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The Impact of ESG Rating on Stock Price Volatility (Evidence from COVID-19 and Russia-Ukraine Conflict)

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ABSTRACT:
The prevalent effects of a financial market crisis are instability and increased stock price fluctuations. COVID-19 and the conflict between Russia and Ukraine are two recent crises that have affected the global economy and consequently hit the stock market. During these turbulent periods, financial activists strive to discover ways to mitigate the unsteadiness in the market. One factor that aggravates stock price fluctuations in crisis is individual firms' lack of transparency in disclosure. Financial market activists react violently to minor market changes when companies do not disclose enough information, exacerbating volatility.

ESG indicators, which serve as benchmarks to demonstrate companies' responsibility towards the environment and society, can potentially influence stock price volatility. A higher ESG score can indicate the transparency of an economic enterprise and its ability to provide more information. Consequently, such companies are perceived as healthy and less risky, potentially reducing price volatility. Moreover, companies that have invested more in ESG initiatives tend to gain more popularity and reputation. This increased goodwill can shield them from negative news, leading to more stability after a shock.

This study aims to investigate the role of ESG in maintaining firms' stability in the financial market during periods of turmoil. It specifically examines the impact of ESG on stock price volatility during two recent crises: COVID-19 and the Russia-Ukraine conflict. The study includes a comprehensive analysis of 3,240 European firms during the COVID-19 crisis and 3,466 European companies during the Russia-Ukraine conflict. The research employs the OLS regression and Difference-In-Difference model to investigate the relationship between ESG and stock price volatility. The companies are categorized based on ESG scores and divided into ten equal groups for the Difference-In-Difference model. The study focuses on the groups with strong and weak ESG scores to understand the impact of ESG on these two groups before and after the crisis.

The OLS regression results during both crisis periods reveal a statistically significant negative relationship between ESG and stock price volatility. The study's results indicate that companies with better ESG scores have lower stock price volatility in both crises. The Difference-In-Difference model results also show that stock price volatility is generally lower for the strong ESG score group than for the weak ESG score group before and after the shock. This study confirms that stock price volatility increased after the shock of COVID-19 and the conflict between Russia and Ukraine. However, companies with strong ESG scores show more resilience, and their price fluctuation increases less after the shock than companies with weak ESG scores.

KEYWORDS: Crisis, COVID-19, Russia-Ukraine Conflict, ESG, Volatility, OLS, Difference-In-Difference, resilience

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1 Introduction

Global warming, climate change, war, epidemics, poverty, economic and social inequality, etc., pose threats to humanity's and the planet's future. Therefore, humanity seeks avenues to alleviate environmental and societal risks, further evidenced in its investments. Investors consider themselves responsible to others and the world and opt for responsible investments. They strive to allocate funds to places with less environmental and societal risk and contribute to a more sustainable world.

On the other hand, companies rely on investor capital to continue their activities. They attempt to attract more investors to increase efficiency and value. Companies can present a better image by using renewable resources, avoiding environmental and social harm, and promoting social and economic equality. This will create more trust and reassure investors that they support eco-friendly projects through their investment.

ESG indicators serve as benchmarks for corporate conduct towards the environment and society. Ranking companies in ESG criteria shows how responsible they are towards their surroundings and helps investors avoid allocating funds to assets that pose a risk to society and the environment. Therefore, companies can achieve higher popularity and capital by improving their ESG rating.

Since ESG investment is commonly known as a sustainable long-term investment, it has captivated the attention of investors (Mehr et al., 2020). The popularity of ESG has also increased among companies, as a higher ESG rating can help them achieve more credibility among their respective industries (Olsen et al., 2021). The widespread adoption of ESG ratings by both investors and companies has made analysts and researchers study the relationship between ESG and company performance (Heinkel et al., 2001; Yu & Xiao, 2022; Aydogmus et al., 2022; Giese et al., 2019). They delve into identifying if a better ESG ranking also brought companies higher returns. Several studies have also examined the relationship between ESG and corporate risk in terms of whether better ESG ratings

enable companies to manage risk (Kumar et al., 2016; Li et al., 2022; Feng et al., 2022; Jo & Na, 2012; He et al., 2023).

If ESG has a positive effect on the company's performance (see Nguyen et al. (2022)) or if it can help identify low-risk investments (e.g., Li et al. (2022)), then it can be used during a crisis when the risk of investment is higher and garnering investors' trust plays a more critical role in attracting capital (Lins et al., 2017).

Financial crises have existed for centuries, and Business has seen many crises in different periods, from the Great Depression (1929–1939) to the Asian financial crisis (1997-1998) and then the global financial crisis (2008-2009). After globalization, access to the global financial market increased, making markets more vulnerable to each other's events and crises. (Islam, 2019).

In December 2019, a contagious virus was detected in Wuhan, China, and quickly spread worldwide. To deal with the epidemic, many countries implemented quarantine laws. Many borders were closed, and disruptions in the transportation of goods and services hampered economic activities at the national and international levels.

All these restrictions and rules caused changes in the level of consumption of many goods and services, or in other words, the level of supply and demand changed. The price of gold rose, oil fell (Bora & Basistha, 2021), and the risk of global financial markets increased sharply (Zhang et al., 2020). Ramelli and Wagner (2020) considered February 24, 2020, the first day after the lockdown in northern Italy, as the most challenging period for some stock markets since the 2008 financial crisis. Therefore, this virus threatened human health, the economy, and the financial markets.

Uncertainty, which had not wholly dissipated after COVID-19, was exacerbated by Russia's invasion of Ukraine, leading to escalating energy costs, inflation, and unstable

economic circumstances. This military attack also affected the stock market, and stock price volatility increased (Wu et al., 2023).

COVID-19 and the war between Russia and Ukraine have resemblances and disparities with the financial crisis of 2008. One of these disparities is the origin of their formation. While the origin of the financial crisis of 2008 was subprime mortgages (Jebabli et al., 2022), the COVID-19 crisis was rooted in a virus and public health, and the war between Russia and Ukraine arose from geopolitical conflicts between the two countries (Ahmed et al.,2023). Nonetheless, all these crises resulted in economic downturns and instability in the financial market (Jebabli et al., 2022; Ahmed et al.,2023). The 2008 financial crisis began when the US economy suffered several foundational challenges (Li et al., 2022); the war between Russia and Ukraine happened when the global economy had not fully recovered from the consequences of the COVID-19 pandemic. However, among these three crises, COVID-19 was the only one that shocked the world (Li et al., 2022).

COVID-19 disrupted the balance of supply and demand via quarantines and social distancing and affected the economy and financial market (IMF, 2022; Gunay and Can, 2022). However, the war between Russia and Ukraine affected the economy and financial market through sanctions on Russia, one of Europe's leading oil and gas suppliers, increasing the cost of borrowing and vulnerability to capital outflows (Ahmed et al.,2023; International Monetary Fund, 2022).

One expected consequence of the abovementioned crises was instability in the financial market or increased stock price fluctuations. The International Monetary Fund's reports (2003) have shown that stock price volatility increases during times of turmoil.

While Bloom (2009) considers the uncertainty of investors and policymakers as the reason for the increase in stock price fluctuations after political and economic shocks, according to the reports of the International Monetary Fund (2003), worries about illiquidity and failure of financial markets, weak market infrastructure, and lack of solid risk

management are the factors that aggravate stock price volatility. The other factor that aggravates stock price fluctuations is individual firms' lack of transparency in disclosure (IMF, 2003). Financial market activists react violently to minor market changes when companies do not disclose enough information, exacerbating volatility (International Monetary Fund, 2003). Indeed, investors are unsure about the rates and long-term economic growth during the crisis. Thus, they buy and sell on the slightest news, aggravating the volatility (International Monetary Fund, 2003).

However, not all crises have the same impact on the fluctuation of stock prices. Huang et al. (2011) believe that the impact of financial and political crises on stock prices is different. According to them, financial crises such as the Asian financial crisis affect the profitability of companies so that they can have a more significant impact on stock prices. Conversely, political crises do not fundamentally reduce the company's profitability; investors' emotional selling decisions affect the stock price (Huang et al., 2011). Therefore, the impact of political crises on stock prices is less, and they are usually considered fleeting (Huang et al., 2011).

Talbi et al.'s (2022) point of view is somehow different. They argue that wars and political crises create negative attitudes in investors toward financial markets and make them less risk-averse, which leads to their emotional reactions and causes stock prices to fluctuate wildly. For instance, according to Rigobon and Sack (2005), the 2003 Iraq invasion of US financial markets considerably decreased stock prices and treasury rates.

As stated earlier, price fluctuations are more severe during the crisis. Thus, knowing the factors affecting stock price fluctuations during these situations becomes more critical, and the significance of a secure market is manifested more during the crisis periods (Lins et al., 2017). Consequently, investors will look for more stable stocks during the crisis period. Companies also strive to reduce the volatility of their stock prices and increase the investor's trust.

ESG is one of the factors that can affect price volatility, and its effect is through various channels. First, a higher ESG score can indicate the transparency of that economic enterprise. A transparent company provides more information (Gelb & Strawser, 2001) and is considered healthy and less risky (Bae et al., 2021); therefore, it should have less price volatility. Also, companies that have invested more in ESG gain more popularity and reputation (Lai et al., 2010). Thus, negative news affects them less (Bae et al., 2021) and makes them more stable during shock.

From the perspective of Friedman (1970), investing in ESG factors can increase the costs of an economic enterprise and increase the credit risk of companies (Abdul Razak et al., 2023). An increase in the credit risk of companies causes more uncertainty among investors about that company's financial health and enhances the volatility of the company's stock price. As companies with better ESG scores have more ESG investment, companies with better ratings can show higher stock price volatility.

1.1 Purpose of Study

The previous part explained that crises are inevitable, and one expected consequence of that is increased stock price volatility. Thus, identifying the factors that mitigate the outcome of crises can be advantageous. Furthermore, ESG was recommended as a potential fundamental element. Thus, this study aims to investigate the linkage between ESG and price variability during the crisis.

Understanding the significance of ESG in the European financial market is even more important because the European Union is striving to achieve its Green Deal objectives. It decided to be the first climate-neutral continent and reduce net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels (European Commission, 2023). Furthermore, European countries are the leaders in measuring sustainability (European Commission, 2023) and are more aware of ESG issues (Ho et al., 2012). Therefore, the data related to the sustainability of European countries is more available

and precise, and the study results can be more accurate and reliable. Moreover, if it can be shown that ESG has a positive impact on firm performance and a negative effect on investment risk, more investors and corporations would consider ESG when making investment decisions and cooperating to reach the EU's targets.

The other reason for choosing Europe for investigation is that most studies conducted in European stock markets cover the impact of ESG on firm value and stock return. However, this study investigates the relationship between ESG scores and stock price volatility, which was less focused on before.

Additionally, COVID-19 affected the European stock markets like other financial markets worldwide. Also, According to the European Commission (2023), Russia was one of the major trading partners of the European Union, and 5.8% of the EU's total trade in 2021 was with Russia. Therefore, the war between Russia and Ukraine might affect Europe more than other parts of the world. Since these two crises were two significant events that affected the European stock markets, this study specifically examines the relationship between companies' ESG scores and their stock price volatility during these two recent crises.

This study aims to determine whether companies' ESG scores help them mitigate stock price fluctuations during these critical periods and whether companies with better ESG scores are more stable in the presence of stock market shocks.

1.2 Hypothesis

Stock price volatility, which is one crucial parameter that increases during turmoil and aggravates the instability in the financial market, can be used as a criterion to indicate stock risk (Handayani, 2019). This part postulates ESG as an advantageous element that may fetch some market resilience. Thus, Based on what has been noted so far, the research hypotheses are as follows:

H1: Companies with higher ESG scores had lower price volatility during COVID-19.

