Vaasan yliopisto
UNIVERSITY OF VAASA

Joni Mattila

Firm-specific factors exposing Finnish companies to geopolitical risks

Evidence from Russia's Attack on Ukraine

School of Accounting and Finance
Master's thesis in Finance
Master's Degree Programme in Finance

Vaasa 2025

UNIVERSITY OF VAASA
School of Accounting and Finance

Author:	Joni Mattila
Title of the thesis:	Firm-specific factors exposing Finnish companies to geopolitical risks : Evidence from Russia’s Attack on Ukraine
Degree:	Master of Science in Economics and Business Administration
Discipline:	Master’s Degree Programme in Finance
Supervisor:	Janne Äijö
Year:	2025 **Pages:** 86

ABSTRACT:

Tämä Pro Gradu tutkii Venäjän Ukrainaan aloittaman hyökkäyssodan vaikutusta Helsingin pörssin päälistan yhtiöihin. Tutkimus pyrkii arvioimaan, kuinka 24 helmikuuta 2022 alkanut hyökkäyssota vaikutti Helsingin pörssin julkisesti noteerattujen yhtiöiden kumulatiivisiin epänormaaleihin tuottoihin, sekä pystytäänkö havaittuja epänormaaleja tuottoja selittämään yrityskohtaisilla muuttujilla. Tutkimusmenetelmänä käytetään epänormaalien tuottojen laskemiseksi tapahtumatutkimusta, sekä yrityskohtaisten muuttujien vaikutuksen arvioimiseksi regressiomallia. Kolmea eri mittaista tapahtumaikkunaa käytetään määrittelemään vaikutukset eri aikajänteillä.

Päiväkohtaiset epänormaalit tuotot lasketaan jokaiselle yhtiölle käyttämällä CAPM-mallia, jonka jälkeen päiväkohtaiset havainnot kumuloidaan kumulatiiviseksi epänormaaliksi tuotoksi jokaiselle tapahtumaikkunalle. Tämän jälkeen regressiomallia käytetään selvittämään kuinka yrityskohtaiset muuttujat, kuten esimerkiksi menneet tuotot, velkaantuneisuus ja yrityksen koko, selittävät havaittuja kumulatiivisia epänormaaleja tuottoja. Tutkimuksen otos poissulkee Helsingin päälistan yhtiöistä luotto- ja rahoituslaitokset, sekä ne yhtiöt, joille ei ole päiväkohtaisen tuottoindeksin dataa saatavilla koko estimointi- ja tapahtumaikkunan ajalle. Näiden seulontakriteerien jälkeen otoksen kooksi jää 113 julkisesti noteerattua Helsingin pörssin päälistan yhtiötä.

Tulokset osoittavat, että Venäjän Ukrainaan aloittamalla hyökkäyssodalla oli huomattava vaikutus Helsingin pörssiin. Keskiarvo ja mediaani epänormaalit tuotot ovat negatiivisia kahdella tapahtumaikkunalla, jonka lisäksi epänormaaleissa tuotoissa havaitaan toimialakohtaisia eroja. Huonoimmat kumulatiiviset epänormaalit tuotot havaitaan kulutustavaroiden, teollisuuden ja yleishyödyllisten palveluiden toimialoilla, ja korkeimmat tuotot energia- ja perusmateriaalialoilla. Tulokset osoittavat, että yrityskohtaisten muuttujien vaikutus riippuu tapahtumaikkunan pituudesta. Menneet tuotot, likviditeetti sekä kirjanpitoarvon suhde markkina-arvoon osoittautuvat tilastollisesti merkittäviksi muuttujiksi jokaisella tapahtumaikkunalla. Tämän lisäksi lyhyimmällä tapahtumaikkunalla selittäviä muuttujia ovat yrityksen koko, kannattavuus ja kustannustehokkuus, sekä keskipitkällä tapahtumaikkunalla velkaantuneisuus ja kauppariippuvuus Venäjästä.

Johtopäätöksenä todetaan, että Helsingin pörssin reaktiota geopoliittisiin kriiseihin voidaan selittää yrityskohtaisilla muuttujilla. Koska menneiden tuottojen havaitaan olevan merkittävin selittävä muuttuja, voidaan todeta sijoittajien mielialan yhdistettynä geopoliittisten kriisien tuomaan epävarmuuteen olevan merkittävin tekijä epänormaalien tuottojen selittämisessä. Tulokset tukevat aiempaa kirjallisuutta geopoliittisten kriisien vaikutuksista osakemarkkinoihin, ja täydentävät kirjallisuuden katvealuetta laajentamalla analyysin Suomen osakemarkkinoille.

KEYWORDS: Political crises, armed conflicts, uncertainty, financial markets, resilience, Russian invasion of Ukraine 2022

Contents

Figures

Tables

1 Introduction

Russia’s attack on Ukraine was being speculated for weeks prior the attack, and the former president of the United States, Joe Biden, warned Russia that any military action against Ukraine would be met with severe sanctions (Gaur et al., 2023). Shortly after, the European Union echoed these warnings and claimed that it would also place their own economic sanctions against Russia if it was to threaten the independence of Ukraine. Nevertheless, on an early Thursday morning on 24th of February 2022, Russia started an invasion of Ukraine by launching air attacks against Ukraine’s military facilities and critical infrastructure, and by moving their ground forces over the border on to the Ukrainian soil (Mudrov, 2022). That day marked the beginning of the Russia-Ukraine war, although their political tensions had been tensed since the Crimean Peninsula crisis in 2014. The United States and the EU followed this attack by placing enormous sanctions against Russia during the first half of 2022, among them halting trading with Russia (Gaur et al., 2023). More sanctions were placed in multiple waves from 2022 onwards.

This thesis investigates the impact of the recent geopolitical turmoil in Europe on Finnish publicly listed companies’ abnormal returns, focusing on the period surrounding Russia's attack on Ukraine. By analyzing market data of the Helsinki stock market publicly listed companies from one year before event windows, this thesis aims to find whether the war and sanctions regarding it affected the performance of the Finnish companies through cumulative abnormal returns. Further, the importance of firm-specific characteristics is measured through a cross-sectional regression model to find what are the key determinants of the financial resilience to geopolitical shocks. In addition, sectoral and time-dependent aspects are reviewed to find whether there are notable differences in the findings between different event windows and sectors of the companies. Hence, this thesis aims to shed light on what matters for Finnish companies during geopolitical shocks, and whether there are time-dependent or sectoral effects.

1.1 Background and motivation for the topic

The background of the Russia-Ukraine crisis dates to early 2014, when Russian soldiers seized government buildings in the Crimea region and illegally annexed the Crimean Peninsula to Russia (see Walker, 2023, pp. 11-13). The situation did not lead to an all-out war but tensed the political tensions between Russia and Ukraine, which eventually escalated eight years later in February 2022 (Walker, 2023). The Russia-Ukraine war is a major armed conflict event within the EU's economic region and hence enables a possibility to examine its fundamental impact on the Finnish stock markets, since the sanctions placed against Russia also impacted Finnish companies. Magnitude of these firm-specific impacts vary since ties with Russia vary among Finnish companies. Some companies have no business operations in Russia, whereas some have a substantial share of revenue derived from Russia's operations (see tables 3 and 10). Issue is the firm-level degree of operations in Russia, for example through revenue or having production facilities and other assets located on Russian soil. However, Hasan et al. (2024, p. 632) find that both the general investor sentiment changes and increasing uncertainty in the market impacts companies even if they have no business operations with either side of the countries involved in the war. This suggests that the armed conflict event has a general impact on the market regardless of the firm-level operations with either side of the war.

Motivation for this topic revolves around the uniqueness and topicality of the crisis. Although the Russia-Ukraine war is a horrible crisis that has claimed lives of thousands of both civilians and military personnel, its unique impact on the Finnish economy provides an opportunity to examine the resilience of Finnish companies to geopolitical shocks in their operating environment. The so called "Russia risk" has been a part of the risk profile of Finnish companies for decades, particularly for the companies with operations in Russia or companies that have a highly energy intensive business models, such as industrials and manufacturing (see Koskinen & Voutilainen, 2022). In addition, as Finland imported a lion's share of its total energy consumption from Russia before 2022 (see Tilastokeskus, 2024), it is expected that such a drastic change in energy politics impacts the whole economy, including the stock markets.

1.2 Purpose and relevance of the research

The purpose of this thesis is to deepen our understanding of the interplay between geopolitical risks and financial markets, with a specific focus on the Finnish stock markets. This thesis aims to shed light on how firm-specific variables backed by previous literature, e.g. leverage, size and profitability, explain the negative market reactions when the war disrupted the operations of Finnish companies. Market disruptions are found e.g. through sanctions, supply chain- and energy disruptions or increased costs (Ahmed et al., 2023, p. 1080). A negative market reaction is expected to be found in Finland, since Ahmed et al. (2023) also find that the European stock markets reacted negatively to the Russia-Ukraine crisis, with notable differences between individual sectors.

The topic of this thesis has practical relevance, since the findings may offer valuable insights for the market participants, company stakeholders and government officials about the importance of the financial characteristics of the company during a geopolitical shock event. Findings may shed light on how firm-specific characteristics impact Finnish companies' resilience to geopolitical shocks, and how abnormal returns are expected to behave during the times of distress caused by armed conflict events. Hence, findings may enable a possibility to forecast market reactions during similar events in the future, if Europe is to be casted into a dark conflict-saturated future.

Findings could be used to enhance the resilience of different sectors or companies and to further understand the dynamics of the market reactions in response to major geopolitical events, potentially providing value for risk management strategies and investment decisions. For instance, investors could benefit from the findings by understanding what sectors or certain firm characteristics to avoid or what kind of share price trends to monitor when geopolitical tensions begin to increase. The horrible events that have been taking place in Ukraine for the past few years can be used to enhance Europe's military preparations, economic co-operation and understanding of how to maximize the resilience of the stock markets and individual companies to similar events in the future.

1.3 Previous studies on the topic and the existing research gap

The term resilience has different dimensions when applied to different kind of situations or events, hence no universal definition for it exists. However, in this thesis the definition of resilience follows that of Pagano et al. (2023). They define the resilience of the company by the response of its stock price to the shock. That is, the more resilient the company is, the less severely its stock price reacts to sudden events or shocks and vice versa. On their definition, Pagano et al. (2023, p. 2) place more weight on the firm-specific characteristics on defining the level of resilience. This approach allows the resilience of the company to depend on firm-specific factors rather than on external variables.

Abbassi et al. (2023) examine how firm-specific characteristics impact the cumulative abnormal returns of the G7 indices in the aftermath of the Russia-Ukraine war. They find (2023, p. 33) that a larger size, a higher book-to-market ratio and a higher financial leverage correlated negatively with the abnormal returns. This suggests that smaller companies outperformed larger ones, potentially due to more internationally divided operating environment of the larger companies, hence being more exposed to Russian markets. Aligning with this, as book-to-market ratio serves as an indicator of the growth opportunities of the company, findings suggest that war affects these opportunities, impacting the companies with higher book-to-market ratios (Abbassi et al., 2023, p. 33). The findings of negative impact of the financial leverage are supported by Bradford et al. (1997), who also find leverage to negatively drive returns around armed conflict events.

