for small-middle sample sizes (Razali & Wah, 2011). The notion of Shapiro-wilk is compared to a standard normal distribution with research data distribution using the significant level (α) of 5% (=0.05). If the research distribution, commonly called a p-value, is above the value of α (0.05), then the data is normally distributed. On the contrary, if the p-value is lower than the value of α, the data is not normally distributed.

Statistical Hypothesis Testing

The hypothesis for this research is to investigate the significant difference the European Union coal embargo announcement had in the period before and after the event, gauged by abnormal return and trading volume activity on coal companies listed in South Africa. In order to check the claim of the hypothesis developed in the previous chapter, this study performs a hypothesis testing analysis. In order to assess the significant difference before and after the embargo announcement, there are two types of statistical tests. First, a parametric test is more appropriate if the data is normally distributed. The parametric test for this data type can be calculated through Paired Sample T-test. This test analyzes whether two variables before and after the embargo differ significantly. The significance level of 5% is applied to calculate the hypothesis testing. The analysis of this test should pay attention to a null hypothesis of each variable, for abnormal return data:

H_0 = There is no significant differences in abnormal return before and after the announcement of the European Union coal embargo in the alternative country for trading volume activity data;

H_0 = There are no significant differences in trading volume activity before and after the European Union coal embargo announcement in the alternative country.

Then the result of the hypothesis testing should follow the following criteria:

If the p-value > 0.05, H0 should be accepted.

If p-value < 0.05, H0 should be rejected, and the alternative hypothesis should be accepted.

The second type of statistical test is a non-parametric test. This type of test takes place if the data observed does not meet the condition of normality required for a parametric test. The non-parametric test used in this study is the Wilcoxon Signed Rank Test. This test aims to check if there is a significant difference between two variables before and after the embargo announcement when the observed data is not normally distributed. Wilcoxon Signed Rank test compares two related samples or repeated measurements of a single sample to determine if there are differences in population rank. This may be done in order to identify whether or not there is a difference between the samples.

D. RESULTS AND DISCUSSION

The result shows that the mean of AAR before the embargo announcement is 0.003579, while the mean of AAR after the coal embargo is -0.000338. This demonstrates a response from the investors that tends to be negative because the mean decrease by 0.003917. This condition is supported by the graph in Figure 4, which shows that the AAR daily during the event period tends to decline after surging.

Table 4: AAR Before - After The Announcement

	Before Announcement Embargo	After Announcement Embargo
N	10	10
Min	-0.034534	-0.018821
Mean	0.003579	-0.000338
Max	0.022786	0.035459

The result shows that the mean of AAR before the embargo announcement is 0.003579, while the mean of AAR after the coal embargo is -0.000338. This demonstrates a response from the investors that tends to be negative because the mean decrease by 0.003917. This condition is supported by the graph in Figure 4, which shows that the AAR daily during the event period tends to decline after surging.
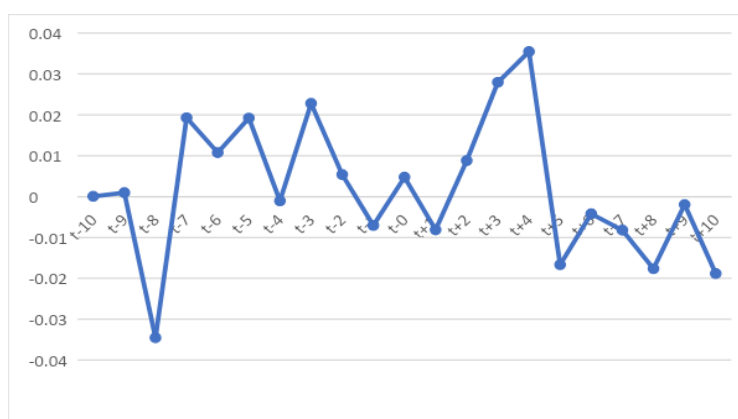
Figure 5: AAR Daily

The mean of ATVA before the embargo announcement is 0.003812, and the mean of ATVA after the embargo announcement is slightly lower, which is 0.002559. The decrease of 0.001253 after the embargo announcement shows a negative reaction from the investors. Movements of the increase can be seen from the daily data in Figure 5, which showcase the mean of ATVA during the event window period; showcasing the mean after the embargo announcement tends to have a negative reaction compared to the mean after the announcement embargo.