H2: Companies with higher ESG scores had lower price volatility during Russia's invasion of Ukraine.

H3: After the COVID-19 shock, stock price volatility showed a lesser increase in companies with strong ESG scores than in companies with weak ESG scores.

H4: After the Russia-Ukraine conflict, stock price volatility showed a lesser increase in companies with strong ESG scores than in companies with weak ESG scores.

2 Environmental, Social, and Governance (ESG)

This chapter explains the concept of ESG and its regulation. First, it mentions the path ESG took to become its current form. Then, it provides a definition and discusses some European regulations related to it.

2.1 The Evolution of ESG

Initially, religions such as Judaism, Christianity, and Islam directed the morals and investment ethics to their adherents (Renneboog et al., 2008). According to Renneboog et al. (2008), Judaism taught people how to spend their money ethically. The Catholic Church banned usurious practices, and the British Methodist Church required people not to invest in alcohol, tobacco, gambling, and gun companies (Renneboog et al., 2008). Islam also forbade Muslims from investing in companies that produce pork, pornography, and gambling (Renneboog et al., 2008).

Over time, the gravity of responsible investment intensified and manifested in companies' reports about their employees and society (Unerman et al., 2007). Responsible investment primarily considers security and justice for people, employees, and society (Unerman et al., 2007). For instance, from 1901 to 1980, companies reported the services they provided to their employees (Hogner, 1982). These services included housing, health, safety, and support loans (Hogner, 1982).

In the years after World War I, Americans took the lead in advancing their social policies and held themselves responsible for their employees' welfare, safety, and security (Cristina& Zalles, 2021). After World War II, they continued until the issue expanded and became global (Cristina& Zalles, 2021).

Bebbington et al. (2014) refer to the CSR (Corporate Social Responsibility) and SD charts drawn by the media in the OECD region from 1961 to 2001 and articulate that the interest in considering social factors depends on its type during these years and in some cases, increasing and in others decreasing (Bebbington et al., 2014).

Subsequently, the importance of the environment in responsible investing was introduced. In the late 1980s and early 1990s, several companies commenced to report on their environmental activities; for example, Noranda in Canada and Norse Hyder in Norway set environmental standards for themselves in the early 1990s (Bebbington et al., 2014). Over time, severe climate change, global warming, deforestation, and marine casualties caused by plastic pollution demonstrated that environmental damage threatens future generations, and taking action to slow down and eliminate these damages is necessary (Cristina& Zalles, 2021). After that, disclosing some information about the effect of companies on the environment and compliance with environmental standards became obligatory; for example, Canadian securities Administrators forced a list of companies to disclose their environmental information (Bebbington et al., 2014).

In 2004, Eighteen financial institutions with assets of more than 6 trillion US dollars from 9 countries were invited by Kofi Annan, the Secretary-General of the United Nations, to cooperate in a joint initiative with the UN Global Compact to expand financial institutions' consciousness towards the environment, society, and corporate governance (UN, 2004). The result of this joint initiative was included in a report titled "Who Cares Wins," and the participants confirmed that by globalization and increasing interrelationships worldwide, companies that care about social, environmental, and governance issues improve their reputation and popularity, win the competition, and help develop the society in which they are settled. (UN, 2004).

After the 2008 financial crisis, the financial markets were no longer safe for investors. Therefore, the regulators enacted laws to increase security, justice, transparency, and efficiency in the financial markets (Lykkesfeldt& Kjaergaard, 2022). The European Union

was the leader in establishing such rules; with time, these rules became more complete and are known as ESG standards (Lykkesfeldt& Kjaergaard, 2022). From early January 2022, major EU institutional investors and early January 2023 companies were required to report their ESG functioning (Lykkesfeldt& Kjaergaard, 2022).

2.2 ESG Performance

ESG scores indicate a company's accountability toward the environment and society, and they are measured in various ways. If companies reduce their detrimental effects on the environment, shrink the utilization of non-renewable resources, improve their behavior towards employees and society, establish good corporate governance, and consider the rights of stakeholders, they can enhance their ESG rating (Ribando & Bonne, 2010).

2.2.1 Environmental Aspect

Issues such as global warming, deforestation, and environmental pollution, including water and air pollution, threaten the limited resources available on the planet. Therefore, these matters have gained greater focus in recent years. They have driven humans to take measures to protect their limited resources from rapid destruction. One of these actions is measuring companies' footprint on the environment.

The value that companies impute for environmental issues such as climate change, deforestation, air and water pollution, land exploitation, biodiversity loss, energy efficiency, greenhouse gas emissions, waste, water, resource management, and other issues related to the ecosystem determines their score on the environmental part of ESG (Billio et al., 2021).

Garel and Petit-Romec (2021) perceive the environmental aspect of ESG as instrumental in improving stock return. They denoted that companies that believed in the threat of

global warming had environmental concerns and acted responsibly towards the environment had higher returns during the COVID-19 crisis (Garel & Petit-Romec, 2021).

2.2.2 Social Aspect

The social factor measures how much firms care for employees, vendors and suppliers, customers, partners, and society and how much they are accountable to them (Cristina & Zalles, 2021). According to the social aspect, the company must have gender diversity when hiring employees and reduce gender inequality in its employment environment. It must comply with human rights, improve workplace standards for its employees, pay attention to its staff's mental and physical health, and attempt to increase employee satisfaction (Billio et al., 2021).

From Edman's (2011) point of view, higher employee satisfaction is associated with higher long-term stock returns in American companies. His results align with human relations theories, which believe that the performance of companies with higher employee satisfaction is more robust because their employees have higher motivation (Edmans, 2011).

The study by Sassen et al. (2016) also confirmed the importance of the social aspect of ESG. They evaluated the impact of social performance by examining the company's relationship with stakeholders, customers, workers, and society as a whole and showed that social performance reduces total, systematic, and idiosyncratic risk (Sassen et al., 2016)

If there were no investors, consumers, workers, and society in general, the existence of firms would be meaningless by itself; in fact, the existence of firms depends on the existence of society around them and the people (Bem et al., 2022). Therefore, companies need to satisfy the demands of their stakeholders to protect their prospects, which is achieved by considering social factors.

Paying attention to investors' demands increases the company's market return and decreases risk and cost of capital (Bem et al., 2022). Meeting the needs of customers enhances their loyalty and extends market share. It also causes product diversification and creates brand equity (Malik, 2014). When a company cares about its employees and their welfare, job satisfaction increases, employee morale is strengthened, and labor productivity increases. Therefore, all these benefits are a testament to the importance of social factors for economic enterprises (Malik, 2014).

2.2.3 Governance Aspect

In the governance aspect of ESG, matters such as the board of director's independence, the rights of shareholders, managers' compensation, and companies' adherence to the law are measured (Billio et al., 2021).

In large organizations, capital owners and management are almost entirely separated (Sarkis et al., 2016). Maximizing profits is not the most crucial goal of these organizations; satisfying people and customers or the popularity and reputation of the organization is much more critical (Sarkis et al., 2016). Therefore, corporate governance was formed to show that companies work for their customers' interests and consider the interests of shareholders (Sarkis et al., 2016).

Corporate governance gives investors and finance suppliers the right to monitor the performance of managers and directors (Shleifer & Vishny, 1997). Therefore, investors can ensure the return of their money from company managers and profit from their investments (Shleifer & Vishny, 1997). Managers are also encouraged to promote fairness, transparency, and accountability in company management (Sarkis et al., 2016).

Corporate scandals like Enron, Lehman Brothers, Bear Stearns, AIG Insurance, Xerox, Arthur Andersen, WorldCom, Tyco, Ahold, Cable and wireless, Harshad Mehta scam, Ketan Parikh scam, UTI (United Trust of India), and Bhansali scam, are as a result of weak corporate governance. They acknowledged the importance of Ethical standards and appropriate disclosure in corporate governance (Kandukuri et al., 2015). To develop the company and maintain stability and reliability in financial reports, the interests of shareholders must be considered, and transparency in communications and disclosures must be observed (Kandukuri et al., 2015).

To ensure the transparency of the management of companies and the readiness to respond optimally to the stakeholders, a company's corporate governance regulations were created (Kandukuri et al., 2015). Therefore, as Bhimani and Soonawalla (2005) stated, corporate governance and CSR are inseparable, like two sides of a coin, and weak governance indicates weak adherence to CSR principles.

2.3 ESG Standards in Europe

The European Commission created the European Green Deal to conquer the challenges caused by climate change and environmental deterioration. The EU decided to eliminate greenhouse gas emissions by 2050 and isolate economic growth from resource use (European Commission, 2023). According to this deal, by participating in all areas and inhabitants of the Union, the European Union will become a resource-efficient economy in addition to being developed (European Commission, 2023).

To achieve those targets, the EU first needed to define sustainable activity and then make regulations to ensure participants followed them. Therefore, the EU taxonomy and the corporate sustainability reporting directive were initiated.

2.3.1 EU Taxonomy

The EU taxonomy, which came into effect on 12 July 2020, presents a clear and standard definition of sustainable activities and classifies them to reach its targets in line with the European Green Deal (European Commission, 2023).

With the assistance of EU taxonomy, the companies can move toward being ECO-friendly, and investors can recognize green companies, be protected from greenwashing, and make sustainable investment decisions (European Commission, 2023).

Based on the EU commission, the economic activities are defined as environmentally sustainable if (European Commission, 2023):

”They make a substantial contribution to at least one of the EU’s climate and environmental objectives while at the same time not significantly harming any of these objectives and meeting minimum safeguards.”

To consider an economic activity as environmentally sustainable, The EU taxonomy first determines six targets and then defines four conditions (European Commission, 2023).

The objectives are as follows:

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems.

(European Commission, 2023).

The conditions are:

1. Making a substantial contribution to at least one environmental objective.
2. Doing no significant harm to the other five environmental objectives.
3. Complying with minimum safeguards; and,
4. Complying with the technical screening criteria in the Taxonomy delegated acts.

(European Commission, 2023).

2.3.2 The Corporate Sustainability Reporting Directive (CSRD)

The Corporate Sustainability Reporting Directive (CSRD) came into effect in January 2023 and caused the European Union to enhance the rules on corporate sustainability reporting. According to this directive, more large companies, companies listed in SMEs, and non-EU companies operating in the EU with revenues of more than 150 million euros are obliged to submit their annual sustainability reports (European Commission, 2023).

The European Sustainability Reporting Standards (ESRS) include ESRS 1, ESRS 2, Local ESRS, and Sector-Specific Standards ESR, which cover basic reporting principles, mandatory disclosure of sustainability issues, and critical environmental, social, and governance (ESG) issues (Sasfai, 2023; OpenAI, 2023).

ESRS 1 applies to reporting entities and covers the specified general procedural requirements. The mandatory items that companies must disclose are detailed in ESRS 2. The topical ESRS assesses the materiality of 10 ESG topics (Sasfai, 2023). The topics are as follows (Sasfai, 2023; OpenAI, 2023):

1- Environmental: Climate change, Pollution, Water and marine resources, Biodiversity and Ecosystems, Circular economy
2- Social: Own workforce, Workers in the value chain, Affected communities, Consumers and end-users

3- Governance: Business conduct

Topical ESRS requires companies to report on the sustainability-related impacts, risks, and opportunities of materials in their value chain (Sasfai, 2023). Some Specific industries, such as textiles, electronics, information technology, pharmaceuticals, and biotechnology, must disclose additional requirements listed in the sector-specific standards section (Sasfai, 2023; OpenAI, 2023).

3 Risk

Investors allocate capital to gain profit, and their preference naturally leans toward higher returns. More return requires accepting higher risk, or there is a trade-off between risk and return (Bodie et al., 2014). Therefore, investors consider more than return when creating portfolios; they also consider risk (Huang et al., 2011).