Abbassi et al. (2023, p. 33) also find that the past returns (i.e. momentum factor) significantly explain the observed cumulative abnormal returns during the post-attack period. This suggests that the investor behavior and market sentiment are key factors during geopolitical turmoil, as the expectations before the event influence the performance after it. This suggestion aligns with the findings of Fama (1998, p. 304), that pre-event abnormal returns may continue during the post-event period. Furthermore, Martins, Correia and Cró (2023) find that the impact of the liquidity of the company is positive and statistically significant in terms of explaining the cumulative abnormal returns, implying that companies with liquid assets are better prepared to meet their cash obligations in a turbulent operating environment. In addition, Martins, Correia and Gouveia (2023) find that a higher financial stability and a better cost-to-income ratio of the company contribute to the resilience of the companies during the Russia-Ukraine war.

The relations to Russia must not be neglected when observing the market reactions around the war. Recent literature indicates that the different forms of relations to Russia impact the performance of the companies in the aftermath of the war, depending on how the company is exposed to Russia. For instance, Martins, Correia and Cró (2023, p. 14) find that the impact on the European tourism and hospitality sectors was driven by the Russian and Ukrainian tourism inbound flows before the crisis period. Therefore, the relations to Russia must be considered to uncover how firm-specific relations to Russia impacted companies' abnormal returns. In this thesis, the relations to Russia are examined through a trade dependence, i.e. revenue derived from Russia's operations.

The issue with the recent academic literature regarding market reactions to the Russia-Ukraine crisis is that the Finnish stock market is hardly represented in the data. Research is mainly focused on broad indices (e.g. G7 indices by Abbassi et al., 2023) or specific sectors in Europe (e.g. tourism and hospitality sectors by Martins, Correia and Cró, 2023), giving the Finnish stock markets only a marginal representation in the sample data. Given that Finland is a neighboring country to Russia and had economic ties with it for over a half of a century, it is justifiable to assume that negative market reactions are found from the Helsinki stock markets (as negative reactions are found from the neighboring countries by Hasan et al., 2024). In addition, Ahmed et al. (2023) find that the Russia-Ukraine crisis had an overall adverse impact on the STOXX 600 Europe index, with notable differences between individual sectors. Thus, the specific research gap is the implication of the literature into the Finnish stock market, as it has a unique relationship with Russia. This thesis aims to find whether similar results can be observed in Finland that the existing literature has found on other indices and sectors around the Russia-Ukraine war.

1.4 Hypotheses development and research questions

The objective of this thesis is to find whether Russia's attack on Ukraine affected Finnish publicly listed companies' abnormal returns, and to what extent did the firm-specific characteristics explain those observed returns. First, based on the Efficient Market Hypothesis, this thesis aims to find whether abnormal returns are observed among Finnish publicly listed companies or not. Under the assumptions of the Efficient Market Hypothesis, stock prices follow a Random Walk hypothesis (Fama, 1970, p. 386), thus abnormal returns should not be found, and if so, further examination of the selected firm-specific variables' contribution is useless. Under the Efficient Market Hypothesis, the Russia-Ukraine war should have been priced into the share price during the first day market reaction, and no abnormal returns should be found from the days preceding the start of the invasion. However, if abnormal returns are found, it provides a possibility to answer the first research question of this thesis, that is how the abnormal returns of the Finnish publicly listed companies behaved during the event windows surrounding Russia's attack on Ukraine. Therefore, the first hypothesis of this thesis is formulated followingly.

H_1: Statistically significant presence of negative cumulative abnormal returns is found from the event windows compared to the estimation window.

If H_1 can be accepted, it enables this thesis to examine whether firm-specific variables contribute to or explain the degree of the observed cumulative abnormal returns. Following the research methodologies of the recent academic literature regarding market reactions to the Russia-Ukraine crisis (e.g. Abbassi et al., 2023; Ahmed et al., 2023 & Martins et al., 2023), this thesis aims to find whether firm-specific characteristics explain the degree of cumulative abnormal returns. Hence, if H_1 is accepted, the second hypothesis can be either accepted or rejected.

H_2: Firm-specific characteristics of the Finnish publicly listed companies explain the abnormal excess returns observed during the event windows.

After either accepting or rejecting these hypotheses, this thesis further examines whether there exist any notable sectoral differences between the returns that the Finnish companies experienced. Acceptance of the hypothesis H_2 enables a possibility to answer the second research question, that is what variables are found to be the most relevant in explaining the cumulative abnormal returns, and whether the importance of the different variables shift when the event window is extended. This research question aims to find what factors matter on a short-term versus on a long-term, and if there are any persistent variables with explanatory power.

1.5 Data and methodology of the thesis

This thesis employs a traditional event study and a cross-sectional regression model in examining the abnormal returns and in evaluating the impact of the firm-specific characteristics, following the approach of Abbassi et al. (2023) and Martins et al. (2023). A traditional event study is employed by conducting an analysis for three different length event windows by extending the adjustment window, thus capturing the waves of economic sanctions and changes in the market sentiment. After conducting the event study, a cross-sectional regression model is employed to examine the impact of the selected firm-specific variables on the cumulative abnormal returns. Variables are selected based on the existing literature regarding the Russia-Ukraine war.

For this methodology, a variety of data is needed. The sample is all publicly main listed Finnish companies (excluding the First North listed companies) with applied screening criteria, totaling 113 companies. Hence, daily return index data is needed for each company for each day of the event- and estimation windows. Also, to calculate the excess returns, the OMX Helsinki Price Index (OMXHPI) daily closing data is needed as a benchmark index for all the Finnish companies. Benchmark index data is used to find the alpha- and beta variables for each company, which are needed to find the cumulative abnormal returns by using the CAPM abnormal return model. Further, to determine the impact of the firm-specific characteristics, various data from the financial statements is also needed. These data are retrieved from the financial statements of 2021, as they are used to explain the returns observed on the first half of 2022. Usage of 2022 financial statements data could potentially bias the observed results, as this data may be influenced by the Russia-Ukraine war during the financial period of 2022.

After gathering the required data, the cumulative abnormal returns are calculated for each event window for each company of the sample. Then, the impact of firm-specific variables is measured through a cross-sectional regression model. To control for the robustness of the findings, three different length event windows are used, with the same cross-sectional regression model. Further robustness checks and tests are conducted to validate the model and the presented findings, e.g. a Durbin-Watson test and Variance Inflation Factor analysis. Plausible issues of the model are also discussed to highlight the potential concerns of the presented results.

1.6 Structure of the thesis

First, the theoretical framework and central terminology linked to the topic and the chosen methodology are introduced. This includes an introduction of the Efficient Market Hypothesis with its central terminology and underlying assumptions. In addition, risk and return theories are discussed from the Capital Asset Pricing Model point of view, and its central concepts such as the Security Market Line, Alpha and Beta are reviewed. These concepts and theories are a key function in the methodology part of this thesis. Regarding the important theories and their hypotheses, behavioral finance perspectives are also discussed briefly, as they offer alternative approaches to the Efficient Market Hypothesis, and reasons if possible cumulative abnormal returns can be explained by the investor behavior (e.g. momentum), rather than by the company's fundamentals.

After presenting the theoretical framework, the existing literature regarding armed conflicts and equity markets is examined. Literature review is chunked into sub-chapters to approach the methodology and expected results efficiently. First, the unique relationship between Finland and Russia is briefly discussed. This includes a review of the key dependencies the EU and Finland had with Russia before the war. Then, the interplay between geopolitical risk and financial markets is discussed through the existing literature and findings from various geopolitical crises. This includes a sectoral analysis regarding the observed returns in various indices around the Russia-Ukraine war. Then, findings about the key variables in explaining crises and shocks' impact on cumulative abnormal returns are discussed. Lastly, the central findings of the literature review are concluded, with additional discussion on the expected results of this thesis based on the existing literature's findings. Literature review provides justification for the usage of different methods and variables through presenting what the existing literature has found using similar approaches.

Further, the employed methodology is introduced. This includes an introduction of the data, event windows and cross-sectional regression model alongside with its explanatory firm-specific factors. After introducing the methodology of the thesis, the findings are presented. This includes central tables about the data and findings (e.g. descriptive statistics and correlation matrix). Regression results are further presented and discussed, and the variable estimation results are reviewed. A robustness check is conducted through analyzing the event window residual plots and conducting a Durbin-Wason test and a Variance Inflation Factor analysis. Then, the results are discussed in detail, and the sectoral differences are examined. The findings section is completed by discussing the practical implications of the presented findings. After the results and discussion, the conclusion section wraps the central findings of the thesis and discusses potential limitations of the results and presents future research suggestions based on the unanswered and newly introduced questions. Finally, the final remarks end the discussion, shedding light on the importance of the future research on the interplay between financial markets and geopolitical risks.

2 Theoretical framework

2.1 The Efficient Market Hypothesis

The first hypothesis this thesis aims to accept is whether negative cumulative abnormal returns are found from the chosen event windows. One of the central theories and assumptions in examining the market behavior and excess returns through event studies is the Efficient Market Hypothesis (EMH). According to the EMH, abnormal returns should not be found in the post-event period, as any information is instantaneously priced into the asset’s price (Fama, 1970, p. 384).

Before 1970’s, academic research suggested that share price changes were independent of each other and followed a random walk (Adams et al., 2003, p. 51). The search for an explanation for this observed randomness led to the introduction of the Efficient Market Hypothesis by Eugene Fama in 1970. The Efficient Market Hypothesis suggests that all stock prices fully reflect all available information in the market, and thus are informationally efficient (Fama, 1970, p. 384). Fama (1970, p. 386) continues that all stock prices follow a Random Walk Hypothesis, that is, the movement of a stock price is independent and equally distributed, meaning that the stock price is as likely to go down as it is likely to go up in any given moment. Hence, no predictable price patterns can be found. Under these assumptions, the prices of securities should quickly and accurately reflect all available information in the market, making it impossible for the market participants to generate returns that are consistently higher than the average market returns.

Fama determines the key assumptions that are consistent with the efficiency. He states (1970, p. 387) that in efficient markets there are no transaction costs, all information in the market is available to all participants and that all market participants agree on the implication of available information to the current share price. The assumption of the agreement on information’s implication suggests that the markets are “frictionless”, and that all market participants react to the new information the same way. This means that all market participants are rational, their actions are based on logical and unbiased assessment of the new information, and that they act in their own self-interest to maximize their utility. For instance, regarding the first research question of this thesis, market participants should, according to the EMH, price the information about the war in asset prices during the event day, thus no abnormal returns should be found in the days after it. Following figure illustrates how the EMH assumes a share price reacts to a new information (red) and how a non-efficient slow reaction impacts the share price (blue).

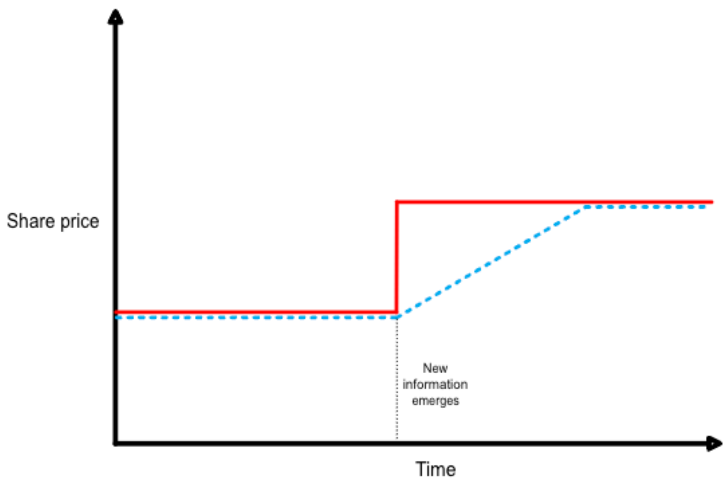

Figure 1. Efficient versus slow reaction.