Table 5: ATVA before - after the announcement

	Before Announcement Embargo	After Announcement Embargo
N	10	10
Min	0.002099	0.001779
Mean	0.003812	0.002559
Max	0.013279	0.003844

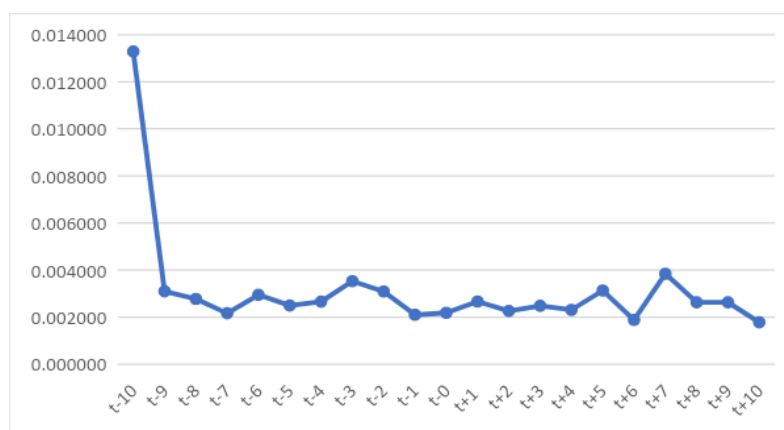**Figure 6: ATVA Daily**

Abnormal Return

Normality Test

Based on the author's SPSS test, the p-value of the Average Abnormal Return (AAR) from the Shapiro-Wilk Test is showcased in Table 8. The normality of the data is determined by the p-value (presented by Sig.); if the p-value < 0.05, the data does not follow the normal distribution, and if the p-value > 0.05, the data follow the normal distribution. The p-value of the AAR before the embargo announcement is 0.301, and since the value is more than 0.05; thus the AAR before the announcement is normally distributed. The p-value of the AAR after the announcement is 0.001, which indicates that the data is also not normally distributed. Since one of the data is not normally distributed, the author will use the Wilcoxon Signed Rank Test to assess the statistical hypothesis test in the next step.

Table 6: Normality result for AAR

	Statistics	df	Sig.
Average Abnormal Return Before	0.913	10	0.301
Average Abnormal Return After	0.71	10	0.001

Hypothesis Testing

The result of the Wilcoxon Signed Rank Test is shown in Table 10; it can be concluded that the *p-value* (shown by Asymp. Sig. 2-tailed) of AAR before and after the announcement produces a value of 0.285, meaning that the p-value is more than 0.05. Based on the hypothesis developed, if the p-value > 0.05, H0 is failed to be rejected. The result indicates that there is no significant difference between the average abnormal return before the announcement and the average abnormal return after the announcement.

Table 7: Hypothesis test for AAR

Test Statistics[b]

	AAR Before - AAR After
Z	-1.070[b]
Asymp. Sig. (2-tailed)	0.285

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks

Trading Volume Activity

Normality Test

According to Table, it can be seen that the *p-value* of Average Trading Volume Activity (ATVA) before the announcement is 0.000, while the *p-value* after the announcement produces a value of 0.004 as both ATVA before and after the embargo announcement shows the results of p-value < 00.05, thus the two data are not normally distributed. The normality test results for ATVA in two countries show that both data are not normally distributed, and the appropriate statistical hypothesis test will be analyzed using Wilcoxon Signed Rank Test.

Table 8: Normality test for ATVA

	Statistics	df	Sig.
Average Trading Volume Activity Before	0.471	10	0.000
Average Trading Volume Activity After	0.757	10	0.004

Hypothesis Testing

The Wilcoxon Signed Rank Test findings are shown in Table 15; the p-value of ATVA before and after the announcement (shown by Asymp. Sig. 2-tailed) gives a value of 0.721. This indicates that the p-value > 0.05 resulting in H0 failed to be rejected; thus, the average trading volume activity before the announcement and average trading volume activity after the announcement does not differ significantly from each other.