Horcher (2005) defines risk as the probability of loss due to changes in market conditions. In his view, risk and exposure to financial markets have a direct relationship. The more an organization is exposed to financial markets, the more likely it is to lose, but there are opportunities to gain profit. Therefore, one could contend that risk also provides profit opportunities (Horcher, 2005).

According to Hull (2023), there are different types of risk in financial markets, such as 1-market risk, which includes changes in market variables like interest rates, exchange rates, etc. 2-Credit risk means that there is always a risk that financial debtors will not be able to pay their debts. 3-Operational risk is the risk that the company's performance is unsuccessful enough to face external events, such as hacking. Any risk not part of the credit and market can be included in this category. 4-Modeling risk: Today, financial institutions use financial models for their financial decisions, such as the valuation of derivatives, client portfolio management, etc. There is always a risk that the models are unsuitable for their purpose or not used correctly. 5-Liquidity risk: Although companies have enough equity, their equities have no liquidity possibility. 6-Systemic risk is a risk that involves all companies and the entire market in some way. Financial crises are classified in the systemic risk category (Hull, 2023).

Bodie et al. (2014) divide risk into systematic and idiosyncratic risk. If risk cannot be eliminated by diversification, it is termed systematic risk or non-diversifiable risk; otherwise, it is a unique risk, firm-specific risk, or idiosyncratic risk (Bodie et al., 2014). This section provides an overview of these two categories and other significant risks related to this study.

3.1 Idiosyncratic Risk

In the Capital Asset Pricing Model, beta measures systematic risk and residuals or firm-specific risk, referred to as idiosyncratic risk unique to a stock (Bodie et al., 2014). Bansal and Clelland (2004) believed that almost 80% of total risk and stock price volatility consist of idiosyncratic risk. Although the general view is that diversification can remove idiosyncratic risk and increasing this risk could result in higher returns, there are also different views about the relationship between idiosyncratic risk and returns. For example, Ang et al. (2006) found a negative relationship between idiosyncratic volatility and return, and this decrease in average return could not be explained even by value, size, and momentum (Ang et al., 2006). Blitz et al. (2013) also found that the returns of portfolios sorted based on past volatility show no negative relationship with volatility in emerging markets.

3.2 Systematic Risk

As noted above, systematic risk cannot be diversified away. It involves the whole market and is not only specific to one company. Systematic risk occurs when usual risk factors encompass all companies and persist even after a vast diversification (Bodie et al., 2014). Thus, after extensive diversification, the variance of a portfolio converges to the systematic variance (Bodie et al., 2014).

Companies' sensitivity to market movement determines their systematic risk (Bodie et al., 2014). Hence, firms with a higher dependency on the business cycle have greater systematic risk since they are more affected by the market than other firms (Bodie et al., 2014). Systemic and market risks are systematic, and epidemics and war are among systemic risks.

3.3 Climate Risk

The losses from climate-related events such as storms, floods, wildfires, and heat waves that impact the economy and financial market are categorized as climate risks (Hull, 2023; Huang et al., 2018). Hull (2023) classifies climate risk into two groups: physical risk and transition risk. Physical risk is the direct cost that extreme climate events impose on companies, and transition risk is the cost of investing in transitioning to environmentally friendly production methods (Hull, 2023). From Hull's (2023) point of view, physical and transition climate risks may affect customers' perceptions and create reputational risk. Hull (2023) considers COVID-19 as a climate risk that has had a negative impact on the economy and financial market.

Huang et al. (2018) found that climate risk has a negative relationship with firm revenue and a positive relationship with firm revenue fluctuations. They also believe that firms in countries with a higher probability of climate risk increase liquidity and decrease short-term debt. They also have a greater inclination for long-term debt alongside a less inclination for cash dividend allotments (Huang et al., 2018).

Similarly, Bagh et al. (2024) examined the linkage between climate change risk, one crucial part of climate risk, and firm value, concluding that climate change risk reduces firm value. They also consider ESG to be a tool to alleviate climate change risk. Their findings demonstrate that ESG has a negative effect on climate change risk and increases firm value.

3.4 Geopolitical Risk

Geopolitical risk is when conventional diplomatic relationships between states are disrupted, and global economic stability is threatened (Fiorillo et al., 2024). Tensions among nations due to geography and politics also cause geopolitical risk (Wang et al., 2024). War and conflict between countries, such as the US-China trade war, Brexit, the

Russian-Ukrainian conflict, and related nuclear threats, are among the geopolitical risks (Fiorillo et al., 2024).

Geopolitical risk affects macroeconomic variables by imposing costs on the country, such as military expenditure, the cost of treatment or the loss of people, and the cost of capital loss; it creates uncertainty among investors and influences the financial market (Caldara & Iacoviello, 2022).

Fiorillo et al. (2024) investigated the impact of geopolitical risk on stock price trends. They concluded that geopolitical risk causes severe stock price crashes, but the severity is less for companies with strong ESG scores. Ahmed et al. (2023) specifically examined the effect of the Russia-Ukraine war, which is one example of geopolitical risk, on stock price variation and summarized an increase in stock price fluctuation due to the war.

3.5 Volatility

Investors review their portfolios to prevent losses when the financial market is exposed to new information. Therefore, the investor's tendency to purchase and sell assets changes the asset's price and creates volatility (Hull, 2023).

Stock price volatility is computed mainly by academic and financial professionals by calculating price changes (Schwert, 2011). However, in risk management, a variable's volatility is the standard deviation of that variable per day (Hull, 2023).

Stock price volatility is essential for risk management strategies and investment portfolio enhancement techniques, including options valuation (Hull, 2023). It consists of systematic and firm-specific risks. Systematic risk affects the whole market and is not particular to a specific stock; unlike firm-specific risk or idiosyncratic risk, it cannot be diversified (Bodie et al., 2014).

Several researchers advocate that price fluctuation increases during the crisis (Kapar & Buigut, 2020; Ahmed et al., 2023; Huang et al., 2011; Schwert, 2011). However, Choudhry et al. (2016) found a mutual causality between stock price fluctuation and the business cycle. According to their results, volatility changes during the recession and expansion and can also be utilized as a forecaster of impending economic trends (Choudhry et al., 2016).

Different factors may cause stock price volatility, but Chi et al. (2023) assert that information asymmetry is a crucial factor that impacts price fluctuation. When companies diverge from their previous strategy, it is costly for investors to update their information regarding the firms' strategic information, resulting in stock price volatility (Chai et al., 2023). However, according to Chai et al. (2023), financial market analysts can play a role in mitigating volatility by providing information to investors.

From Lee et al.'s (2002) point of view, investors' sentiment is a systematic risk that causes the price to move from its fundamental value, causing volatility. When investors' sentiment changes and they become more bullish or bearish, the market volatility alters (Lee et al., 2002).

Although price volatility may escalate in different situations, companies can alleviate it by enhancing their corporate governance and increasing investor confidence (Huang et al., 2011). According to the study by Huang et al. (2011), companies with more robust corporate Governance can manage stock price volatility better than others and experience higher stability during crises. Bae et al. (2021) delve deeper and consider ESG ranking as a tool to mitigate information asymmetry and lower stock price volatility.

4 THEORETICAL BACKGROUND

This section addresses the main theories related to this study. It argues the relationship between ethics and business. Two critical theories consider this relationship and discuss whether firms should care about maximizing their profit or whether non-profit ethical objectives should be considered. Then, modern portfolio theory is discussed.

4.1 Shareholder Theory

Milton Friedman first proposed the shareholder theory. He declared in the book "Capitalism and Freedom" in 1962 that as long as free trade is not at stake and the activities of companies are not deceptive and fraudulent, economic enterprises should pursue only one goal: maximizing the shareholder's profit. According to Friedman (1962), companies that spend their resources on CSR activities exploit their shareholders' investments. Because they must use all of the company's resources to maximize profits, he believed that companies fulfill their responsibility to society by paying taxes, and they are no longer responsible.

However, the shareholders' theory is incomplete because it has ethical limitations (Mansell, 2013). It does not consider the interests of other stakeholders, such as customers and employees, and participation in CSR activities is considered an obstacle to maximizing shareholders' profits (Mansell, 2013). While companies will gain a reputation by doing CSR activities and considering the interests of other stakeholders, others who do not participate in CSR activities go behind their competitors (Mansell, 2013). Therefore, shareholders theory only obtains short-term benefits, while participating in CSR activities involves the company in short-term costs but provides long-term benefits (Bird et al., 2007).

4.2 Stakeholder Theory

The roots of stakeholders' thinking go back to Adam Smith's economic theories, which state that economic and moral interests have a typical relationship and that if combined, society will perform best. In 1994, Edward Freeman argued that the separation theory that indicates ethics and business can be separated should be rejected (Sandberg, 2008). From his point of view, ethics cannot be separated from business because it hinders unethical decision-making in the organization (Sandberg, 2008).

According to the stakeholder theory, firms should consider their shareholders' needs to maximize their wealth and meet their stakeholders' interests (Mansell, 2013). From Freeman's (1984) point of view, stakeholders are groups or individuals who influence or are affected by firms' objectives. He believes that considering stakeholders' needs is requisite for the survival and progress of the organization.

According to Freeman et al. (2004), stakeholder theory deals with the goals and interests of companies and their responsibilities toward stakeholders. It argues that companies should consider the demands of stakeholders in order to fulfill their interests (Freeman et al. 2004: 364.). This theory seeks to find common interests between stakeholders so that companies pursue interests that bring the most harmony between stakeholders (Freeman, 2010). Freeman (2010) argues that if the stakeholders' interests conflict, the managers should find a solution for this conflict of interest. One can find a common goal that satisfies the primary stakeholders' interests. In this way, they can provide the company's long-term interests (Freeman, 2010).

4.3 Portfolio Theory

In 1952 Markowitz initiated modern portfolio theory (MPT), or mean-variance analysis. Markowitz (1952) believed that investors are risk-averse and desire to maximize their returns.

Based on Markowitz (1952), Since the risk or the variance of return is not desirable from the investor's point of view, the investors seek to maximize their expected return and minimize the investment risk. However, the investment with the highest yield does not necessarily have the lowest risk (Markowitz, 1952). For more return, the investor must accept more risk or lower the expected return to bear less risk (Markowitz, 1952). According to Markowitz (1952), investors have access to different combinations of return and risk to form their portfolios. They can make sets of efficient portfolios with the highest expected return at a certain level of risk or bear the least risk at a certain level of return. Investors can achieve this by diversifying their portfolios (Markowitz, 1952). The lower the correlation between assets, the better the diversification and the lower the risk (Markowitz, 1952).

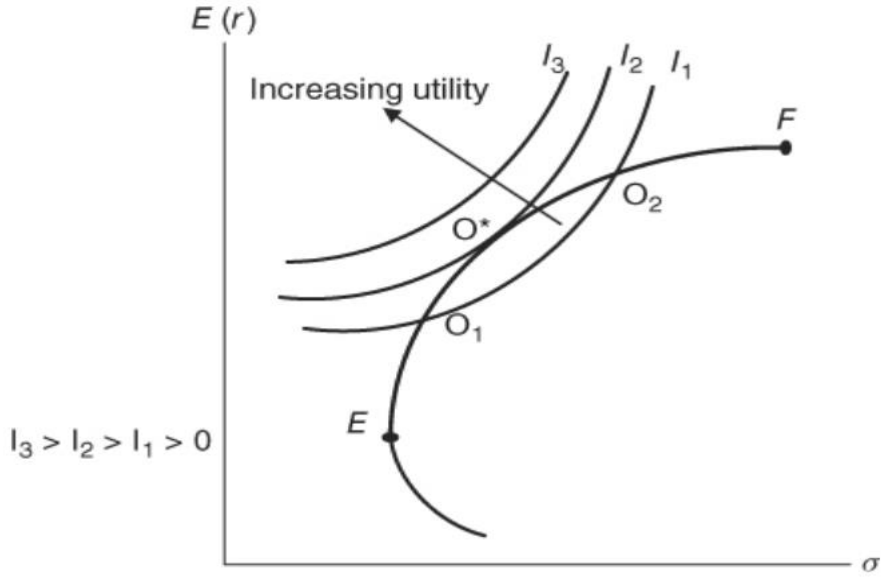

Figure 1. The Efficient Frontier and Optimal Portfolio for the Markowitz Model (adapted from Francis & Kim 2013).