Since in the real world there are fees and other transaction costs when trading securities, practical definition of informational efficiency is that share prices incorporate all available information to the extent that the benefit gained from using the information equals the costs of obtaining it (Adams et al., 2003, p. 52). Adams et al. (2003) continue that the formal proving of informational efficiency on a given share price is impossible, but that there are tests that can be carried out. Tests of informational efficiency were originally divided into three different categories by Fama (1970, p. 388), that are weak form, semi-strong form and strong form of tests, that are the forms of market efficiency.

According to Fama (1970, p. 388), there are three types of market efficiency that can be tested which are categorized by the type of information the prices include. Under a "weak form" of market efficiency, current asset prices fully reflect all past information, such as historical prices, trading data, volumes etc. That is, all past information is already included in the current share price. This form of efficiency renders technical analysis pointless, as all past information is already embedded in the share price, and thus no predictable patterns can be found nor exploited (Ayala et al., 2021, p. 1).

Fama (1970, p. 388) continues that under a "semi-strong form" of market efficiency, asset prices do not only reflect all past information, but also all publicly available information, for example current trading data, financial statements data, economic indicators and news. Under this form of market efficiency, share prices adjust immediately to newly published information. Hence, it is not possible to achieve superior investment returns without an access to a private information (Adams et al., 2003, p. 52).

Lastly, under a "strong form" of efficiency, asset prices reflect all past, public and private information (Fama, 1970, p. 388). Under the strong form of efficiency, no market participant can generate excess returns using any information, neither public nor private. This means that for example insiders, such as company managers and board members cannot benefit from trading on inside information (Adams et al., 2003, p. 52). Fama (1970, p. 409) states that as a strong form of efficiency means that the prices reflect all available information, it also means that the strong form of efficiency encompasses both semi-strong and weak form of efficiencies. Thus, the semi-strong form of efficiency also encompasses the weak form of efficiency. If the market is strongly efficient, it is simultaneously semi-strongly and weakly efficient. Vice versa, if informational efficiency test implies only weak form of efficiency, it implies semi-strong and strong form of inefficiency. Following figure (2) illustrates how forms of market efficiencies encompass each other.

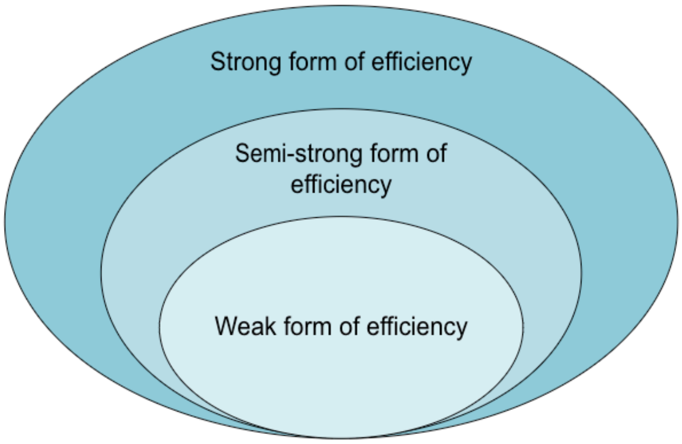

Figure 2. Forms of market efficiency.

2.1.1 Market efficiency and empirical evidence

Although the Efficient Market Hypothesis is one of the central theories of financial economics, it has also been a subject of research and disagreement between academics and practitioners. Whereas practitioners have tended to reject the hypothesis, academics have promoted its acceptance (Adams et al., 2003, p. 52). Under the assumptions of the EMH, no abnormal excess returns should be found, and thus anomalies or arbitrage opportunities should not exist. However, empirical evidence suggests that anomalies and arbitrage opportunities do emerge from time to time, enabling investors to generate abnormal excess returns that exceed the average returns of the market.

One of these anomalies is momentum. Fama (1998, p. 286) describes momentum phenomenon as that stocks that have performed well and had higher returns during the past year tend to perform similarly for the next few months, and vice versa. That is, the past returns impact the future returns. Chan et al. (1997) examine whether abnormal excess returns emerge when the momentum phenomenon is exploited through different momentum strategies. They find (1997, p. 1710) that when stocks are selected by ranking them with their moving averages or with past months' yields, arbitrage opportunities are found and are often exploitable. This thesis incorporates the momentum factor in the regression analysis to examine if the past performance (pre-attack period) affects the future performance (post-attack period). According to the EMH, this variable should be useless as even under the weak-form of efficiency the share price should already encompass all previous information (Fama, 1970, p. 388). If past returns exhibit a statistical significance in the event window's returns, it suggests that the momentum phenomenon affects the event window's returns, which does not align with the EMH.

Since 1990's, behavioural finance has gained momentum as a field of research. Behavioural finance suggests that market participants do not make investment decisions on a rational basis but act under the influence of their emotions (Adams et al., 2003, p. 53). As a result, share prices may differ from their fundamental values even for extended periods of time, causing anomalies like momentum. For instance, Malkiel (2003, p. 61) states that the rally in the United States stock markets in the late 1990's was driven by the psychological contagion of fear of missing out, leading to irrational and abundant level of abnormal returns. This further led to a "dot com" bubble and ultimately to its burst. Thus, behavioural finance argues that the psychological factors impact stock prices and investment decisions, which further impacts the behaviour of the entire market. Therefore, behavioural finance provides plausible explanations for the existence of various anomalies through a variety of theories (Adams et al., 2003, p. 53). The momentum factor (past returns) in the regression analysis investigates whether the behavioural finance aspects influenced the returns of the companies in the aftermath of the Russia-Ukraine war. It may offer valuable insights on whether behavioural aspects offer explanation to market reactions alongside with the fundamental aspects of the company.

Malkiel (2003, p. 62) highlights that interpreting empirical results of the market inefficiency does not necessarily mean that the markets are inefficient. He states that although the stock market may not behave perfectly by the rules of the random walk in a mathematical sense, there should be a distinction between a statistical significance and an economic significance. For instance, although statistical evidence suggests that there is a momentum anomaly to be exploited, in most cases investors who try to exploit it lose money compared to traditional buy-and-hold strategies (Malkiel, 2003, p. 62).

Malkiel (2003) continues that this is due to large transaction costs when attempting to exploit momentum, which quickly surpasses the possible abnormal return, acting as a limit to arbitrage. Also, the key factor in justifying whether markets are efficient or inefficient lies in the consistency of the observed patterns. Most anomaly strategies appear to generate positive excess returns in some periods of time, but highly negative returns in other periods which offset each other in a long run (Malkiel, 2003, p. 62). In addition, most of the predictable patterns disappear when they are published in the finance literature, and some models may exhibit statistically significant results whereas other methods or samples would not. To conclude, Malkiel (2003, p. 63) states, that although practitioners seek arbitrage opportunities to exploit, no pattern is ever sufficiently large or stable enough to provide superior investment returns consistently.

2.2 Risk and return approach in Finance

Risk and return approach, or the portfolio theory, was introduced by Harry Markowitz in 1952, and has since become the cornerstone of academic finance. Markowitz (1952, p. 77) argues, that investors consider the expected return of the asset desirable, and simultaneously the variance (i.e. riskiness) of those returns undesirable. Investors should also diversify their assets among the securities that provide maximum expected return, while also minimizing the variance. Hence, there exists a portfolio in which the minimum variance is achieved and the maximum expected return received (Markowitz, 1952, p. 79). With the variance on the x-axis, and the expected return on the y-axis, the efficient portfolio frontier is formed, from which the investor can choose weight combinations of different assets and thus move in either direction of the frontier based on their desire. A rational investor would choose the portfolio that has the minimum variance with the maximum expected return (Markowitz, 1952, p. 82). Markowitz (1952) states, that investors should use the expected return – variance relationship rule as a hypothesis to explain investment behavior and to guide investment decisions. He continues, that diversification should also consider different sectors that the securities are chosen from. For example, a portfolio of ten different companies from the same sector is not as well diversified as a portfolio of ten companies from different sectors (Markowitz, 1952, p. 89). This is because the different sectors are exposed to different risks, which are diversifiable only to a certain point, from which the industry specific risk is undiversifiable. Following figure (3) presents an example of an efficient portfolio frontier, in which on the y-axis is the expected rate of return of the portfolio, and on the x-axis is its risk, measured by standard deviation. Each dot represents a different portfolio, from which the investor can choose the desired portfolio.

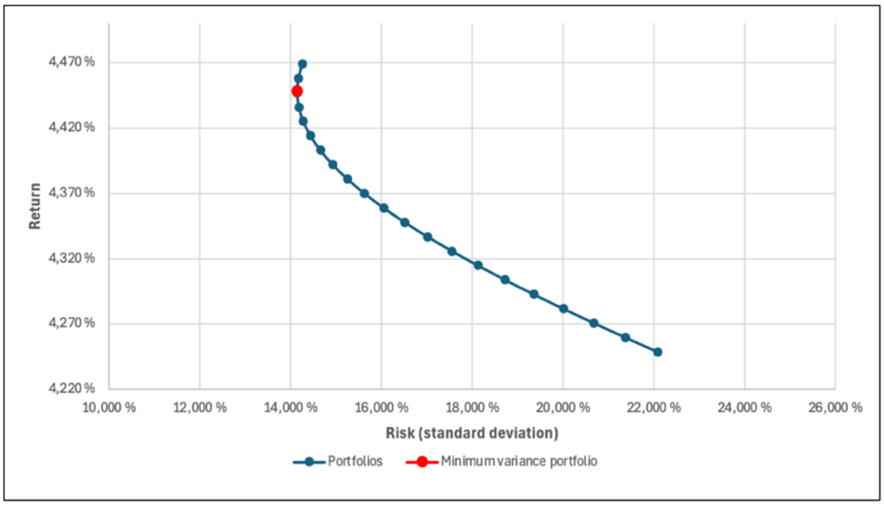

Figure 3. Efficient portfolio frontier.

2.2.1 The Capital Asset Pricing Model

Market participants may have views of the future that differ from one another. Thus, their estimations of expected returns and variance of the given asset differ, and forming efficient portfolios becomes a subject of debate. Therefore, a market pricing model for securities is needed. The Capital Asset Pricing Model (CAPM) was first introduced by William Sharpe, Jack Treynor, John Lintner and Jan Mossin in the late 1960's. The CAPM gives market participant insights on the risks that are related to the return of the given security, and how the security is expected to perform in the future (Perold, 2004, p. 3).

The CAPM has a set of underlying assumptions, that allow the model to function as intended. Firstly, all market participants are assumed to be risk-averse and use the standard deviation of the returns as a measure of risk (Adams et al., 2003, p. 246). Additionally, all market participants have a common time horizon for investment decisions and identical estimates of the future returns. Adams et al. (2003) continue that the CAPM assumes there exists a risk-free asset which all market participants can borrow or lend unlimited amounts. All securities are assumed to be completely divisible, and no transaction costs or taxes exist when trading these securities. As with the Efficient Market Hypothesis, information is assumed to be instantaneously, simultaneously and freely available to all market participants (Adams et al., 2003, p. 246).