Table 9: Hypothesis test for ATVA

Test Statistics^b

	AAR Before – AAR After
Z	-0.561^b
Asymp. Sig. (2-tailed)	0.575

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks

Discussion

After analyzing the descriptive data, the researcher conducted the normality test using the Shapiro-Wilk and statistical tests to examine the hypothesis proposed, which rejected or not the null hypothesis. The findings will be presented as follows :

Table 10: Statistical hypothesis result

Variable	Type of Test	P value	Hypothesis test	Findings
AAR	Wilcoxon Signed Rank Test	0.285	Failed to reject the null hypothesis	No significant difference
ATVA	Wilcoxon Signed Rank Test	0.575	Failed to reject the null hypothesis	No significant difference

According to the result in Table 10, it can be concluded that the average abnormal return before and after the announcement of the embargo in South Africa produces a p-value of 0.285, which indicates that the value is more than the significance level of 0.05. This results in H0 failing to be rejected, which means there is no significant difference between 10 days before and ten days after the embargo announcement. It follows South Africa a weak form efficient market, which is when the information is released, the market is weak form does not immediately give a reaction. Therefore, it is safe to say that the announcement of the European Union coal embargo does not affect the coal market in South Africa.

This result is in line with the study conducted by Amelya (2022), which shows that Russia Ukraine Invasion of Oil and Gas stocks gave no significant difference in abnormal returns because the issue regarding the announcement had been circulating before the official announcement was published. However, geopolitical events can still produce a significant difference if the event can not be predicted in advance, as proven in a study conducted by Naidenove (2018), which provided an abnormal return after US sanctions against Russia. This result might be caused by the fact that the USA initiated the imposition

of sanctions, making their sanctions precede sanctions of other countries. Therefore, the event was unexpected news to investors in the targeted country. Another study conducted by Kollias et al. (2011) shows that terrorism, such as bombs, gives a significant difference in abnormal returns because the event can not be predicted in the future.

Based on Table 10, a significant difference in average trading volume activity before and after the embargo announcement has not been found in the South African market as it produces a p-value (0.575) greater than 0.05. This indicates that the embargo announcement is no longer relevant to investors, so it does not make investors conduct transactions in coal sector stocks. The absence of significant difference in trading volume activity indicates that the investor in a country with weak efficient form does not react immediately when transacting in their stocks.

This aligned with the research by (Wahyudi et al., 2018), which investigated no significant difference in trading volume activity before and after the government regulation on coal subsector stocks. This can happen because the regulation does not affect the companies' financial performance; thus, it does not influence investors to make trading transactions. However, such events still allowed significant differences in trading volume activity, proven by Amelya (2022), that found a significant difference in trading volume activity after the Russia-Ukraine invasion. This is because investors perceive that Russia is the third largest oil supplier in the world, and when this event took place and affected the oil supply, the event made the investors conduct transactions.

In conclusion, both indicators that examined the market reaction in the alternative country had a similar result; no significant difference was found in the South African market. These findings may happen probably been because the European Union, who proposed the embargo, had first anticipated and made the action before the announcement as the monthly coal import volume of the European Union can see it. The data from Refinitiv shows that from October 2021 until Mar 2022 European Union had already raised its import volume before the official announcement released in April 2022. This hinders the high price after announcing the coal ban on Russia's coal. Secondly, the insignificant difference might happen because news spreads before the press release announcement of the fifth sanctions. According to the statement by Von Der Leyen, president of the European Commission, through the press release on March 15th, the fourth sanctions package against Russia emphasizes the agreement to propose a far-reaching ban across Russia's energy sector (ec.europe.eu). However, this is still unclear which commodity will be banned for the next sanctions since Russia's energy sector exports include oil, coal, and natural gas.

E. CONCLUSIONS

This research is motivated by the announcement European of Union coal embargo on Russia on April 8th, when the EU Commission announced the press release publicly. As Russia, which accounted for 45% of total European Union coal import, is banned from coal import activities, European countries tend to find other coal exporting countries to meet their local demand for coal. This caused coal supplier countries, besides Russia, to increase their export volume to the European Union. Out of them, South Africa became the most substantial country to increase their supply volume, which surged by 564.7%. The massive increase in import volume indicates that South Africa is the alternative European Union country after the coal embargo was announced. Therefore, the author questioned how the market would react to stocks in the country that are being the alternative country, South Africa.

Based on the result from the analysis, it can be concluded that there is no significant influence on abnormal return and trading volume activity before and after the European Union coal embargo announcement in alternative countries. Thus, the first and second hypotheses of this research should be rejected. This finding indicates that the investors probably had predicted the event due to pre-caution actions from European Union before the official announcement since the European countries had raised the coal import from other exporting countries months before the announcement. Therefore, the market did not react when the official announcement was published. Another reason that might happen is that the alternative country market might already get the signal by the increase of coal export to Europe, so they probably already conducted the stock transaction before the official announcement by EU Commissioner published. It is also possible for investors to make the stock transaction after the fourth sanctions are

announced, as it signals future restrictions on energy sectors. Finally, the European Union coal embargo announcement on coal import from Russia does not affect the alternative country in the stock market.