Figure 1, adapted from Francis and Kim (2013), depicts the Markowitz diversification model. Among the portfolios available to investors, those closest to the EF curve are called the efficient frontier portfolio set (Francis & Kim, 2013). I1 to I3 are indifference curves and show investors' utility. Therefore, higher curves provide higher utility, and the slope of the indifference curve determines the investor's risk aversion. For more risk-

averse investors, the utility curve is steeper. Therefore, the EF curve tangent on the highest utility curve. In Figure 1, F has the highest expected return among the set of portfolios on the efficient frontier, and E has the lowest risk. However, O is the optimal portfolio in the efficient frontier. Portfolios located on the lower part of the efficient frontier belong to investors who are more risk-averse, and less risk-averse investors select portfolios on the upper part of the efficient frontier (Francis & Kim, 2013).

5 Literature Review

In recent years, following the increasing popularity of responsible investing among investors and companies, there has been a developing interest in studying the impact of responsible investing on financial markets. This section discusses previous studies on the relationship between ESG and company performance. It also discusses the studies conducted on the relationship between ESG and risk and looks at the studies that have examined the impact of ESG during crises.

5.1 ESG and Firm Performance

A considerable amount of literature has been published on the impact of social responsibility on firm performance and profitability (Heinkel et al., 2001; Aydogmus et al., 2022; Nguyen et al., 2022; Yu & Xiao, 2022; Wong et al., 2021). One of these studies is the paper by Heinkel et al. (2001), which examines the impact of social responsibility on corporate behavior and states that green investors are reluctant to invest in companies that pollute the environment. Heinkel et al. (2001) believe that this reduction in investment increases the cost of capital for polluting firms. Therefore, these companies have more incentive to reduce their pollution to attract more capital (Heinkel et al., 2001).

Yu and Xiao (2022) investigated the effect of ESG scores on the value of companies in the Chinese financial market from 2010 to 2019. To measure the company's value, they used the Tobin Q index, return on assets, and market-to-book ratio and then investigated the impact of the ESG rating on them. They examined the company's ESG rating from the environmental, social, and governance dimensions. They concluded that the impact of the environmental dimension on non-key pollution monitored companies was significantly positive. While the impact of the social dimension was also positive on the company's value, no stable relationship was found between the dimension of governance and the company's value. The relationship between the company's total ESG Score and its value was generally positive (Yu & Xiao, 2022).

Aydogmus et al. (2022) selected 1720 companies that were among the most significant 5000 publicly listed companies with a market capitalization of more than USD 2.85 billion from the Bloomberg database and analyzed the impact of ESG factors on their firm value and profitability during the period of 2013 to 2021. According to their results, the ESG combined positively and significantly impacts firm value. Also, they indicated that although the effect of social and governance factors on firm value was positive and significant, there was no significant relationship between Environment and firm value (Aydogmus et al., 2022).

5.2 ESG and Firm Risk

The impact of corporate social performance (CSP) on systematic, idiosyncratic, and total risk of firms in the European financial market from 2002 to 2014 was evaluated by Sassen et al. (2016). They measured CSP by using ESG factors provided by Thomson Reuters Asset4. They examined social performance in terms of three groups: customers, employees, and society. They indicated that social performance concerning society reduces systematic and total risk. According to their findings, environmental performance reduces total and systematic risk in environmentally sensitive industries and harms idiosyncratic risk. (Sassen et al., 2016).

Li et al. (2022) analyzed the effect of ESG rating on the default risk of Chinese companies from 2015 to 2020. According to their study, the impact of ESG rating on the credit risk of Chinese companies was significant and negative. They concluded that companies with a higher ESG rating are more competitive in their industry and have lower default risk. Therefore, according to Li et al. (2022), investors should pay attention to ESG investment to choose the optimal portfolio.

Feng et al. (2022) evaluated the impact of ESG ratings on companies' risk in China from 2009 to 2020. According to their research, companies with higher ESG scores are more

transparent about their performance and do not hide bad news. This transparency prevents sudden price falls due to the sudden disclosure of bad news. Hence, according to Feng et al. (2022), ESG rating and the likelihood of stock-price crashes have a negative relationship (Feng et al., 2022).

Jo and Na's article (2012) investigates the relationship between corporate social responsibility (CSR) and corporate risk in controversial companies such as alcohol, tobacco, gambling, etc. The companies studied by Jo and Na (2012) were selected from a comprehensive sample of the United States from 1991 to 2010. Jo and Na's (2012) findings show an inverse relationship between social responsibility and corporate risk. Jo and Na (2012) state that even controversial companies can reduce risk by participating in various social responsibility programs and improving their corporate image (Jo & Na, 2012).

He et al. (2023) measure the company's risk-taking using their joint cash holdings and net leverage level and then examine the impact of companies' ESG performance on their risk-taking. They state that the better the company's ESG performance, the more stable it is and the less risk-taking it is. Also, according to He et al. (2023), the impact of ESG on companies' risk-taking is more intense for companies with less transparency, weaker corporate governance, and less regulatory pressure. At the same time, they note that this negative effect of ESG on the company's risk-taking may hinder innovative investment in companies with better ESG performance. Therefore, to obtain optimal results from ESG performance and encourage innovative investment, the company's internal governance and external supervision should be strengthened (He et al., 2023).

Giese et al. (2019) analyze the effect of ESG on a firm’s value and performance through its systematic and idiosyncratic risk. They indicate that the impact of ESG factors on the financial value of companies occurs through a multichannel process. Giese et al. (2019) also state that the financial impact of ESG factors is less in terms of severity than traditional factors, but their impact is more durable so that they can be considered for long-term investment (Giese et al., 2019).

Zhang et al. (2023) investigated the effect of ESG performance on the downside risk of funds in the equity mutual fund market between July 2018 and March 2021. Their study examined the effect of ESG performance on the downside risk of funds through three channels. One of the channels is the company channel. In this channel, decreasing the risk of companies with better ESG performance decreases the fund's risk. The second channel is the diversity channel, in which a portfolio consisting of funds with better ESG performance reduces the downside risk of the fund more strongly (Zhang et al., 2023). Moreover, the third channel is the flow channel, in which more investors notice funds with better ESG performance, and as a result, the downside risk of the fund is reduced (Zhang et al., 2023).

5.3 ESG in Crisis

Lins et al. (2017) investigated the effect of CSR rating on the stock returns of 3000 large American companies during the 2008 financial crisis. Their study showed that companies with higher CSR performance were better during the crisis. They indicated that corporations with better CSR scores had higher returns than companies with lower CSR ratings during the 2008 financial crisis. They also pointed out that during the recovery period after the crisis, the returns of the companies were not much different. Furthermore, according to Linz et al. (2017), in non-crisis periods, the effect of the social performance of companies can be detected in their stock price, and it causes the social performance of companies to become more prominent during the crisis periods.

In 2021, Zhou and Zhou published a paper describing the impact of ESG ratings on price volatility in China's financial markets during the COVID-19 crisis. Since stock price volatility was higher during the COVID-19 crisis, their empirical test showed that companies with better ESG performance experienced less volatility (Zhou & Zhou, 2021). The better performance of ESG reduces the increase in stock price volatility caused by the crisis and leads to more "resilience" and stability in stock prices (Zhou & Zhou, 2021, p.13).

Bae et al. (2021) examined the relationship between CSR and stock returns during and after the COVID-19 crisis in 1,750 US companies. They considered 18 February to 20 March 2020 for the crisis period and 23 March to 5 June 2020 for the post-crisis period. They used the same methodology that Lins et al. (2017) used. They found that companies with higher CSR did not have higher returns during the COVID-19 crisis. They concluded that CSR cannot protect investor's funds in harsh times (Bae et al., 2021).

Yoo et al. (2021) investigated the impact of ESG factors and GC rating on stock returns and stock price volatility during the Covid-19 period (the GC rating of companies is determined based on the reputation of companies in following the rules set by the United Nations). They concluded that a better ESG rating during COVID-19 has increased companies' stock returns and reduced their stock price volatility. Meanwhile, their studies showed that companies with better GC ratings experienced lower returns and higher stock price volatility during COVID-19 (Yoo et al., 2021).

Cardillo et al. (2023) used a large sample of 1204 financial and non-financial companies from 15 European countries to investigate the relationship between ESG, stock market performance, and the shock of the COVID-19 pandemic in the period from January 1, 2020, to December 31, 2020. Their results show that companies with higher ESG scores and higher cash assets and liquidity can eliminate the externalities of the pandemic and perform better than other companies during the COVID-19 crisis.

After investigating 5,073 stocks listed on stock markets in 10 countries from January 2018 to October 2020, Loof et al. (2022) suggest ESG as a beneficial instrument to reduce risk. Since their study spans the pandemic period, they concluded that the role of ESG in reducing downside risk was more evident during the crisis of COVID-19 than before. Their findings indicated that companies with better ESG ratings have lower downside risk and lower upside returns (Loof et al., 2022).

6 Data and Methodology

In this section, the data and methodology are outlined. First, it is explained how and on what basis the data were selected, then the variables are discussed, and finally, the methodology used to check the research hypotheses is explained.

6.1 Data

The data used for this study was collected from the Refenitive database. Among the European companies available in Refinitiv's database, those that had an ESG rating during the study period and had completed other financial data required for this study were selected. The reason behind choosing Europe for the study is that European countries are more aware of ESG issues (Ho et al., 2012). They are the leader in measuring sustainability and aim to be the first climate-neutral continent in the world (European Commission, 2023). Therefore, the data related to the sustainability of European countries is more available and precise, and the study results can be more accurate and reliable. Therefore, 3,240 European companies for the period of COVID-19 and 3,466 companies for the period of the Russia-Ukraine conflict were selected. The data studied for each period are from 23 European countries and 39 industries. The studied companies have different levels of ESG rating (medium, strong, and weak) and different sizes. The countries that comprise the sample data are Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, the Channel Islands, Czech Republic, France, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, Germany, Iceland, Greece, Hungary, Jeresy, and Turkey. Following the article by Zhou and Zhou (2021), the first quarter of 2020 was considered to investigate hypothesis one. To evaluate the third hypothesis, the period from November 18, 2019, to the end of March 2020 was chosen, with a base date of January 23, 2020, when Wuhan, China, was closed due to COVID-19. The period and the base date were determined, similar to what Zhou and Zhou (2021) had done in their paper. Since it takes time for ESG to make an impact, the ESG scores were inserted into the model with a year lag. Table 1 presents each

variable's sample size, mean, standard deviation, minimum, and maximum values during the COVID-19. Since intraday volatility shows fluctuations over multiple days, it has a larger sample size than others.

Table 1. Descriptive Statistics.

Variable Name	Variable code	sample size	Mean	Std. dev.	Min	Max
ESG Performance	ESG	3,240	60.213	19.3414	1.67	94.16
Size	size	3,240	15.6491	1.8205	10.1953	21.0494
Financial Leverage	lev	3,240	0.2918	0.1931	0	2.7136
TobinQ Value	TobinQ	3,240	1.3977	2.0171	0.0098	29.8851
Cash Ratio	Cash	3,240	0.1225	0.1109	0	0.9344
Window volatility	VolQ	3,240	0.0034	0.0046	0	0.1075
Intraday volatility	Vol	146,862	0.03279	0.03561	0	0.9787

Table 2 shows the correlation matrix of the variables during COVID-19. As the table depicts, there is a weak correlation between the variables.