These assumptions are simplified and represent an idealized and efficient world, where no frictions in the market exist. Nevertheless, these assumptions are essential for the CAPM to function in its basic form (Perold, 2004, p. 16). The premium for holding the given asset must be higher than the risk-free rate and at least equal to the expected market return, for investors to rationally invest in it. Thus, the expected rate of return of the given security must satisfy the following equation (1) and its conditions.

$$E_s - r_f = \beta(E_M - r_f) \qquad (1)$$

Where E_s represents the expected return of the given security, r_f the risk-free rate and E_M the expected return of the market. β is the beta coefficient, that is the sensitivity of the asset's return to the expected return of the market (Perold, 2004, p.16). Left-hand side of the equation is the market risk premium, or the excess return on risk-free asset that is the product of the right-hand side where asset's beta determines the performance to the excess market return. When these variables are re-arranged, the formula for the CAPM in its basic form is obtained.

$$E_s = r_f + \beta(E_M - r_f) \qquad (2)$$

Equation (2) obtained, also known as the Security Market Line (SML), presents the relationship between the expected return and the risk of the given security as measured by the beta (β) coefficient (Adams et al., 2003, p. 249). The higher the beta is, the more sensitive the security is to the changes in expected market returns, either positive or negative. Adams et al. (2003) continue that it represents the systematic risk that is the asset's covariance to market's return. The expression of $(E_{(M)} - r_f)$ represents the market risk premium, which is the return of the market that exceeds the risk-free return. Equation (2) considers only the systematic risk, but the total risk is measured by the standard deviation of the returns (Adams et al., 2003, p. 249). The unsystematic risk that is the firm specific risk can be obtained by deducting systematic risk from the total risk.

$$Total\ risk = systematic\ risk + unsystematic\ risk \qquad (3)$$

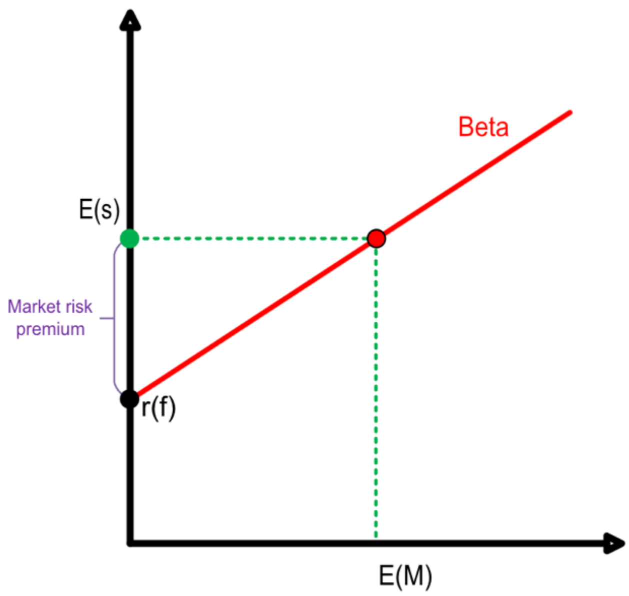

Figure 4. The Security Market Line.

Figure (4) illustrates how the equation (2) forms the Security Market Line. Fairly priced securities plot exactly on the SML, whereas underpriced assets plot above the SML, and overpriced assets below it. The Security Market Line predicts the expected return of the asset based on the sensitivity (beta) of the asset to the expected market return. As Adams et al. (2003, p. 249) state, the steeper the beta slope is (i.e. higher), the higher the expected return on the asset is relative to the expected market return.

To extend the estimation capability of the CAPM, Jensen (1968) proposed to add another intercept to the CAPM equation, an y-intercept, which became known as the Jensen's alpha. The equation (2) is suitable for empirical estimation of the systematic risk-return relationship between the security and the market (Jensen, 1968, p. 393). However, Jensen (1968) continues that the equation (2) neglects the systematical ability of the company to earn more than the market risk premium. Hence, the company's ability to generate excess returns is applied to the estimation of the expected returns with its own intercept variable. Jensen (1968, p. 393) applies this variable in the equation (1) as Jensen's alpha (α) and re-arranges the equation followingly.

$$E_s - r_f = \alpha + \beta\left(E_M - r_f\right) \qquad (4)$$

When the equation (4) is further re-arranged, the formula for the Jensen's alpha is obtained. The alpha intercept is obtained from the realized past returns rather than from estimated returns. Jensen (1968, p. 393) states, that the alpha measures the ability of the company to generate excess returns in addition to the estimated returns obtained with equation (2). Thus, instead of using estimated return for the security and the market, realized past returns are used, R_s for the security and R_M for the market, respectively. When these variables are further re-arranged, equation (5) for Jensen's alpha is obtained.

$$\alpha = R_s - (r_f + \beta(R_M - r_f)) \qquad (5)$$

CAPM equation that encompasses both the systematic risk (β) and the company's ability to generate excess returns (α) can be formed to estimate the future returns using the presented equations. According to Bunnenberg et al. (2019, p. 236), using a single-factor market model that Jensen (1968) proposed, excepted returns are calculated with equation (6). Bunnenberg et al. (2019) continue that the Jensen's alpha intercept represents the ex post average excess return, resulting from company's ability to generate returns even when the market's return is zero. The expression of μ_s denotes the independently distributed residual error term, which has an expected value of zero (Bunnenberg et al., 2019, p. 236). Hence, the equation (6) illustrates how the expected return of the given security is calculated by using the ex post average return and the security's sensitivity to market's returns.

$$E_s = \alpha_s + \beta_s(E_M - r_f) + \mu_s \qquad (6)$$

2.2.2 Limitations of the CAPM

Although the CAPM is a renowned theory in academic finance and is taught in all finance textbooks, it also has limitations that rise discussion between the academics and practitioners regarding the model's usefulness. Adams et al. (2003, p. 248) argue that the CAPM as a pricing model is not well supported by the empirical tests. In addition, testing its estimation capabilities is problematic, as the CAPM is based on investor expectations rather than on the historical performance.

Knüpfer and Puttonen (2009, p. 150) discuss about the limitations of the model and name for example the question about the risk-free interest rate. Depending on the situation and the given asset it may be unclear what interest rate to use as a risk-free rate, for example whether it should be a shorter market interest rate (e.g. Euribor rates in the EU) or a longer bond rate. Also, as the market risk premium plays a vital part in the calculation, it also has been a subject for debate. For example, although historically in the U.S. the market risk premium has been over 10 percent higher than the risk-free rate, the actual risk premium may be a lot lower, since the high premium cannot be explained by general macroeconomic factors (Knüpfer & Puttonen, 2009, p. 150). Welch (2000, p. 520) finds, that many finance professors and economists estimate the real market risk premium in the U.S. to be around 4,7% to 6% on one-year perception, and 7,2% to 8,2% on a ten-year perception, materially differing from the assumed 10% premium.

Also, the sensitivity of the asset to the returns of the market, the beta (β) variable, is debatable. As beta can be calculated from a daily, weekly, monthly or yearly data, it may be controversial to decide which beta to use, and it fundamentally affects the outcome of the CAPM estimations (Knüpfer & Puttonen, 2009, p. 150). In addition, stocks that are not traded frequently or in large quantities and thus have low trading volumes may have betas that are substantially biased downwards. Knüpfer and Puttonen (2009, p. 151) state that the scarcity of trading reflects to returns as a lower covariance with the market index, which causes bias and thus materially affects the CAPM estimations.

2.3 Event Study methodology

The first step of an event study is to determine the date of interest and identify the period over which the companies are involved in the event, that is called the event window (MacKinlay, 1997, p. 14). Depending on the nature of the event, the event window may be longer than the event day itself, which enables a possibility to examine the periods around the event day. MacKinlay (1997) continues that the event window is then often extended multiple days before or after the event to examine the market's anticipation and adjustment to the event. The days before the event date are called an anticipation window, and days after the event are called an adjustment window. Together the anticipation window, event date and adjustment window generate the full event window. Event window may also be the event day and the adjustment window alone, depending on the nature of the event and purpose of the research.

After identifying the event window, selection criteria for the inclusion of different companies are formed (MacKinlay, 1997, p. 15). Screening criteria are for example including only publicly listed companies, or including publicly listed companies from a specific sector, depending on the nature of the event study. Then, returns for the event window's selected companies are calculated, for example through the daily closing prices or return index. Hudson and Gregoriou (2015) find that the decision to use simple returns or logarithmic returns can significantly influence the results of practical financial studies, such as event studies. However, they argue (2015, p. 152) that there are numerous reasons for using logarithmic over simple returns when conducting an event study. For example, they argue that the logarithmic returns can be interpreted as continuously compounded returns, which suits the nature of event studies (Hudson & Gregoriou, 2015, p. 152). Also, using logarithmic returns is advantageous when considering multi-period returns, as they are a sum of continuously compounded single period returns.

MacKinlay (1997, p. 15) continues, that after forming the event window and calculating its returns, an estimation window must be formed. Corrado (2011, p. 209) states that the estimation window represents a control window to which the event window's returns' statistical significance is determined. The estimation window in event studies is generally the period prior to the event window and is usually at least 120 trading days long (MacKinlay, 1997, p. 15). MacKinlay (1997) continues that the estimation window must not be included in the event window dates, as it may influence and bias the performance of the parameter estimates. Event studies are built on an assumption that the event's impact is measured by the abnormal returns and overlapping event- and estimation windows would cause event's returns to influence the normal return measure of the market (MacKinlay, 1997, p. 20). After the estimation window is determined and its returns are calculated, the abnormal returns of the event window can be calculated.

Following figure (5) presents how different windows are formed in event studies. Highlighted by red color, t(0) represents the event date, and t(-1) the date the anticipation window begins. Similarly, t(0) to t(+1) represents the adjustment window, which ranges from the event date to the selected last day of the adjustment window. Therefore, together t(-1) to t(+1) generate the full event window. Estimation window begins from the selected date t(-2) and ends to the beginning of the anticipation window, that is t(-1). Thus, numbers in brackets do not represent a number of days from the event date, but the selected dates for different windows. Hence, a timeline for the estimation- and event window is formed followingly as of figure (5).

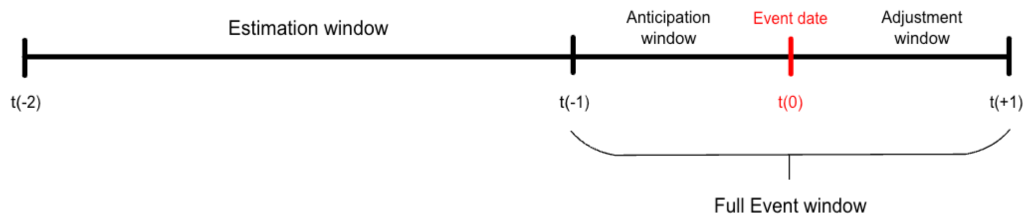

Figure 5. The Estimation- and Event Window.

2.3.1 Abnormal Returns

Abnormal returns can be calculated with multiple different methods and models (e.g. market adjusted-, constant return etc.), but in this thesis the abnormal returns are calculated through the CAPM equation (6), which is further adjusted to find the unexplainable abnormal return (Corrado, 2011, p. 210). The expression of μ_s in the equation (6) represents the error term, which has an expected value of zero. The focus is set on this specific variable, which in an event study is called the abnormal return. Corrado (2011) continues to re-arrange the CAPM equation to calculate the abnormal return followingly.

$$AR_0 = R_0 - (\alpha_s + \beta_s RM_0) \qquad (7)$$

AR_0 represents the abnormal return observed during a specific day, R_0 the actual realized return during a specific day, α_s is the Jensen's alpha obtained from the estimation window, β_s is the beta coefficient obtained from the estimation window and RM_0 the realized market return during the same day. Corrado (2011, p. 210) continues that the AR_0 obtained is the error term in equation (6), that is the unexplainable return. In equation (7), the AR_0 represents the return that remains when the CAPM expected return is subtracted from the actual realized return and can be either positive or negative.