Following the result of this research which validates that there is no market reaction to the European Union coal embargo in other exporting countries, it is safe to say that if an embargoed event might happen in the future, the impact will not happen for the alternative producing countries during the official announcement. This happens because the country that proposed the sanctions may anticipate increasing their import volume from other exporting countries before the announcement is disclosed to the public, so high prices might be hindered.

Based on the result of this research, the author gives some recommendations to investors and future researchers, as follows: 1) The investors will not obtain any abnormal returns from a predictable event. Therefore, the investors will only gain abnormal returns if the event is unpredictable. Investors are also suggested to be more careful and actively find the information before the next event; also, it is important to know how the geopolitical information spreads as it helps make investment decisions; and 2) The researcher suggests that future researchers conduct the test around the date of the fourth sanctions announced since there is a signal for potential energy sector restriction in the future. Other than that, future researchers can also check whether it is valid that the European Union had prepared to increase volume before the official announcement; thus, they sought other supplier countries prior to the event.

REFERENCES

Alwi, Z. I., 2008. *Pasar Modal: Teori dan Aplikasi.* Jakarta: Nasindo Internusa.

Amelya, R., 2022. The Impact of Russia-Ukraine Invasion on Oil and Gas Stocks in 7 Countries by Using Event Study Approach. *International Journal of Advanced Research in Economics and Finance,* 4(3).

Biglaiser, G. & Lektzian, D., 2020. The effects of economic sanctions on targeted countries' stock markets. *International Interactions,* 46(4).

Brown, S. J. & Warner, J. B., 1985. Using Daily Stock Returns: The Case Study. *Journal of Financial Economics,* Volume 14, pp. 3 -31.

Campbell, C. J., Cowan, A. & Salotti, V., 2010. Multi-country event-study methods. *Journal of Banking & Finance,* 34(12).

ec. europa.eu, 2022. *Ukraine: EU agrees fourth package of restrictive measures against Russia.* [Online] Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1761 [Accessed 5 6 2023].

ec.europe.eu, 2022. *Ukraine: EU agrees the fifth package of restrictive measures against Russia.* [Online] Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2332 [Accessed June 4th 2023].

Fama, E. F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance,* 25(2).

Fama, E. F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal of Finance,* 25(2), pp. 383 - 417.

furtherafrica, 2022. *EU importing more South African coal as Russian ban looms.* [Online] Available at: https://furtherafrica.com/2022/08/23/eu-importing-more-south-african-coal-as-russian-ban-looms/ [Accessed 7 6 2023].

Gitman, L. J. & Zutter, C. J., 2014. *Principle of Managerial Finance.* 14th ed ed. s.l.:Pearson.

Hadityo, 2022. The Effect of Domestic Market Obligation (DMO) Policy on Assurance of Domestic Energy Supply Requirements for Power Generating and National Coal Using Industry. *Budapest International Research and Critics Institute-Journal,* 5(3).

hellenicshippingnews.com, 2022. *EU: 40 Million Tons of Coal Will Need to Be Sourced from Elsewhere After Ban on Russian Coal.* [Online] Available at: https://www.hellenicshippingnews.com/eu-40-million-tons-of-coal-will-need-to-be-sourced-from-elsewhere-after-ban-on-russian-coal/ [Accessed 4 6 2023].

hellenicshippingnews.com, 2022. *EU: 40 Million Tons of Coal Will Need to Be Sourced from Elsewhere After Ban on Russian Coal.* [Online] Available at: https://www.hellenicshippingnews.com/eu-40-million-tons-of-coal-will-need-to-be-sourced-from-elsewhere-after-ban-on-russian-coal/ [Accessed 4 6 2023].

hellenicshippingnews.com, 2023. *EU The Fifth Largest Importer of Coal, as Flows Up Again During First Quarter of 2023.* [Online] Available at: https://www.hellenicshippingnews.com/eu-the-fifth-largest-importer-of-coal-as-flows-up-again-during-first-quarter-of-2023/ [Accessed 25 4 2023].

Heymans, A., 2018. How efficient is the Johannesburg Stock Exchange really?. *South African Journal of Economic and Management Sciences (SAJEMS),* 21(1).

Izzeldin, M. et al., 2023. The impact of the Russian-Ukrainian war on global financial markets. *International Review of Financial Analysis,* Volume 87.