Table 2. Correlation Analysis.

	ESG	**Size**	**Lev**	**TobinQ**	**Cash**	**VolQ**
ESG	1					
Size	0.4836	1				
Lev	0.1027	-0.1287	1			
TobinQ	-0.1393	0.2505	-0.2449	1		
Cash	-0.1214	-0.1451	-0.1354	0.3689	1	
VolQ	-0.0879	-0.0433	0.0287	-0.0292	0.0243	1

Figure two illustrates the frequency of ESG scores applied to the COVID-19 period. As can be seen from the figure, companies with different levels of ESG scores are in the data sample.

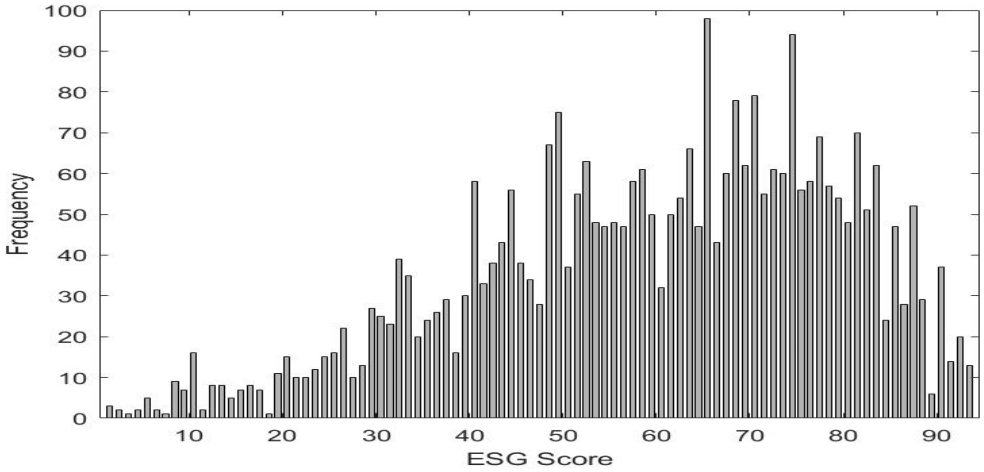

Figure 2. The frequency of the ESG scores in the COVID-19 period.

To investigate the second hypothesis, following the article by Boungou and Yatié (2022), the period was considered from January 22, 2022, to March 24, 2022. Although the war between Russia and Ukraine started on February 24, 2022, since many countries already knew about the conflict and had prepared themselves for war (Boungou & Yatié, 2022), the period of the conflict between Russia and Ukraine was considered from January 22 to March 24. The period for the fourth hypothesis is from December 15, 2021, to April 28, 2022, and the base date for investigating the fourth hypothesis is February 21, 2022, which is the date Russian troops were stationed in Donbas. The base date is chosen according to the study by Ahmed et al. (2023), who considered 21 February 2022 as the base date of the Russia-Ukraine conflict in their study. According to Ahmed et al. (2023), world leaders considered February 21, 2022, the beginning of the war, as it was regarded as Russia's operational departure from the Minsk Protocol. The ESG scores were inserted into the model with a year lag. A summary of variables that have been used for the period of the Russia-Ukraine conflict is shown in Table 3.

Table 3. Descriptive Statistics.

Variable Name	Variable code	sample size	Mean	Std. dev.	Min	Max
ESG Performance	ESG	3,466	64.8142	16.9898	2.9	94.2
Size	size	3,466	15.6647	1.8487	8.9567	21.4701
Financial Leverage	lev	3,466	0.2685	0.1669	0	1.2495
Tobin Q Value	Tobin Q	3,466	1.0369	1.3937	0.0163	14.2736
Cash Ratio	Cash	3,466	0.1032	0.1051	0	0.9003
Window Volatility	VolQ	3,466	0.0019	0.0033	0	0.0944
Intraday volatility	Vol	151,672	0.0291	0.02400	0	1

Table 4 depicts the correlation matrix of the variables during the conflict between Russia and Ukraine. In this period, there is also a weak correlation between the variables.

Table 4. Correlation Analysis.

	ESG	**Size**	**Lev**	**TobinQ**	**Cash**	**VolQ**
ESG	1					
Size	0.4432	1				
Lev	0.0954	-0.1199	1			
TobinQ	-0.0817	0.264	-0.2189	1		
Cash	-0.135	-0.1325	-0.1535	0.2798	1	
VolQ	-0.0887	-0.0706	0.0128	-0.0049	0.037	1

Figure 3 shows the frequency of ESG scores during the conflict between Russia and Ukraine. The data sample also included companies with different ESG scores during this period.

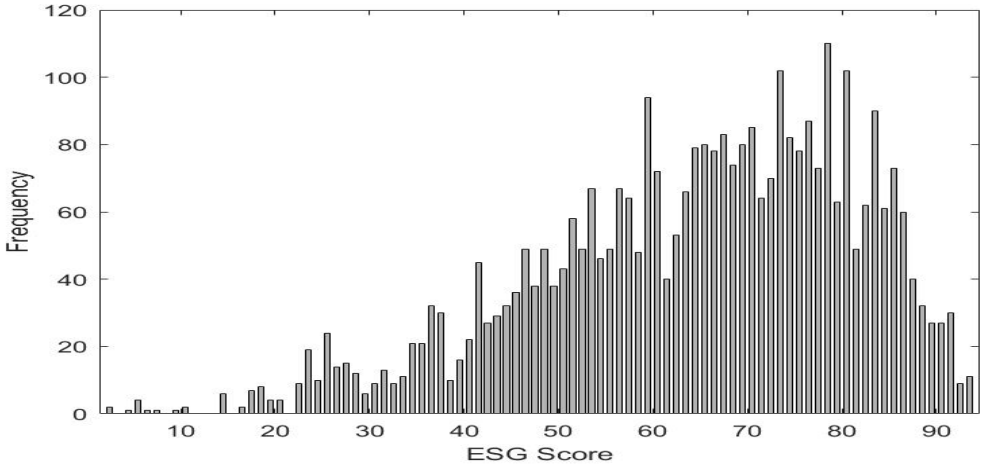

Figure 3. The frequency of the ESG scores in the Russia-Ukraine conflict period.

Following the article by Zhou and Zhou (2021), enterprise Size (Size), financial leverage (Lev), Tobin Q, and Cash holding ratio (Cash) are utilized as the control variables. All the data needed to create these variables are obtained from the Refinitiv Datastream database.

6.2 Variables

The dependent variable in this study, such as what was done by Zhou and Zhou (2021), is the volatility of prices, and It is assessed via two different methods. The first method calculates the window volatility, which is utilized to evaluate the first and second hypotheses. It is estimated by calculating the standard deviation of daily prices, which indicates the fluctuations of daily prices during the window period. As previously stated, the window period for COVID-19 is the first Quarter of 2020, and the window period for the conflict between Russia and Ukraine is from 22 January 2022 to 24 March 2022. Therefore, the window volatility is computed as follows, which is consistent with the paper by Zhou and Zhou (2021):

First, stock price changes are obtained through the following formula, where P_{it} is the closing price of the stock i on day t:

$$R_{it} = \frac{P_{it}}{P_{i,t-1}} - 1$$

Then, the stock price volatility is estimated by the subsequent equation, N shows the duration of the window period:

$$Vol_i = \sqrt{\frac{\sum_{t=1}^{N}(R_{it} - \frac{\sum_{t=1}^{N} R_{it}}{N})^2}{N-1}}$$

The succeeding technique estimates intraday volatility and is applied to investigate hypotheses three and four. The intraday volatility presents the stock price fluctuations during each day. The approach to compute the intraday volatility is based on what Zhou and Zhou (2021) used in their paper and is stated below:

$$vol_{it} = \frac{High_{it} - Low_{it}}{Avg_{it}}$$

vol_{it} is the intraday volatility of company I on date t, $High_{it}$ is the intraday high price of company I on date t, the Low_{it} is the intraday low price of company I on date t, and Avg_{it} is the intraday average price of company I on date t. Figure 4 illustrates the intraday stock price volatility from 31 December 2018 to 18 March 2024.

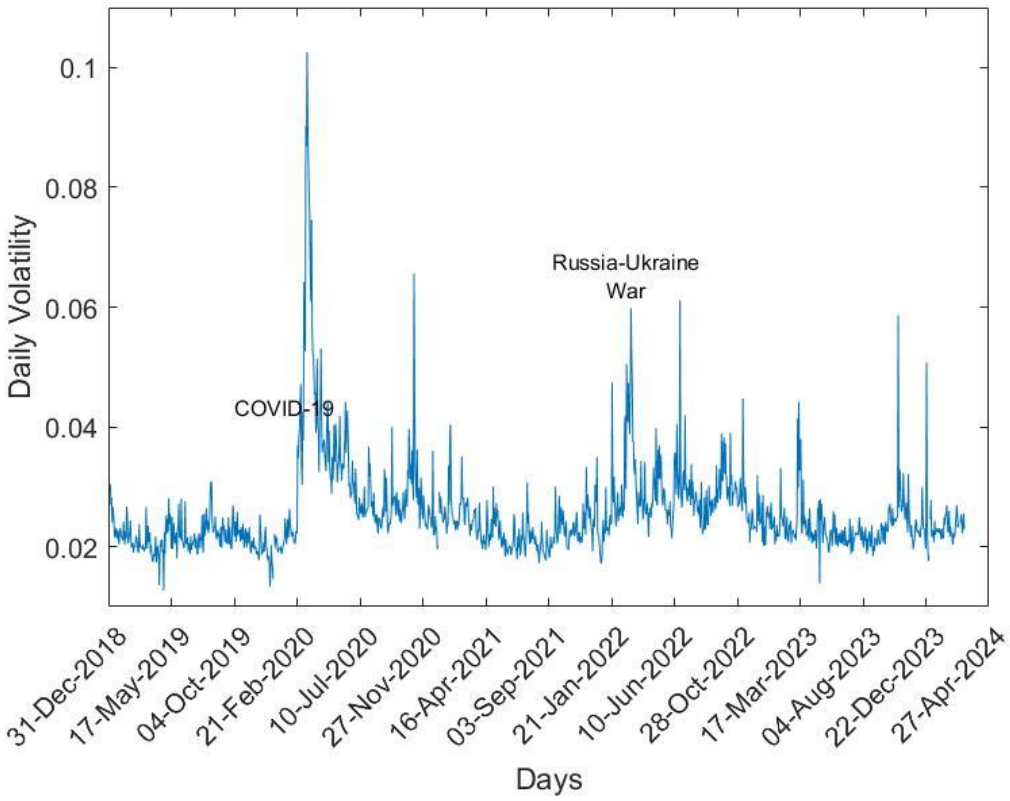

Figure 4. Stock Price Volatility.

The explanatory variable in this study is the ESG scores obtained from the Refinitiv database. ESG scores indicate the responsibility of companies for the environment, society, and corporate governance issues. The companies selected for this study have different ESG scores and can be divided into companies with strong, medium, and weak ESG scores.

A series of control variables were added to the model to isolate the impact of ESG on stock price volatility. Since companies with significant market capitalization experience higher stock price volatility in response to bad news (Sabbaghi, 2022), the firm size is added to the model as a control variable. However, Shakil (2022), who studied the impact of ESG on stock price fluctuations, recognized the effect of company size as insignificant on volatility. Following Abdul Razak et al. (2023), this study measures firm size as the logarithm of market capitalization.

Guo et al. (2011) found that companies with a lower leverage ratio experience less price volatility when an unexpected shock enters the financial market. Still, a lower leverage ratio can not help companies reduce their price volatility if a predictable shock hits the market (Guo et al.,2011). Therefore, the leverage ratio is expected to have some effect on stock price fluctuations during COVID-19 and the conflict between Russia and Ukraine, so it is used as another control variable. Abdul Razak et al. (2023) calculated the leverage ratio using the ratio of total debt to total assets in their article, and the same formula is used here.