MacKinlay (1997, p. 20) continues that the abnormal return is the disturbance term of the market that is calculated on an out of sample basis. To observe the overall influence of the event, all the calculated daily abnormal return observations must be aggregated. The aggregation can be two-dimensional, i.e. across securities or through time (MacKinlay, 1997, p. 21). When considering aggregation through time for an individual security, all event window daily abnormal returns are aggregated starting from the day one of the anticipation window, ending to the last day of the adjustment window. An aggregated abnormal return is called a cumulative abnormal return (CAR). In the equation (8), left-hand side $CAR_{(t-1\,,\,t1)}$ represents the sum product of aggregated individual daily abnormal returns from the full event window (MacKinlay, 1997).

$$CAR_{(\tau_{-1}\,,\,\tau_1)} = \sum_{\tau=\tau_{-1}}^{\tau_1} AR_{s\tau} \qquad (8)$$

In addition to the cumulative abnormal return (CAR) in equation (8), the average abnormal return (AAR) over the event window can be calculated (MacKinlay, 1997, p. 25). Calculation of the AAR enables a possibility to compare the daily average abnormal returns of the sample's assets. The AAR is calculated by accumulating the period's abnormal returns and dividing the sum product with the total number of observations. MacKinlay (1997, p. 24) states that the formula for the average abnormal returns is formed followingly with the equation (9). In the regression analysis of the methodology, the AAR variable is used to represent the past returns using the average abnormal returns of the anticipation window to measure its impact on the event window's return. This period is isolated from the estimation and event windows to control for the endogeneity and is further discussed in section 4.

$$AAR_{(\tau)} = \frac{1}{N} \sum_{i=1}^{N} AR_{i\tau} \qquad (9)$$

2.3.2 A nonparametric hypothesis test

To either accept or reject the first hypothesis of this thesis about the presence of negative CARs, it must be tested. Tests can be conducted either as parametric or nonparametric. The problem with parametric tests (e.g. power tests) is that they assume the distribution of the cumulative abnormal returns to be normally distributed (MacKinlay, 1997, p. 32). This may bias the test result when the returns are not normally distributed, and for the most cases, they are not, as in reality the return distributions are found to follow the Chebyshev distribution that is biased in either direction of the distribution's tails (Kihn, 2015). Also, the objective of the first hypothesis is only to determine the presence of negative CARs, which can be conducted with a nonparametric test.

A basic nonparametric test used in event studies is a sign test, when the probability of the positive or negative CAR is measured to accept or reject the hypothesis of their presence (MacKinlay, 1997, p. 32). The sign test evaluates whether the proportion of negative or positive CARs exceeds 50%, under the assumption that the abnormal returns are independent across all securities. A basis of the test is, that under the first hypothesis of this thesis, it is more probable that the observed firm-specific CAR is negative than positive. That is, under the H_1 $\rho \geq 0{,}5$ and the alternative H_{1a} $\rho \leq 0{,}5$ where $\rho = (CAR \leq 0{,}0\%)$. The test is simple and easy to conduct, as the requirement is to know the total sample of CAR observations (N), and the cases when the CAR is found to be negative (N^{-}). The test statistic θ_1 is calculated followingly (MacKinlay, 1997, p. 32).

$$\theta_1 = \left[\frac{\mathrm{N}^{-}}{\mathrm{N}} - 0{,}5\right]\frac{\sqrt{\mathrm{N}}}{0{,}5} \sim \mathrm{N}(0{,}1) \qquad (10)$$

The result of the equation (10) is asymptotic (MacKinlay, 1997, p.32). H_1 is rejected if $\theta_1 < \phi^1(1-\alpha)$, meaning that if the test statistic is lower than the critical value for one-tailed test from the standard normal distribution table (depending on the determined significance level α, e.g. 5% = 1,645). If it is found that $\theta_1 > \phi^1(1-\alpha)$, we fail to reject the H_1 and conclude that a statistically significant presence of negative CARs is found.

3 Literature review

To better understand why the Helsinki stock exchange may be sensitive to relations with Russia, the history between Finland and Russia must be understood. From the 13th century to 1809 Finland was a part of the Swedish Kingdom, but in 1809 Finland became a part of the Russian Empire as an autonomous region. Russian rule lasted up until 1917, when Finland declared its independence among the soviet revolution waged in Russia (Vihavainen, 2010). Vihavainen (2010, p. 190) continues, that the peace with the Soviet Union (former Russian Empire) lasted up until 1939, when the Winter War started when the Soviet Union attacked Finland. The Winter War lasted until March 1940, but the peace was temporary. Finland waged yet another war, the Continuation War, with the Soviet Union from 1941 to 1944. After the Second World War, Finland managed to remain as a sovereign country, whereas many of its neighboring countries (e.g. Baltic countries) were annexed to the Soviet Union (Vihavainen, 2010). However, the sovereignty did not come without a price tag. Finland had to pay a war debt of 300 million USD to the Soviet Union, which was mostly paid through a supply of different materials and industrial products (see Kortelainen, 2023). Kortelainen (2023) continues, that the war debt was fully paid back by 1952, but it had consumed approximately a third of Finland's annual expenditure each year. This established a trade partnership between Finland and Russia, which lasted through the 20th century until the beginning of the 21st century.

Before the Ukrainian crisis, Finnish companies had a variety of different business operations with Russia. In 2019, more than 2200 Finnish firms had business with Russia, but at the end of 2023, only 100 companies remained (Simola, 2024). Before Russia attacked Ukraine, it was a major trading partner for Finland. Each year, around 5,5% (3,9 billion €) of Finland's exports and 12% (7,9 billion €) of Finland's imports came from Russia (see Suomen Pankki, 2022). Hence, Russia was the fifth largest importer and the third largest exporter in the Finnish economy. Of all the European countries, Finland and the Baltic countries were the most exposed to Russia risk, since they had the largest percentual share of trade-partnership with Russia, when compared to the other EU countries. For instance, Finland and the Baltic countries had 10-12% of their annual import derived from Russia, while on average the other EU member countries had approximately 3% of their imports derived from Russia (Simola, 2024).

Russia's significance to the European Union and Finland also applies to the energy markets. Before Russia attacked Ukraine, and the European Union's economic sanctions were issued, Russia was an important supplier of energy to the EU, including Finland. In 2020, Russia supplied 47% of the solid fuel, 41% of the natural gas and 27% of the crude oil imported by the EU (Ahmed, 2023, p. 1079). Finland was also dependent on the Russian energy, since it imported 34% of its total energy consumption from Russia in 2021 (see Tilastokeskus, 2024). Finland's energy import from Russia dropped drastically by 16% to only 18% in 2022 in the aftermath of the Russia-Ukraine war. This declining trend continued, and in 2023 Finland imported only 7% of its energy from Russia. Energy that Finland imported from Russia consisted mainly of crude oil and electricity, which plays a vital role for some sectors, such as industrials (see Koskinen & Voutilainen, 2022).

3.1 Geopolitical risk and financial markets

When the political tensions between Russia and Ukraine escalated to an armed conflict in 24th of February 2022, it had major impacts on the financial markets in the EU. Obi et al. (2024) state that the most significant impact was the escalation of the geopolitical tensions in the European region, that had been present since April 2014, when Russia annexed the Crimea region, marking the beginning of the Crimean Peninsula crisis. Escalation of the geopolitical tensions caused a rapid incline in food costs due to disruptions in grain exports, since Ukraine was a major grain exporter in the EU and in the world. Additionally, fossil fuels supply and demand were disrupted which caused a rapid increase in the price per barrel of oil, which further increased the energy costs in the whole European region (Obi et al., 2023).

Although the immediate impact was seen on the energy and commodity markets, the impact of the Russia-Ukraine war also extended to the equity markets. Hasan et al. (2024,

p. 632) highlight that the geopolitical risk factors such as armed conflicts have a significant impact on the financial markets in a multiple way. They state that factors such as economic stability, trade relationships between countries, and investor sentiment are closely monitored by the market participants. Hence, geopolitical risk generates a high level of uncertainty, which further increases the market's volatility and disruptions (Hasan et al., 2024, p. 632). Specifically, they state that from all the different geopolitical risks, particularly armed conflicts are associated with increased volatility in the stock markets. They continue that during times of geopolitical disruptions, investors often seek refuge in safe-haven assets by re-investing their money into assets that are considered safer, for example to bonds, gold or currencies. This further draws liquidity from the equity markets and increases its volatility and price decline, causing a vicious cycle of increasing volatility and capital outflow to other asset classes. Hasan et al. (2024, p. 632) find that the Russia-Ukraine crisis had a significant impact on industries such as energy and agriculture, aligning with Obi et al. (2023). They further find that the impact of the war does not only affect the stock markets of the involved countries but also neighboring countries and countries that had economic ties with either side of the war-involved countries (Hasan et al., 2024, p. 632).

Hasan et al. (2024) find that armed conflicts impact the stock markets, but Schneider and Troeger (2006) examine what are the specific consequences of armed conflicts to the stock markets. They set their focus on the conflict between Iraq and the United Nations in 2003, and the civil war waged in former Yugoslavia in the 1990's. Their results (2006, p. 634) indicate that the stock market reactions and consequences to armed conflicts depend on the nature of the event, and rallies in the stock exchanges are found from certain types of conflicts. For instance, they find (2006, p. 635) that the operation of the UN in Iraq did not cause negative abnormal returns when the United States joined it to neutralize Saddam Hussein. In fact, the U.S. stock indices experienced a significant boost. Traders viewed that this conflictive event reduced the uncertainty in the market, and that the participation of the U.S. in the operation reduced the economic costs of the ongoing conflict. This finding is also supported by Guidolin and La Ferrara (2010, p. 675), as they find that not only did the U.S. stock indices experience a boost, but also the MSCI World Index. They find that the MSCI World Index increased ten percentage points during the first five weeks of the Iraq operation. Thus, cooperative conflict events are found to have a positive impact on the world stock markets (Schneider & Troeger, 2006, p. 634). However, Schneider and Troeger (2006) continue that when the conflict is considered highly severe and publicly visible, the stock market reactions are observed to be negative. For example, the civil war in Yugoslavia caused a negative impact on the world stock markets and was more pronounced in Europe than in the United States (Schneider & Troeger, 2006, p. 635). Although the armed operation in Iraq was found to have a positive impact on the stock markets, reactions to armed conflicts on stock markets are most often negative. The reaction is found to depend on what kind of outcome international traders expect form the crisis, and whether the crisis was anticipated or not. Schneider and Troeger (2006, p. 642) conclude that even in a modern integrated world economy, armed conflicts and international crises affect the stock markets differently, depending on the nature of the event and the sensitivity of the markets to the event.

Similar conclusions have been made from other geopolitical crises as well. Burdekin and Siklos (2022) examine the impact of the Cuban Missile Crisis on the stock markets of the United States, Canada and Mexico. They state (2022, p. 112) that the threat of a nuclear annihilation has never been as close as it was from October 16th to 28th in 1962, when the Soviet Union Premier Khruschev and the U.S. president Kennedy waged a heated cold war about the placement of the Soviet nuclear missiles in Cuba. Their findings (2022, p. 121) show that the U.S., Canada and Mexico experienced significant negative abnormal returns during the crisis period. The peak in negative abnormal returns is found from the October 23rd, 1962, when the President Kennedy held a television address about the ongoing crisis. Decline in all three stock indices began weeks, if not months, prior the crisis when uncertainty about the geopolitical tensions began to influence the stock markets. Their results (2022, p. 123) show, that the uncertainty in the United States had a significant negative spillover effect to the Canadian and Mexican stock markets. Change in daily abnormal returns from negative to positive in all three stock exchanges occurred after November 1962, when the crisis had been resolved, and the world dodged a nuclear bullet. Burdekin and Siklos (2022, p. 123) conclude, that the stock markets' response to this geopolitical crisis was significant. They state that the negative impact was caused by the nature of the crisis, since there is no financial strategy to hedge against a nuclear war outcome. This conclusion aligns with the findings of Schneider and Troeger (2006), who find that the nature of the event dictates the outcome in the stock markets.