Jogiyanto, H., 2003. *Teori Portofolio dan Analisis Investasi.* 3rd ed ed. Yogyakarta: Badan Penerbit Fakultas Ekonomi Universitas Gadjah Mada.

Kim, T. K., 2015. T test as a parametric statistic. *Korean J Anesthesiol,* 68(6).

Kollias, C., Papadamou, S. and Stagiannis, A. (2011). Terrorism and capital markets: The effects of the Madrid and London bomb attacks. *International Review of Economics & Finance*, 20(4), pp.532–541. doi:10.1016/j.iref.2010.09.004.

Levy, H., 1996. *Introduction to investments.* [Online] Available at: https://archive.org/details/introductiontoi00levy/page/n5/mode/2up [Accessed 26 5 2023].

MacKinlay, A. C., 1997. Event Studies in Economics and Finance. *Journal of Economic Literature,* 35(1).

Mahendra, I. K. R. & Rasmini, N. K., 2019. Reaksi Pasar Terhadap Kenaikan Bank Indonesia 7-Day Reverse Repo Rate Tanggal 15 Agustus 2018. *E-Jurnal Akuntansi Universitas Udayan,* 27(3).

Markowitz, H., 1952. Portfolio Selection.. *Journal of Finance,* 7(1), p. 77.

McWilliams, A. & Siegel, D., 1997. Event Studies in Management Research: Theoretical and Empirical Issues. *The Academy of Management Journal,* 40(3).

Mulya, R. T. & Ritonga, K., 2017. Pengaruh Reaksi Pasar Modal Terhadap Peristiwa Aksi Damai 4 November 2016 (Event Studi pada Saham Kompas 100 Yang Terdaftar Di Bursa Efek Indonesia). *Jurnal Tepak Manajemen Bisnis,* IX(3).

Naidenova, J., 2018. The Reaction of Russian Public Companies' Stock Prices to Sanctions Against Russia. *Journal of Corporate Finance Research,* 12(3).

Pandey, A., 2022. *Can the EU survive without Russian coal?* [Online] Available at: https://www.dw.com/en/how-can-the-eu-survive-without-russian-coal/a-61379128 [Accessed 2 6 2023].

Panjaitan, A. T. G., 2020. Pengaruh Kebijakan Boikot Minyak Kelapa Sawit Oleh Uni Eropa Terhadap Perusahaan Penghasil Minyak Kelapa Sawit Yang Terdaftar Di Bursa Efek Indonesia Dan Malaysia.

Pratiwi , K. R. D. I. & Wirakusuma, I. G. M., 2018. Reaksi Pasar Modal Indonesia Atas Pengumuman Kenaikan Tingkat Suku Bunga Acuan Oleh Fed di AS. *E-Jurnal Akuntansi Universitas Udayana,* 25(3), pp. 1966-1993.

Razali, N. M. & Wah, Y. B., 2011. *Journal of Statistical Modeling and Analytics,* 2(1).

Reuters, 2022. *Europe imports more South African coal as Russian ban looms.* [Online] Available at: https://www.reuters.com/markets/commodities/europe-imports-more-south-african-coal-russian-ban-looms-2022-06-15/ [Accessed 2 6 2023].

Ryngaert, M. & Netter , J., 1990. Shareholder Wealth Effects of the 1986 Ohio Antitakeover Law Revisited: Its Real Effects. *Journal of Law, Economics, & Organization,* 6(1).

Skvarciancy, V., Jureviciene, D. & Vidziunaite, S., 2020. The Impact of Russia's Import Embargo on the EU Countries' Exports. *Economies,* 8(3).

Suganda, R. 2019. *Event Study Teori dan Pembahasan Reaksi Pasar Modal Indonesia.* s.l.:Seribu Bintang.

Tandelilin, Eduardus. (2010). *Portfolio and Investment, Theory and Application.* First Edition. Yogyakarta: Kanisius.

Wardoyo, P., 2012. *Pasar Modal.* s.l.:Semarang University Press.

Yasa, G. E. & Sari, M. M. S., 2020. Analysis of Market Reaction on Wall Street Attenuation in Indonesia. *American Journal of Humanities and Social Sciences Research (AJHSSR),* 4(8).

ZAWYA, 2022. *South Africa's coal exports to Europe surge amid Russia-Ukraine war.* [Online] Available at: https://www.zawya.com/en/business/energy/south-africas-coal-exports-to-europe-surge-amid-russia-ukraine-war-ehhudct1 [Accessed 6 6 2023].