Tobin Q shows a company's performance. It is achieved by dividing a company's market value by total assets. The paper by Zhou and Zhou (2021) was followed to compute it. The cash holding ratio shows companies' liquidity. It is calculated by dividing the cash and cash equivalent by total assets, consistent with the article by Abdul Razak et al. (2023). Table 5 presents the selected variables, the code used in this study, and their definitions.

Table 5. Variable selection and definition.

Variable Types	Variable Name	Code	Variable definition
Dependent variable	Intraday Volatility	Vol	(Intraday high price - intraday low price)/Intraday average price
	Window Volatility	VolQ	Stock price volatility during the window period
Explanatory variable	ESG performance	ESG	Firms ESG scores
Control Variables	Firm Size	Size	log ($Market\ capitalization$)
	Financial leverage	Lev	$total\ debt/\ total\ asset$
	Tobin Q value	Tobin Q	$Market\ capitalization\ /total\ asset$
	Cash holding ratio	Cash	$(cash + cash\ equivalent)/\ total$ assets

6.3 Methodology

The methodology of this study follows Zhou and Zhou's (2021) article, which consists of two models. The first model examines the validity of the first and second hypotheses, and a typical OLS model does this.

The impact of ESG rating on volatility is obtained by using the following formula:

$$VOL_i = \beta_0 + \beta_1 ESG_i + \beta_2 size_i + \beta_3 lev_i + \beta_4 tobinQ_i + \beta_5 cash_i + \varepsilon_i$$

Vol is the dependent variable, and ESG is the company's ESG score. $\beta_1$indicate the effect of ESG scores on the stock price volatility. A negative β_1 indicates an inverse relationship between a company's ESG scores and stock price volatility. In other words, a negative beta illustrates that increasing the company's ESG rating will decrease its price fluctuations during COVID-19 or the conflict between Russia and Ukraine. The other variables in the formula are control variables: enterprise Size (Size), financial leverage (Lev), Tobin Q, and Cash holding ratio. The period from 1 January 2020 to 31 March 2020 is considered to investigate the COVID-19 crisis, and 22 January to 24 March 2022 is considered the period of Russia's invasion of Ukraine. Since the data sample consisted of different industries and countries, the industry and country-fixed effects should be added to the model to solve the endogeneity problem caused by the missing variables.

The second model is the difference-in-difference model, and it again pursues the model in Zhou and Zhou's (2021) article and evaluates the third and fourth hypotheses. In this model, the sample data comprised two groups. The treatment group consists of companies with high ESG scores, and the control group consists of companies with low ESG scores. To determine the high ESG score and low ESG score groups, companies are sorted based on their ESG scores, which range from 100 to 0, and then divided into ten equal groups. Companies among the first 10% are considered to have high ESG scores, and those in the last 10% are weak ESG-sore companies.

Therefore, the first difference calculates the difference in stock price volatility between crisis and non-crisis periods in the control and treatment groups.

$$\Delta vol_{high} = vol_{high}^{crisis} - vol_{high}^{non-crisis}$$
$$\Delta vol_{low} = vol_{low}^{crisis} - vol_{low}^{non-crisis}$$

The second difference calculates the difference between 2 equations above:

$$\hat{\beta}^{DID} = \Delta vol_{high} - \Delta vol_{low}$$

The period from 18 November 2019 to 31 March 2020 is considered to investigate the COVID-19 crisis, and 15 December 2021 to 28 April 2022 is considered the period of Russia's invasion of Ukraine. The base date for the COVID-19 period is January 23, 2020, when Wuhan, China, was closed due to COVID-19. The base date for the Russian-Ukrainian conflict period is February 21, 2022, when Russian forces were deployed in the Donbas.

Finally, the impact of ESG scores on stock price volatility is calculated by the following formula:

$$vol_{it} = \beta_0 + \beta_1 ESGf_{it} + \beta_2 post_t + \beta_3 ESGf_{it} \times post_t + \beta_4 lev_{it} + \beta_5 tobinQ_{it} + \beta_6 cash_{it} + \beta_7 size_{it} + \varepsilon_{it}$$

In the above formula, $ESGf_{it}$ and $post_t$ are dummy variables. $ESGf_{it}$ is equal to 1 for companies in the high ESG score group and zero for companies with low ESG scores. $post_t$ is equal to 1 in the crisis period and 0 for non-crisis periods.

7 Empirical Results

This section explains the empirical results obtained from the study. It examines the impact of companies' ESG ratings on their stock price volatility during the two crises of COVID-19 and the conflict between Russia and Ukraine. This section consists of four sub-sections. The experimental results related to each research hypothesis are examined in each sub-section.

7.1 The Impact of ESG on Stock Price Volatility During COVID-19

In this part, the first hypothesis of the research is empirically investigated whether the companies' ESG ratings have influenced their stock price fluctuations during COVID-19. The investigation is done through the OLS model, and the coefficient obtained from the regression for the ESG rating will show the impact of the ESG rating on stock price fluctuations. Since the data sample includes 23 different countries and 39 different industries, in models two and three, country-fixed effect and sector-fixed effect are added to the regression model, respectively. Table 4 shows the results of this regression.

As indicated in Table 6, the ESG coefficient is negative in all three models, and it shows that the increase in the ESG rating of companies during COVID-19 has reduced the volatility of their stock prices. The ESG coefficients obtained in all three models are statistically significant at 1%. Thus, the H1 cannot be rejected. The coefficient of leverage is positive, indicating that increasing the level of leverage of companies enhances stock price volatility. The coefficient of leverage for the first model is statistically significant at 5%, and for the third model is statistically significant at 10%. However, the coefficient for the second model is not statistically significant, even at a 10% level. The Cash coefficient in all three models is positive and statistically significant at 5%, 10%, and 10% for models one to three, respectively. It illustrates that having more liquidity may increase the volatility of stock prices. The obtained coefficient for Tobin Q is also negative in all three models, which indicates a negative relationship between the firm's performance and

fluctuations in the company's stock price. This coefficient is statistically significant at the 1% level in the first model, but it is significant at the 5% level in the second and third models. The coefficient of the size of the companies in the first and third models is positive, and in the second model, which has the country's fixed effect, is negative and is statistically significant at the 5% level. Therefore, based on the results obtained from these three models, the first research hypothesis can be confirmed and asserted: Companies with higher ESG scores have lower price volatility during COVID-19.

Table 6. Regression results of ESG and stock price volatility during COVID-19.

VARIABLES	(1) Model	(2) Model	(3) Model
ESG	-2.71e-05***	-1.70e-05***	-3.20e-05***
	(5.09e-06)	(5.59e-06)	(5.34e-06)
Size	9.65e-05*	-0.000154**	0.000148**
	(5.73e-05)	(6.78e-05)	(5.96e-05)
Lev	0.000864**	0.000507	0.000827*
	(0.000439)	(0.000440)	(0.000484)
Cash	0.00183**	0.00152*	0.00149*
	(0.000819)	(0.000818)	(0.000862)
TobinQ	-0.000142***	-0.000102**	-0.000116**
	(4.85e-05)	(4.90e-05)	(5.22e-05)
Constant	0.00321***	0.00661***	0.00271***
	(0.000813)	(0.000929)	(0.000841)
Observations	3,240	3,240	3,240
R-squared	0.012	0.016	0.013
Number of countries		23	
Number of sectors			39
Fixed Effects	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7.2 The Impact of ESG on Stock Price Volatility During the Russia-Ukraine Conflict

This part presents the empirical result of the regression model during the Russia-Ukraine conflict. This regression examines ESG's impact on stock price volatility from 22 January

2022 to 24 March 2022. Like the previous part, this examination is also done through three models. The first model does not add a fixed effect, and the second and third models are done by adding country and sector fixed effects, respectively. They help to solve the endogeneity problem that may occur due to missing variables.

As can be observed from Table 7, the coefficient of ESG in all three models is negative. It indicates a negative relationship between the ESG scores of companies and their window stock price volatility. This result confirms that companies with higher ESG scores experienced lower price volatility during the conflict between Russia and Ukraine. Therefore, the second hypothesis cannot be rejected. However, the result of the model with country fixed effect is not statistically significant; the results of the first and third models are statistically significant at a 1% level.

According to Table 7, the size of the companies hurt stock price volatility, meaning the large companies had lower stock price volatility during the war between Russia and Ukraine. Tobin Q also negatively impacts window volatility in the first and third models, but the results are not statistically significant. Based on Table 7, Cash and leverage have positive coefficients, meaning that companies with high liquidity and high leverage had higher stock price volatility during the period of conflict.

Table 7. Regression results of ESG and stock price volatility during Russia-Ukraine conflict.

VARIABLES	(1) Model	(2) Model	(3) Model
ESG	-1.45e-05***	-4.63e-06	-1.45e-05***
	(3.83e-06)	(4.25e-06)	(4.07e-06)
Size	-5.42e-05	-0.000205***	-5.10e-05
	(3.71e-05)	(4.48e-05)	(3.90e-05)
Lev	0.000379	0.000222	0.000304
	(0.000351)	(0.000356)	(0.000396)
Cash	0.000878	0.000578	0.000435
	(0.000576)	(0.000581)	(0.000609)
TobinQ	-1.57e-05	1.78e-05	-2.34e-05
	(4.57e-05)	(4.68e-05)	(5.01e-05)
Constant	0.00356***	0.00532***	0.00358***
	(0.000536)	(0.000617)	(0.000558)
Observations	3,466	3,466	3,466
R-squared	0.010	0.014	0.008
Number of countries		23	
Number of sectors			39
Fixed Effects	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7.3 The ESG's effect on corporate volatility before and after COVID-19.

The difference-in-difference model was used to investigate the third hypothesis. First, all the companies were sorted based on their ESG scores and then divided into ten equal groups. Then, 649 companies were selected as sample companies, consisting of the 10% with the highest ESG score and the 10% with the lowest ESG score. Finally, the difference in price fluctuations in the top 10% of ESG scores and the price fluctuations of the bottom 10% of ESG ratings was reviewed before and after the beginning of the epidemic in Wuhan, China, on January 23, 2020. The review period was from November 18, 2019, to March 31, 2020.

Table 8 outlines the firm characteristics of companies in the top and bottom 10% of ESG groups. According to Table 8, on average, companies in the top 10% of the ESG scores

have lower Tobin Q and cash than companies in the bottom 10% of the ESG scores. However, the two groups do not differ much regarding other variables. Also, regarding the industry, "Non-life Insurance" has the most frequency among the top 10% of the ESG scores, while the "Financial Sector" has the most frequency among the bottom 10% of the ESG scores, 'See Appendix 2'.

Table 8. Descriptive Statistics for Top and Bottom 10% ESG Scores Groups.

Top 10% ESG group					
Variable	No. of Cos.	Mean	Std. Dev.	Min	Max
ESG	325	87.883	2.975	83.73	94.16
Size	325	17.271	1.309	13.96	19.792
Lev	325	.272	.134	.019	.754
TobinQ	325	.896	.9	.016	5.447
Cash	325	.094	.065	.001	.301
Bottom 10% ESG group					
Variable	No. of Cos.	Mean	Std. Dev.	Min	Max
ESG	324	22.917	8.153	1.67	33.16
Size	324	14.206	1.52	9.415	19.265
Lev	324	.243	.234	0	2.714
TobinQ	324	1.822	2.674	.009	29.885
Cash	324	.151	.152	0	.926

Figure 5 shows the mean intraday volatility of the top 10% ESG score companies and the bottom 10% ESG score companies before and after the outbreak. Day zero represents the 23rd of January 2020. The days before this date are days before the outbreak, and the days after this date represent the period after the outbreak. Figure 5 shows that the top ESG score group had lower volatility before and after the outbreak. However, the volatility of the 10% bottom ESG score group increased more than that of the top 10 % ESG score group.