Regarding the recent armed conflict events, Boungou and Yatié (2022) examine what were the observed market reactions to the Russia-Ukraine war on the world stock market returns. They examine the daily stock market data from 94 countries over the period from January to March 2022. They find (2022, p. 1) that the global stock markets reacted severely to Russia's attack on Ukraine. Although the most severe impact was caused by the attack itself, negative impact on the markets is found also from the weeks prior the attack, when the tensions between Russia and Ukraine tensed. They continue, that although these observed tensions impacted the market in advance, the response of the stock market indices around the globe were more pronounced starting from 24th of February 2022 when the invasion began. In addition, they find (2022, p.1) that the stock markets behaved worse in countries bordering Ukraine and in the United Nations countries that condemned the attack and issued economic sanctions against Russia. Boungou and Yatié (2022, p.3) further examine how the world stock markets reacted in pre-invasion and post-invasion period and find that the post-invasion reactions were significantly more negative. To better understand the global impact of the war, their findings indicate (2022, p. 3) that the negative impact during the post-invasion period was observed in all countries that condemned the attack (i.e. most of the UN countries, including Finland) and in the countries that remained neutral (e.g. China and South Africa). Nevertheless, the impact was found to be more severe in the condemning countries than in the neutral-remaining countries. To conclude, their findings (2022, p. 2) indicate a high sensitivity of the world stock markets to the Russia-Ukraine war, especially in the United Nations countries that condemned the attack.

As Schneider and Troeger (2006) find, the nature of the conflict dictates the outcome in the stock markets. Factors such as cooperation between nations and whether the conflict was anticipated or not impact how the stock markets are observed to behave. Although they find that the operation in Iraq had a positive impact on the stock markets, same does not apply to other armed crises presented in this chapter. A negative impact on the stock markets is found from the Yugoslavian civil war (Schneider & Troeger, 2006), the Cuban Missile Crisis (Burdekin & Siklos, 2022) and the Russia-Ukraine war (Boungou & Yatié, 2022). Regarding the findings of Boungou and Yatié (2022), negative impact on the world stock markets is found from the whole event window. Since Finland had a trading relationship between both war-involved countries, is a neighboring country to Russia and is also a part of the United Nations that condemned the attack, the expected result is that a broad negative impact is found on the Helsinki stock markets through negative CARs. Assuming by the findings of Boungou and Yatié (2022), the Helsinki stock exchange is likely to exhibit negative abnormal returns during the full examined period but being more severe during the adjustment window (post-invasion period) compared to the anticipation window (pre-invasion period).

3.2 Sectoral analysis

As previously discussed, Obi et al. (2023) and Hasan et al. (2024) find that the Russia-Ukraine crisis impacted the most energy and agriculture industries. What remains unanswered, is the specific reaction and behavior of different industries and sectors during the Russia-Ukraine crisis, and whether there is difference in the performance in terms of CARs. Ahmed et al. (2023) shed light on this question and examine the impact of the Russia-Ukraine war on the European stock markets, and how the sensitivity of the stock prices to the geopolitical risks differ across industries. As their data, they collect the daily prices for the STOXX Europe 600 index, which includes companies from various countries, industries and with varying sizes. The STOXX Europe 600 index includes a fixed number of 600 companies within Europe’s developed economies and represents around 90% of the investable market of the European Union (Stoxx, 2024). Then, Ahmed et al. (2023)

conduct an event study to measure the abnormal returns of the companies within the STOXX Europe 600 index and group them based on their sectors.

Findings of Ahmed et al. (2023, p. 1088) show, that out of eleven different industries, seven experienced statistically significant negative average abnormal returns during the event day. These sectors were the basic materials, consumer goods, healthcare, industrials, telecommunication, utilities and financial sectors. Out of these seven sectors, the most negatively affected was the consumer goods sector, which was driven by the turmoil in supply chains, rising production costs and concerns about the disruptions in global food production, aligning with the conclusions of Obi et al. (2023) and Hasan et al. (2024). Ahmed et al. (2023, p. 1088) find that the energy industry experienced positive average abnormal returns during the event day, albeit insignificant. Energy sector's positive abnormal returns increased during the post-attack period, which was driven by the increase in energy prices (e.g. crude oil and electricity).

Ahmed et al. (2023, p. 1092) continue, that during the post-attack period, the consumer goods and financials sectors were the most adversely impacted, while other sectors (i.e. basic materials, energy, healthcare, industrials, real estate, telecommunications and utilities) exhibited positive average abnormal returns. During the post-attack period, cumulative abnormal returns for the technology, healthcare and energy sectors remained positive. Further, in an extended post-attack period analysis (+25 trading days from the event date), the CARs of the basic materials, consumer goods, consumer services, financials and industrials sectors are found to be negative (Ahmed et al., 2023, p. 1113). Findings of Ahmed et al. (2023, p. 1092) indicate, that different sectors reacted differently to the Russia-Ukraine crisis. Hence, the stock market reaction to the Russia-Ukraine war is not uniform when the reaction is observed through different sectors. Results are different when viewed from the perspective of, for instance, the consumer goods and energy sectors, suggesting sectoral factors in the resilience.

Are there any winners during armed conflicts? Like with the findings of Ahmed et al. (2023), Hasan et al. (2024) find that during the Russia-Ukraine crisis the returns of the technology sector, and more precisely the Fintech sector, were positive. Hasan et al. (2024) examine how the Fintech sector's stock prices behaved compared to the traditional stock markets during Russia's attack on Ukraine. They examine the data from 28 different stock market indices and compare them to the returns of the Global X Fintech Exchange Traded Fund (ETF), serving as a benchmark for the Fintech sector. They find (2024, p. 647) that the traditional stock markets were significantly more volatile and had lower returns compared to the Fintech sector. Further, they find that the Fintech sector experienced positive returns during the whole event window, and that it did not exhibit any significant volatility. They state that this may be driven by the behavioral aspects through investors losing their confidence in traditional stock markets and seeking stability from the Fintech sector that is not disrupted by the same factors as the other industries are (Hasan et al., 2024, p. 650). They conclude (2024, p. 651) that the Fintech sector may serve as a resilient alternative during times when the geopolitical uncertainty affects the traditional sectors, such as the consumer goods and industrials sectors.

To conclude, the findings of the presented papers suggest that out of all industries, the energy, healthcare and technology sectors experienced positive returns during the Russia-Ukraine crisis post-attack period. As Obi et al. (2023) and Ahmed et al. (2023) find, the rising energy costs accelerated the positive abnormal returns of the energy sector. However, as Ahmed et al. (2023) find, the consumer goods sector experienced the most adverse returns, which was driven by the disruptions in supply chains and in the food production. When the findings of Hasan et al. (2024) are also considered, the expected result in Helsinki stock market returns is that the energy and technology sectors exhibit positive abnormal returns, whereas consumer goods and industrials exhibit negative returns. It should be noted that the Helsinki stock exchange is a smaller exchange than the major European stock exchanges. Thus, different factors may influence the cumulative abnormal returns in Finland, when compared to, for example, Germany or France. Also, the findings of Ahmed et al. (2023, p. 1097) account for the companies within the STOXX

Europe 600 index, and only 18 Finnish companies are represented in this index and thus within their sample data, limiting the generalizability to Finland. Therefore, given the nature of the Helsinki stock exchange and the lack of its presence in the discussed papers, the results in this thesis may slightly differ from the findings presented in this chapter.

3.3 Factors exposing companies to geopolitical risks

It was found that the stock indices around the globe reacted to the Russia-Ukraine crisis, some significantly heavier than others (e.g. neighboring countries to either side of the war as being found by Hasan et al., 2024). In addition, as being found by Ahmed et al. (2023), different sectors reacted differently to the Russia-Ukraine crisis, and the cumulative abnormal returns were significantly worse for the consumer goods sector when compared to, for instance, the energy sector. Yet, what remains unanswered is what specifically drives these observations, i.e. whether there are firm-specific characteristics within companies that expose them and furthermore their sector to the Russia-risk.

Abbassi et al. (2023) examine how the leading G7 stock indices reacted to Russia's attack on Ukraine with a sample of 531 individual companies. They construct a 235-day estimation window with a 14-day main event window and calculate individual companies' cumulative abnormal returns. After calculating the firm-specific abnormal returns, they conduct a cross-sectional regression with a set of firm and country specific variables, with the event window CAR being used as the dependent variable. The firm-specific variables used are the past returns, size, leverage, firm performance and book-to-market ratio (Abbassi et al., 2023, p.27). Additionally, the geopolitical risk index of the country and company's trade to country's GDP -ratio are used as country-specific variables.

Abbassi et al. (2023) find that from the different firm-specific variables, the size and book-to-market ratio explain the degree of observed negative CARs, suggesting that small companies consistently outperform larger ones, and that higher book-to-market possess higher risk to the Russia-Ukraine crisis (Abbassi et al., 2023, p.33). Book-to-market ratio is viewed as a proxy of the growth opportunities of the company, and war is expected to influence it. Additionally, they find that the past returns explain the observed CARs at a 1% significance level when the event window is extended, highlighting the momentum factor's presence in explaining the post-attack abnormal returns. However, it is worth noting that in the approach of Abbassi et al. (2023), the momentum variable's calculation period overlaps with the event window period, introducing a possible endogeneity concern and hence results regarding this variable need caution. The plausible endogeneity concern is mitigated in this thesis by isolating the period over which the momentum factor is calculated completely from the estimation- and event windows and is further discussed in section 4. Furthermore, the negative coefficient of the firm performance (return on assets) indicates that a higher ROA is associated with worse cumulative abnormal returns and vice versa (Abbassi et al., 2023).

Regarding the financial leverage, Abbassi et al. (2023, p. 33) find that it negatively drives the cumulative abnormal returns. They state that this indicates that companies with higher debt ratios are associated with worse returns compared to companies with lower debt levels. Abbassi et al. (2023) continue that this may be driven by the Russian government's decision to settle the debt owed to the enemy nations only in Russian rubles, which significantly weakened in value during 2022. Same conclusions about the leverage's impact are present in the findings of Bradford et al., (1997). They explicitly examine how transportation companies' abnormal returns behaved around the Iraq's invasion of Kuwait in 1990, and whether they can be explained through firm-specific variables. They also find that leverage had a statistically significant negative impact on the abnormal returns that companies experienced during the event window. From all the examined variables, leverage is found to be the most severe negative driver of the abnormal returns (Bradford et al., 1997, p. 202). However, regarding the approach of Abbassi et al. (2023), the measurement of leverage is problematic. They measure the leverage as total debt to total assets, which is not balanced between individual sectors. For instance, Titman and Wessels (1988, p. 2) find, that different company attributes, such as industry classification, materially impact the capital structure decisions of the company. For example, the leverage ratios of industrials and IT sector may exhibit fundamentally differing ratios due to fundamentally differing operating environments and business models. Hence, this plausible industry-issue is resolved by modifying the approach of Abbassi et al. (2023) by changing the measurement of leverage to allow for a more industry-balanced measurement method.

Martins, Correia and Cró (2023) investigate the Russia-Ukraine crisis impact specifically on the European tourism and hospitality sectors from the firm-specific characteristics point of view. They conduct an event study and as a sample use 165 listed companies from 21 different European countries (Martins et al., 2023, p. 9). As their explanatory firm-specific variables, they use the percentage of shares in possession of institutional investors and liquidity as measured by current assets to total assets ratio. Size, leverage and firm performance are also used as with Abbassi et al. (2023). Two country-specific variables are also included; a dummy for representing whether the country shares a border with Russia and another dummy variable representing whether Russian or Ukrainian tourists represent the TOP 5 in terms of the foreign inbound tourism flows (Martins et al., 2023, pp. 11-12). They find that the effect of the liquidity is positive and statistically significant, indicating that it provides an insurance value to investors against geopolitical risks that are otherwise challenging to hedge (Martins et al., 2023, p. 13). They state that geopolitical crises such as wars may negatively influence companies’ sales, thus companies with liquid assets tend to be better prepared to meet their cash obligations. They also find that the higher percentual share of institutional investors impacts the cumulative abnormal returns negatively (Martins et al., 2023, p. 15). They continue that this may be a result of institutional investors being better informed than other investors or having their focus set on the value maximization. However, the research by Martins et al. (2023) is limited to the tourism and hospitality sector, hence these results may not apply to other industries and may not be generalizable to the whole stock market.

When it comes to the size, firm performance and leverage, findings of Martins et al. (2023) are both in align and contradict to the findings of Abbassi et al. (2023). The size is found to have a positive and significant impact, indicating that the larger companies are less affected by the Russia-Ukraine crisis (Martins et al., 2023, p. 13). They continue that this may be explained by larger firms having more diversified businesses and possessing greater resources to withstand the crisis. However, this finding is contradictory to the findings of Abbassi et al (2023, p. 33) who find that size has a negative impact on the abnormal returns. Regarding the firm performance as measured by ROA, Martins et al. (2023, p. 13) find it to be negatively associated with abnormal returns, indicating that more profitable companies reacted more severely to the crisis than their less profitable competitors. This finding is also supported by the findings of Abbassi et al. (2023, p. 34). Lastly, Martins et al. (2023, p. 15) find that leverage has no significant impact on the abnormal returns, which differs from the findings of Abbassi et al. (2023) and Bradford et al. (1997). Differing results are likely to be explained by the differing focus of these papers. While Abbassi et al. (2023) focus on the whole indices, Bradford et al. (1997) focus explicitly on the transportation sector and Martins et al. (2023) on the tourism and hospitality sectors. Hence, findings are likely to differ based on the sector that is being examined, highlighting that the different sectors possess different risks.

Lastly, Martins, Correia and Gouveia (2023) investigate the Russia-Ukraine war impact on the European banks’ abnormal returns through an event study, totaling a sample of 100 banks within the European Union. They use a set of bank-specific explanatory variables, but also more generic firm-specific variables such as size, share of institutional investors, liquidity ratio, equity to total assets ratio and cost-to-income ratio. As the sample in this thesis excludes the financial institutions, the focus is set on the generic firm-specific characteristics that Martins et al. (2023) employ. They find (Martins et al., 2023, p. 9) that the size positively affects the abnormal returns, indicating that larger banks withstood the crisis better. Also, the share of the institutional investors is found to negatively drive abnormal returns, being in align with the findings regarding tourism and hospitality sector by Martins, Correia and Cró (2023). Liquidity ratio on the other hand is found to have no statistical significance in explaining abnormal returns (Martins et al., 2023, p. 10). Regarding the equity to total assets ratio, serving as a proxy of the firm's risk aversion and financial stability, they find (2023, p. 10) it to have a positive and significant impact, indicating that in the post-attack period the best performing companies are those who manage to maintain a better financial stability. Regarding the cost-to-income ratio, being measured by the total expenses over total generated revenue (operational efficiency variable), it is found to impact abnormal returns negatively (Martins et al., 2023, p. 10). This indicates that the companies with higher costs to generate income are more likely to experience inferior abnormal returns, compared to companies that generate more revenue with less expenses. Again, these findings are limited to a specific sector, hence differing results may emerge when the whole stock market is examined.

3.4 Conclusions from the existing literature and expected results

Based on the reviewed literature, geopolitical crises, particularly armed conflicts, do have a significant impact on the financial markets. Evidence from the research of Schneider and Troeger (2006), Burdekin and Siklos (2022) and Boungou and Yatié (2022) suggest that armed conflicts impact the stock markets severely. As being found by Hasan et al. (2024), the negative impact is not only limited to the stock markets of the war-involved countries, but the severe spillover effect is also found from the neighboring countries and countries that have economic ties with either side of the war waging countries. As being also found by Hasan et al. (2024), the most significant driver of the negative returns is found to be the rising uncertainty, which increases market's disruptions and volatility. Uncertainty causes investors to re-direct their investments into assets that are considered safer, drawing money from the equity markets and further increasing its volatility. However, the impact is found to materially differ between sectors. For instance, Ahmed et al. (2023, p. 1113) find, that the industrials and consumer goods experienced negative returns, and that the abnormal returns of the energy sector remained positive. Of all the sectors, technology and particularly the Fintech sector experienced the highest positive abnormal returns, as being found by Hasan et al. (2024).

Abbassi et al. (2023) find the size to be the negative driver of abnormal returns on the G7 indices, whereas Martins et al. (2023) find that size impacted positively the abnormal returns of the tourism and hospitality industries. Hence, this variable may have sector-specific effects. Also, the momentum factor in a form of past returns is found to significantly explain the returns experienced during the post-attack period, highlighting the impact of the investor sentiment and hence behavioral finance aspects (Abbassi et al, 2023). Nevertheless, the potential endogeneity concern of the approach of Abbassi et al. (2023) needs caution and further modifications to the model. Differing from the approach of Abbassi et al. (2023), this thesis completely isolates the period over which momentum is measured to control for its impact on the estimation- and event window's returns. Hence, results presented in this thesis may exhibit differing conclusions than those of Abbassi et al. (2023) due to actions taken to control for the endogeneity.

Furthermore, the financial leverage is found to have a negative impact on the cumulative abnormal returns by both Abbassi et al. (2023) and Bradford et al. (1997), although the evidence from Martins et al. (2023) is contradictory to this finding. To control for the industry-specific differences between companies and hence their capital structures, the problematic measurement of leverage by Abbassi et al. (2023) is changed. Instead of a total debt to total assets ratio, a debt-to-EBITDA ratio is employed to measure leverage and is further reasoned in section 4. Other firm-specific characteristics such as the ROA, book-to-market ratio, liquidity, financial stability and operational efficiency are also found to explain the event window's cumulative abnormal returns, although the presented papers have different points of focus (e.g. differing sectors or a full index), limiting the generalizability of the findings.

Given the fact that before the Russia-Ukraine war, more than 2200 Finnish companies had operations with Russia (Simola, 2024), and that Russia represented a significant portion of Finland's annual import and export (see Suomen Pankki, 2022), it is likely that the war also impacted the Helsinki stock exchange negatively. In addition, considering that Finland imported a lion's share of its energy from Russia (see Tilastokeskus, 2024), and that the Russia-risk is more relevant to highly energy intensive businesses (see Koskinen & Voutilainen, 2022), it is likely that the findings of Ahmed et al. (2023, p. 1113) of industrials sector experiencing negative CARs are also found from the industrials-dominated Helsinki stock market (see table 9, industrials are the most represented sector). To support this reasoning, Ahmed et al. (2023, p. 1100) also find that Finland experienced negative country-level abnormal returns during the post-attack period (-2,34% during a 3-day event window after the attack). Nevertheless, as stated earlier, only 18 Finnish companies are represented in their sample, limiting the generalizability.

Based on the reviewed literature, the expected result is that cumulative abnormal returns are found from all three event windows, both negative and positive, depending on the sector. The impact and relevance of the firm-specific characteristics is a tricky question. A clear gap in the existing literature is how these findings apply to Finland, since in all the presented papers about the impact of the Russia-Ukraine crisis, Finnish companies are hardly represented in the data. Nevertheless, it is expected that both the past returns (i.e. momentum) and size do have a significant impact on CARs in Finland, albeit in a case of the size variable the direction of the impact is debatable and may exhibit differing results. Also, it is expected that the firm performance (ROA), leverage, liquidity and book-to-market exhibit statistical significance in terms of explaining the cumulative abnormal returns of the event windows. However, given the limited representation of the Finnish companies in the examined papers and hence the gap in the literature, results may also suggest materially differing conclusions. The presented papers have fundamentally differing points of focus, hence the results from the Helsinki stock exchange may suggest materially differing findings.

4 Data & Methodology

The methodology of this thesis consists of two phases like with Abbassi et al. (2023) and Martins et al. (2023), i.e. conducting a traditional event study and further using the event window CAR as a dependent variable in the cross-sectional regression model. Like with the approach of Abbassi et al. (2023), this thesis uses one year before the event window as an estimation window to capture the normal dynamics and returns observed in the Finnish publicly listed companies, ranging from 18.1.2021 to 12.1.2022 (250 trading days). After that, a 30-day (trading days) anticipation window is used from 13.1.2022 to 23.2.2022 to capture the behavior of the Finnish stock market when Russia started to gather troops around the border with Ukraine, and the geopolitical tensions began to rise rapidly. The anticipation window also covers the impact of the media- and news coverage, and how investors reacted to the impending attack. However, this anticipation window is not included in the event window, as it is used to calculate the AAR, representing the momentum factor before the outbreak of the war. This period as a window over which momentum is determined is supported by the findings of Boungou and Yatié (2022), who find that the market began to react to the attack a few weeks in advance. Hence, including the period over which momentum is calculated to the event window would cause serious endogeneity concerns and potentially bias the results.

The event date used is the day the Russian troops crossed the border of Ukraine, that is the 24th of February 2022. After that three different event windows are constructed through three different length adjustment windows in a 30 trading-day steps. Hence, the event windows are 31-, 61-, and 91 trading-days long, respectively. Through using three different length event windows, the robustness of the findings can be controlled for (versus only using one event window). The usage of three different event windows enables a possibility to examine on what timeframe are the findings more pronounced, and whether the impact ceases or strengthens for specific variables when the timeframe is extended, and whether the significance of the variables shift.

Regarding the event windows, what differs to the approach of Abbassi et al. (2023) is the length. The focus of their research is on the immediate market reaction to the attack, but this thesis broadens the focus by extending the event window to also capture the impact of the economic sanctions. The impact of the sanctions cannot be measured if a similar length event window was used as Abbassi et al. (2023) employ. As the sanctions against Russia were placed in waves by both the U.S. and the EU, the market reaction explained by the firm-specific characteristics can be measured only by extending the event window, namely by extending the adjustment window. Therefore, event windows are longer ranging from 31 trading days to 91 trading days. Estimation window remains the same for all the event windows (i.e. from 18.1.2021 to 12.1.2022) to prevent event window returns from impacting the estimation window's returns. Thus, the difference between each event window is conducted by extending the adjustment window in a 30 trading day steps. As stated, the anticipation window is not included in the event window, as it serves as a period over which the momentum is measured and later used to explain the full event window's abnormal returns. This controls for a possible endogeneity.

4.1 Event windows

This thesis examines the impact of the Russia-Ukraine war on companies' abnormal returns through three different event windows. Anticipation window is not included in the event windows, as it is used to examine the momentum that formed weeks prior to attack. This window is also separated from the estimation window to control for a possible endogeneity and to isolate the estimation window's dynamics from the Russia-Ukraine crisis's uncertainty and disruptions. The anticipation window serves as its own window between the estimation- and event window to capture the rising uncertainty and investor sentiment. Hence, this isolation is necessary to control for the endogeneity. The anticipation window ranges from 13.1.2022 to 23.2.2022, totaling 30 trading days.