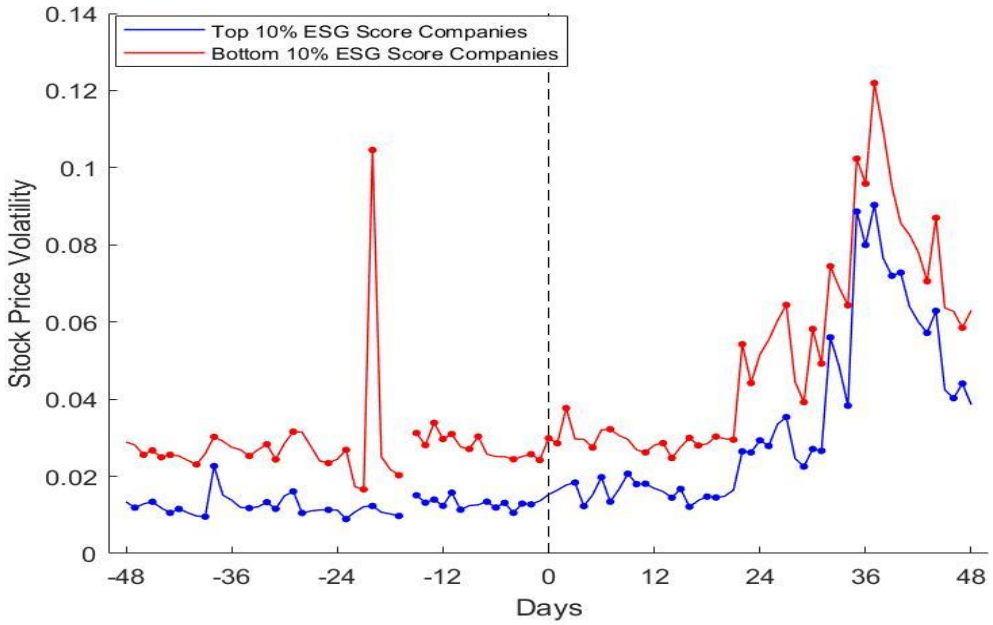

Figure 5. Intraday volatility trend of the High ESG score and low ESG score groups before and after the COVID-19 outbreak.

Table 9 represents the result of the difference-in-difference model during COVID-19. Since the post is a dummy time variable, its coefficient shows the level of stock price fluctuations before and after the outbreak. As seen from Table 9, the post-coefficient is significantly positive, which indicates that stock price volatility increased after the COVID-19 outbreak. ESGf is also a dummy variable, and its coefficient can show the difference between the stock price volatility of the top ESG score group and the bottom ESG group.

According to the regression result, the coefficient of ESGf is negative and statistically significant at the 1% level, indicating that the volatility of the top ESG score group is lower than the bottom ESG score group before and after the outbreak. Finally, the coefficient of ESGf*post shows the changes in stock price volatility of the top ESG score group compared with the bottom ESG score group before and after COVID-19. This coefficient is -0.0027 and is statistically significant even at the 1% level. This shows that the stock price volatility in the high ESG score group increased by 0.0027 less than the stock price volatility in the low ESG score group after the outbreak of COVID-19. It can

be concluded that top ESG score companies experienced more stability after the shock of spreading the virus, and H3 is accepted.

Table 9. Regression results of ESG's effect on stock price volatility before and after COVID-19.

VARIABLES	(1) vol	(2) vol
ESGf	-0.0143***	-0.00927***
	(0.000574)	(0.000767)
post	0.0258***	0.0254***
	(0.000556)	(0.000554)
ESGf_post	-0.00283***	-0.00266***
	(0.000773)	(0.000770)
Lev		-0.00326***
		(0.00111)
TobinQ		0.000204**
		(0.000100)
Cash		0.0258***
		(0.00188)
Size		-0.00113***
		(0.000148)
Constant	0.0269***	0.0397***
	(0.000408)	(0.00217)
Observations	32,009	32,009
R-squared	0.149	0.157

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7.4 The ESG's effect on corporate volatility before and after the Russia-Ukrane conflict.

In this part, the empirical result of the fourth hypothesis is explained. This hypothesis's result is also obtained from the difference-in-difference model. The study period is from 15 December 2021 to 28 April 2022, and the base date is 21 February, When Russian troops were stationed in Donbas. In this part, the companies in the study period were divided into ten equal groups based on their ESG scores. The top 10% and bottom 10%

ESG score groups were chosen as treatment and control groups. Overall, 693 companies were selected for this part.

Table 10 summarizes the characteristics of companies in the top and bottom 10% ESG groups. As the table shows, companies in the bottom 10% of the ESG group have higher Tobin Q and cash on average. While examining other variables, the two groups are not significantly different. Meanwhile, "Automobiles and Parts" and "Pharmaceuticals and Biotechnology" are the most frequent sectors in the top 10% ESG group. In comparison, "Financial Services" are the most frequent sector among the bottom 10% ESG group, 'See Appendix 3'.

Table 10. Descriptive Statistics for Top and Bottom 10% ESG Scores Groups.

Top 10% ESG group					
Variable	No. of Cos.	Mean	Std. Dev.	Min	Max
ESG	347	88.195	2.496	84.83	94.2
Size	347	16.984	1.387	11.198	19.871
Lev	347	.269	.13	.018	.718
TobinQ	347	.756	.812	.02	7.113
Cash	347	.092	.063	.001	.342
Bottom 10% ESG group					
Variable	No. of Cos.	Mean	Std. Dev.	Min	Max
ESG	346	30.738	8.125	2.9	41.33
Size	346	14.352	1.829	8.957	18.761
Lev	346	.239	.181	0	.882
TobinQ	346	1.164	1.677	.022	18.109
Cash	346	.138	.165	0	.936

Figure 6 illustrates the intraday stock price volatility of the treatment and control groups before and after the beginning date of the war. According to Figure 6, the top ESG score group had lower stock price volatility than the bottom ESG score group during the study period.

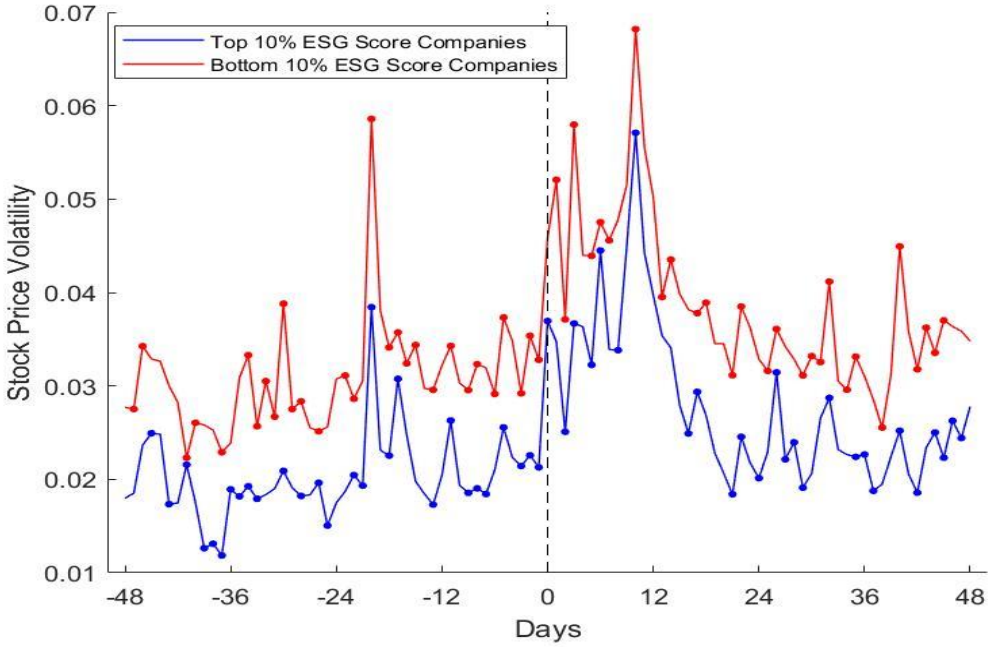

Figure 6. Intraday volatility trend of the High ESG score and low ESG score groups before and after the Russia-Ukraine conflict.

Table 11 represents the result of the difference-in-difference model regression. According to this table, the coefficient of the post is positive and statistically significant, demonstrating that stock price volatility of the top and bottom ESG sore group has increased after the conflict between Russia and Ukraine. Also, the significant negative of the ESGf coefficient reveals that the stock price volatility of top ESG score companies is lower than that of bottom ESG score companies during the whole period.

Following Table 11, the coefficient of ESGf*Post is negative. It can be denoted that the stock price volatility of the top ESG score group increased by 0.0003, lower than the stock price volatility of the bottom ESG score group after the conflict between Russia and Ukraine. However, the result is not statistically significant, but this is again consistent with the result achieved in the previous part. Therefore, it can be concluded that the companies with top ESG scores were more stable after the shock of war than the companies with weak ESG scores. Therefore, the H4 cannot be rejected.

Table 11. Regression results of ESG's effect on stock price volatility before and after the Russia-Ukraine conflict.

VARIABLES	(1) vol	(2) vol
ESGf	-0.0109***	-0.00831***
	(0.000359)	(0.000438)
post	0.00785***	0.00805***
	(0.000368)	(0.000364)
ESGf_post	-0.000301	-0.000362
	(0.000505)	(0.000500)
Lev		0.00767***
		(0.000811)
TobinQ		0.000770***
		(9.73e-05)
Cash		0.0223***
		(0.00109)
Size		-0.000574***
		(8.44e-05)
Constant	0.0312***	0.0336***
	(0.000261)	(0.00127)
Observations	31,880	31,880
R-squared	0.082	0.101

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

8 Conclusion

This study has been done to show the impact of companies' ESG ratings on their price fluctuations in critical periods. Two recent crisis periods, namely, COVID-19 and the conflict between Russia and Ukraine were chosen to study the relationship between ESG and fluctuations in these two periods. The main objective was to show whether companies following sustainability rules can help stabilize their stock prices during turbulent times. European companies were picked for the study because they are leaders in sustainability measurement, and their data is more accurate. Also, the results of such research can be more important for Europe because it aims to be the first carbon-neutral continent. In addition, although many studies have examined the relationship between ESG and firm performance or returns in Europe, few studies have addressed the relationship between ESG and risk or price fluctuations among European companies.

Therefore, to conduct a study, 3,240 European companies with complete financial information and ESG ratings were selected between the first of January and March 31, 2020, to investigate the relationship between ESG and price fluctuations during COVID-19. For the Russia-Ukraine conflict, 3,466 European companies were employed between January 22, 2022, and March 24, 2022. Four hypotheses were considered in conducting the research; the first and second hypotheses refer to the negative impact of ESG on price fluctuations during COVID-19 and the conflict between Russia and Ukraine. The third and fourth hypotheses expected that the price fluctuations of high ESG-rated companies after the arrival of the shock should increase less than those with a low ESG rating. These two hypotheses examined the entry of the shock of COVID-19 and the conflict between Russia and Ukraine into the financial market, respectively.

An OLS model was utilized to investigate the research's first and second hypotheses. To isolate the effect of ESG on price fluctuations, control variables of Size, Tobin Q, Leverage, and Cash were added to the model. Since The data were related to 23 different countries and 39 different industries to control for endogeneity, the regression was performed by three models: the first model without adding the fixed effect, the second model with the

addition of the country fixed effect, and the third model with the addition of the industry fixed effect. All three models for the periods of Covid-19 and the conflict between Russia and Ukraine were carried out. The results of performing three regression models in both crisis periods indicated a statistically significant negative relationship between ESG and price fluctuations. These results showed that companies with a higher ranking in ESG had lower price fluctuations during the crisis of COVID-19 and the conflict between Russia and Ukraine compared to companies with a lower ranking in ESG. The results of this part of the study were in line with previous studies, such as the study conducted by Yoo et al. al. (2021) that concluded better ESG ratings reduced stock price volatility during COVID-19. Alternatively, what was achieved by Zhou and Zhou (2021), who denoted companies with higher ESG scores experienced lower stock price volatility during COVID-19. A study by Shakil (2022) also confirmed a significant negative relationship between ESG scores and stock price volatility of textile and apparel firms.

The difference-in-difference model was employed to examine the third and fourth hypotheses. The results obtained for the period of COVID-19 demonstrated that companies with the highest ESG rating not only had lower price fluctuations than those with the lowest ESG rating during the entire period but also, after the epidemic shock to the financial market, which increased the total price fluctuations of the companies, showed more stability. Therefore, companies that are among the Top ESG scores group after the occurrence of COVID-19 compared to the companies in the bottom ESG score group experienced a minor increase in their stock price volatility. The results obtained were statistically significant at the 1% level. This result was also wholly consistent with what Zhou and Zhou (2021) had reached.

The regression analysis of the impact of ESG on the fluctuations before and after the conflict between Russia and Ukraine also showed that, firstly, in the entire period, companies with a strong ESG rating had less volatility than companies with a weak ESG rating. Also, in general, fluctuations after the outbreak of the war increased compared to before the outbreak, and these results were statistically significant at the 1% level.

Meanwhile, after the war, the companies in the group with the 10% most vital ESG scores showed a lesser increase in their stock price fluctuations than those in the group with the 10% weakest ESG scores. However, this result was not statistically significant.

In general, better ESG performance reduces the increase in stock price volatility caused by the crisis, leading to companies with better ESG ratings being more stable than companies with poor ESG ratings during COVID-19 and the war between Russia and Ukraine. Therefore, the ESG rating can be considered a helping lever for companies to maintain stability in the financial market, especially during crises.

In line with the findings of Zhou and Zhou (2021), this study also underscores the importance of ESG for investors, firms, and policymakers. Investors should consider ESG scores when building their portfolio and not invest in weak ESG score assets to reduce the cost of risk. Also, companies should account for the ESG and improve their ESG rankings. Doing so not only enhances their reputation but also reduces stock price volatility. Policymakers should also encourage corporations to boost their ESG ratings and participate in green projects since better ESG scores can help the stability of the financial market, especially during a crisis (Zhou & Zhou, 2021). Therefore, policymakers can utilize the ESG ranking to manage the market crisis.

Overall, considering ESG ratings by investors and companies and their support by policymakers leads to increased investment in sustainable projects. Such an alignment promises to achieve the objectives of the European Green Deal and create a more sustainable world.

For future studies, it is suggested that this research be carried out in more countries, such as the USA and countries in Asia. It is also recommended that each ESG rating pillar be examined in stock price volatility to understand which parts of their ESG scores companies need to strengthen to be more stable in times of uncertainty. As a case in point, Huang et al. (2011) stated that corporate governance can help companies become

more resilient during a crisis. Also, each pillar may have a different effect on volatility depending on the type of crisis. For instance, if environmental problems cause a crisis, the environmental sector of the ESG rating may have a more significant impact on volatility. Alternatively, if society's problems cause the financial crisis more, the social sector of ESG may have a different effect on stock price volatility.

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”To improve the language and structure in some paragraphs of my work, I have used an artificial intelligence language model called ChatGPT” https://chat.openai.com/chat.”
” I used Grammarly and Google Translate to ensure the text was grammatically and semantically correct.”

Appendices

Appendix 1. Country frequency in data sample during the COVID-19 and Russia-Ukraine Conflict.

COVID-19				Russia-Ukraine Conflict			
Market	Freq.	Percent	Cum.	Market	Freq.	Percent	Cum.
Austria	83	2.56	2.56	Austria	87	2.51	2.51
Belgium	121	3.73	6.3	Belgium	127	3.66	6.17
Channel Islands	2	0.06	6.36	Channel Islands	2	0.06	6.23
Czech Republic	5	0.15	6.51	Czech Republic	4	0.12	6.35
Denmark	128	3.95	10.46	Denmark	144	4.15	10.5
Finland	110	3.4	13.86	Finland	115	3.32	13.82
France	473	14.6	28.46	France	520	15	28.82
Germany	675	20.83	49.29	Germany	726	20.95	49.77
Greece	46	1.42	50.71	Greece	44	1.27	51.04
Hungary	6	0.19	50.9	Hungary	6	0.17	51.21
Ireland	44	1.36	52.25	Iceland	1	0.03	51.24
Italy	224	6.91	59.17	Ireland	48	1.38	52.63
Jersey	4	0.12	59.29	Italy	241	6.95	59.58
Luxembourg	34	1.05	60.34	Luxembourg	34	0.98	60.56
Netherlands	154	4.75	65.09	Netherlands	171	4.93	65.49
Norway	155	4.78	69.88	Norway	161	4.65	70.14
Poland	59	1.82	71.7	Poland	69	1.99	72.13
Portugal	32	0.99	72.69	Portugal	34	0.98	73.11
Slovenia	2	0.06	72.75	Slovenia	2	0.06	73.17
Spain	199	6.14	78.89	Spain	205	5.91	79.08
Sweden	335	10.34	89.23	Sweden	367	10.59	89.67
Switzerland	302	9.32	98.55	Switzerland	311	8.97	98.64
Turkey	47	1.45	100	Turkey	47	1.36	100
Total	3240	100		Total	3466	100	

Appendix 2. Sector frequency for the top and bottom 10% ESG score groups during the COVID-19.

Top10% ESG score group				Bottom 10% ESG group			
Sector	Freq.	Percent	Cum.	Sector	Freq.	Percent	Cum.
-	31	9.54	9.54	-	74	22.84	22.84
Automobiles and Parts	22	6.77	16.31	Aerospace and Defense	4	1.23	24.07
Beverages	1	0.31	16.62	Alternative Energy	5	1.54	25.62
Chemicals	12	3.69	20.31	Banks	2	0.62	26.23
Construction and Materials	21	6.46	26.77	Chemicals	1	0.31	26.54
Electricity	14	4.31	31.08	Construction and Materials	5	1.54	28.09
Financial Services (Sector)	6	1.85	32.92	Electricity	11	3.4	31.48
Fixed Line Telecommunications	13	4	36.92	Financial Services (Sector)	34	10.49	41.98
Food Producers	8	2.46	39.38	Fixed Line Telecommunications	5	1.54	43.52
Forestry and Paper	1	0.31	39.69	Food and Drug Retailers	7	2.16	45.68
General Industrials	8	2.46	42.15	Forestry and Paper	5	1.54	47.22
Health Care Equipment	11	3.38	45.54	Gas, Water and Multiutilities	2	0.62	47.84
Household Goods and Home Construction	2	0.62	46.15	General Industrials	11	3.4	51.23
Industrial Engineering	8	2.46	48.62	General Retailers	6	1.85	53.09
Industrial Metals and Mining	18	5.54	54.15	Health Care Equipment and Services	5	1.54	54.63
Industrial Transportation	7	2.15	56.31	Household Goods and Home Construction	2	0.62	55.25
Life Insurance	4	1.23	57.54	Industrial Engineering	9	2.78	58.02
Nonlife Insurance	30	9.23	66.77	Industrial Metals and Mining	2	0.62	58.64
Oil Equipment and Services	8	2.46	69.23	Industrial Transportation	6	1.85	60.49
Oil and Gas Producers	15	4.62	73.85	Media	12	3.7	64.2
Personal Goods	14	4.31	78.15	Mining	1	0.31	64.51
Pharmaceuticals and Biotechnology	28	8.62	86.77	Nonlife Insurance	4	1.23	65.74
Real Estate Investment and Services	3	0.92	87.69	Oil Equipment and Services	2	0.62	66.36
Software and Computer Services	13	4	91.69	Oil and Gas Producers	3	0.93	67.28
Technology Hardware and Equipment	25	7.69	99.38	Pharmaceuticals and Biotechnology	28	8.64	75.93
Travel and Leisure	2	0.62	100	Real Estate Investment Trusts	7	2.16	78.09
Total	325	100		Real Estate Investment and Serv	23	7.1	85.19
				Software and Computer Services	13	4.01	89.2
				Support Services	12	3.7	92.9
				Technology Hardware and Equipment	6	1.85	94.75
				Travel and Leisure	17	5.25	100
				Total	324	100	

Appendix 3. Sector frequency for the top and bottom 10% ESG score groups during The Russia-Ukraine Conflict.

Top 10% ESG score group				Bottom 10% ESG group			
Sector	Freq.	Per-cent	Cum.	Sector	Freq.	Per-cent	Cum.
-	44	12.68	12.68	-	47	13.58	13.58
Aerospace and Defense	13	3.75	16.43	Aerospace and Defense	4	1.16	14.74
Automobiles and Parts	33	9.51	25.94	Alternative Energy	3	0.87	15.61
Chemicals	14	4.03	29.97	Automobiles and Parts	2	0.58	16.18
Construction and Materials	29	8.36	38.33	Banks	2	0.58	16.76
Electricity	14	4.03	42.36	Chemicals	7	2.02	18.79
Financial Services (Sector)	5	1.44	43.8	Construction and Materials	6	1.73	20.52
Fixed Line Telecommunica-tions	5	1.44	45.24	Electricity	10	2.89	23.41
Food Producers	5	1.44	46.69	Electronic and Electrical Equipment	6	1.73	25.14
Food and Drug Retailers	1	0.29	46.97	Financial Services (Sector)	57	16.47	41.62
Forestry and Paper	7	2.02	48.99	Fixed Line Telecommunica-tions	10	2.89	44.51
Gas, Water and Multiutilities	3	0.86	49.86	Food Producers	4	1.16	45.66
General Retailers	1	0.29	50.14	Forestry and Paper	5	1.45	47.11
Health Care Equipment and Services	7	2.02	52.16	Gas, Water and Multiutilities	3	0.87	47.98
Household Goods and Home Construction	7	2.02	54.18	General Industrials	17	4.91	52.89
Industrial Engineering	8	2.31	56.48	General Retailers	7	2.02	54.91
Industrial Metals and Mining	18	5.19	61.67	Health Care Equipment and Services	5	1.45	56.36
Life Insurance	4	1.15	62.82	Household Goods and Home Construction	7	2.02	58.38
Nonlife Insurance	16	4.61	67.44	Industrial Metals and Mining	6	1.73	60.12
Oil Equipment and Services	4	1.15	68.59	Industrial Transportation	10	2.89	63.01
Oil and Gas Producers	9	2.59	71.18	Leisure Goods	3	0.87	63.87
Personal Goods	16	4.61	75.79	Media	14	4.05	67.92
Pharmaceuticals and Bio-technology	33	9.51	85.3	Mining	1	0.29	68.21
Real Estate Investment and Services	3	0.86	86.17	Nonlife Insurance	8	2.31	70.52
Software and Computer Ser-vices	16	4.61	90.78	Oil Equipment and Services	5	1.45	71.97
Technology Hardware and Equipment	30	8.65	99.42	Oil and Gas Producers	4	1.16	73.12
Travel and Leisure	2	0.58	100	Pharmaceuticals and Bio-technology	32	9.25	82.37
Total	347	100		Real Estate Investment and Services	15	4.34	86.71
				Software and Computer Ser-vices	12	3.47	90.17
				Support Services	16	4.62	94.8
				Technology Hardware and Equipment	2	0.58	95.38
				Travel and Leisure	16	4.62	100
				Total	346	100	