The shortest event window, that is 31 trading days long, aims to place more weight on the attack itself, rather than on the economic sanctions. After the event date (i.e. 24th of

February 2022), the adjustment window ranging from 25.2.2022 to 7.4.2022 captures the direct market impact of Russia's attack on Ukraine, totaling 30 trading days. Thus, the shortest event window consisting of the event date and adjustment window totals 31 trading days.

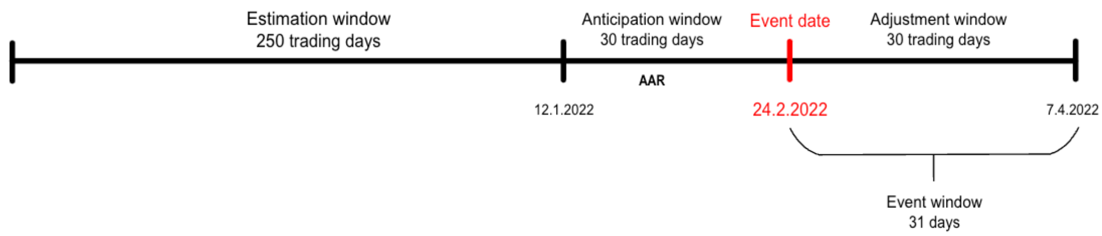

Figure 6. 31-day Event Window.

The second event window, that is 61 trading days long, ranges from 24.2.2022 to 23.5.2022. It includes the event date and an adjustment window of 60 trading days from 25th of February to 23rd of May 2022. This event window serves as a "hybrid" version between the shortest and the longest event windows. It aims to capture not only the impact of the attack itself, but also the effect of the economic condemnations and sanctions through extending the adjustment window with 30 trading days.

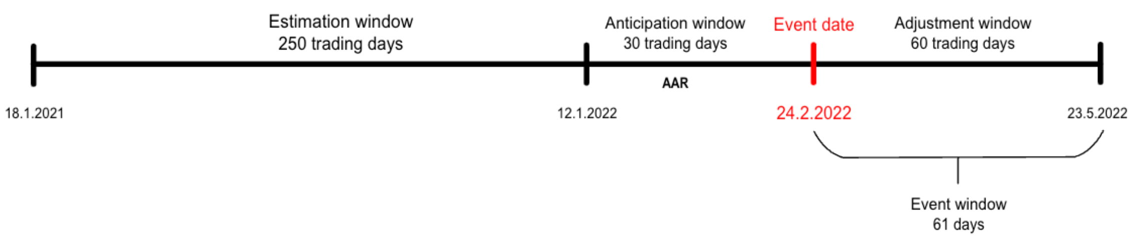

Figure 7. 61-day Event Window.

The third and the longest event window ranges from 24th of February 2022 to 6th of July 2022, totaling 91 trading days. The purpose of the longest event window is to capture the dynamics and the impact of the Russia-Ukraine crisis from a longer period, by placing more weight on the impact of the economic sanctions through a longer adjustment window. The 90-trading day adjustment window (25.2.2022 to 6.7.2022) covers multiple waves of economic sanctions by the U.S. and the EU. Thus, these three event windows of different lengths offer insights whether the observations change when timeframe is extended, and what firm-specific characteristics matter in different event windows.

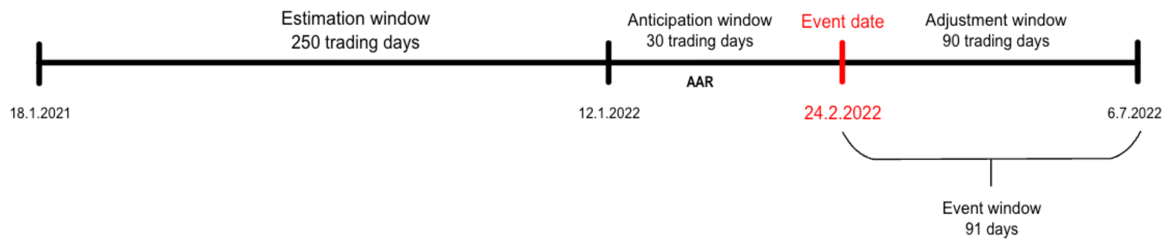

Figure 8. 91-day Event Window.

For all three event windows, the abnormal returns are calculated as of Corrado (2011) and MacKinlay (1997). The approach is the same that Abbassi et al. (2023) and Martins et al. (2023) use, that is the traditional event study methodology. First, the firm-specific logarithmic daily returns are calculated with the return index data, and then the daily abnormal returns are calculated with the equation (7) as of Corrado (2011, p. 210). Daily abnormal return observations are aggregated with the equation (8) as of MacKinlay (1997, p. 21) to find the event window's cumulative abnormal return (CAR).

4.2 Overview of the data

This methodology needs a variety of different data. For instance, the data for the benchmark, that is the OMX Helsinki Price Index, is needed to determine the abnormal returns of the companies. To calculate the abnormal returns, each publicly listed Finnish company daily return index data is needed for both the estimation- and event window dates.

Instead of daily closing prices, this thesis uses the return index data, that accounts for the corporate actions, which is preferrable as the event windows are relatively long. The return index accounts for the dividends, stock splits etcetera, and reflect the total performance of an investor holding the stock. Returns from which abnormal returns are determined are calculated by using logarithmic returns, as Hudson and Gregoriou (2015) find them being superior in event studies compared to arithmetic simple returns.

Regarding the company screening, a few screening criteria are used. Firstly, as financial institutions (e.g. banks and insurance companies) have a different type of balance sheet structure and business models, these entities are excluded from the sample. For instance, some of the variables (e.g. current assets) needed in the regression model cannot be calculated for the financial institutions or they differ fundamentally from other sectors. Hence, the financial entity screening excludes a total of 14 companies. The second screening criteria used is that only the listed companies that have the daily return index data available starting from the first day of the estimation window (i.e. 18th of January 2021) are included, excluding all companies that have been publicly listed after this specific date. In addition, companies that have defaulted during the estimation or event windows are excluded, i.e. the daily return index data must be available for the full period examined in this thesis. Lastly, the First North index listed companies are excluded. Using these screening criteria, the sample totals 113 publicly listed Finnish companies on the Helsinki stock exchange main list.

For the cross-sectional regression, that is used to explain the cumulative abnormal returns (CARs), multiple different firm-specific variables are needed. These variables are used as explanatory variables, through which the significance for the abnormal returns is determined. The financial statement data retrieved is from the financial statements of 2021, as its purpose is to explain the cumulative abnormal returns on the year 2022. Variables and data regarding them are further discussed and explained in the sub-chapter 4.3. Following table (1) presents the data, its abbreviation, description and source.

Table 1. Data description.

Data/variable	Abbreviation	Description	Data source
OMX Helsinki Price index (FI0008900006).	OMXHPI	Benchmark index needed for calculating the abnormal returns. Firm specific alpha and beta variables are calculated through benchmark index.	Nasdaq OMX Nordic database
Daily Abnormal return.	AR	Calculated with the equation (7) from the firm specific return index data using the OMXHPI closing data.	Datastream
Cumulative abnormal return.	CAR	Aggregated ARs for a specific window with the equation (8).	Datastream
AAR for 30 trading days before the attack.	Past	Measures the average abnormal return before the attack, representing the momentum factor. Calculated with the equation (9).	Datastream
Natural logarithm of the total assets.	Size	Measures the firm's size. Investigates whether small or large companies reacted differently.	Datastream
Debt-to-EBITDA ratio.	Leverage	Measures the degree of financial leverage. Investigates if the capital structure impacts the observed CARs.	Datastream
Return on assets.	Profitability	Net income over total assets. Measures the firm's performance and its impact.	Datastream
Book-to-market ratio.	BtM	Measures the difference between value and growth companies. Shareholders' equity over market capitalization.	Datastream
Current assets to total assets ratio.	Liquidity	Current assets over total assets. Measures the firm's liquidity's impact on the CARs.	Datastream
Equity to total assets ratio.	Stability	Measures the financial stability of the company. Shareholders' equity over total assets.	Datastream
Cost-to-income ratio.	Efficiency	Measures the operational efficiency of the company. Operating expenses over total revenue.	Datastream
Trade dependence ratio.	Russia	Measures the impact of the revenue derived from Russia. Revenue from Russia over total revenue. Investigates whether trade dependence with Russia impacts the CARs.	Bloomberg database, annual reports of 2021 & press releases

4.3 Cross-Sectional Regression model

This methodology employs the same cross-sectional regression model approach as Abbassi et al. (2023) and Martins et al. (2023), but the independent explanatory variables are modified and adjusted. Some of the variables that the previous literature employs do not suit the need of this thesis, since the focus is set on one stock market rather than across multiple exchanges or specific sectors in the EU. Regarding Abbassi et al. (2023), variables that are also employed in this thesis are the past returns, size, leverage, firm performance and book-to-market ratio. Other variables used by Abbassi et al. (2023 p. 27), i.e. geopolitical risk and trade-to-GDP ratio are excluded as they serve a function in comparing the returns on a cross-country and cross-index basis.

The past return variable is modified from the 20 trading-day average abnormal return (AAR) before the event day used by Abbassi et al. (2023, p. 27). Instead, a 30 trading-day AAR is used, representing the anticipation window's daily average abnormal return. This variable serves as a proxy for the momentum to investigate the impact of the investor sentiment over the event windows. This approach assumes that the anticipation window captures the price trends and behavioral patterns before the outbreak of the war, reflecting the market's expectations and reactions to the impending attack. The anticipation window provides a natural time window to investigate momentum, as it reflects the period when the geopolitical tensions escalated rapidly towards an armed conflict, and when the market participants began to react to the rising uncertainty. By focusing on this window, the AAR reflects how investors priced in the expectations before the event day, providing a measure for the momentum that formed during January to February 2022. This approach aligns with Boungou and Yatié (2022), who find that the market began to react to the attack a few weeks in advance. In addition, the usage of the anticipation window's AAR as a momentum measure aligns with the nature of the event study, where abnormal returns during the pre-event period can influence the post-event performance (Fama, 1998, p. 304). To control for the robustness and potential endogeneity concerns, the anticipation window is excluded from the event windows, serving only as a window over which the momentum factor is measured.

Additionally, the leverage variable is modified from the approach of Abbassi et al. (2023). In their paper, Abbassi et al. (2023, p. 27) use a total debt to total assets ratio as a measure for financial leverage. However, this variable may not serve as the most accurate measure of leverage, as capital structures differ across different sectors and may hence impact its effectiveness (Titman & Wessels, 1988, p. 5). Graham (2022, p. 2006) finds that most companies use a debt-to-EBITDA ratio for measuring leverage rather than debt-to-assets ratios. EBITDA stands for earnings before interest, taxes, depreciation and amortization. Graham states (2022, p. 2022) that the debt-to-EBITDA ratio quantifies the level of debt using cash-flow measures rather than asset-based measures. Therefore, the debt-to-EBITDA ratio does not counteract with the changes in the stock price, unlike the total debt to total asset ratio, where market capitalization serves as one of the inputs in total assets calculations (Graham, 2022). Hence, debt-to-EBITDA is a method to measure how much income a company can generate compared to its total debt, implying how much there is income available to pay down the debt. Thus, this thesis employs the debt-to-EBITDA ratio as an approach for financial leverage, rather than total debt to total assets ratio that Abbassi et al. (2023) use.

Based on the existing literature regarding the market reactions to the Russia-Ukraine war, three additional variables are introduced to enhance the effectiveness of the model. In their paper, Martins, Correia and Cró (2023) investigate the impact of the Russia-Ukraine war on the European tourism and hospitality industries. As one of the independent firm-specific variables, they employ the liquidity ratio and find it to be statistically significant in explaining the observed CARs (Martins et al, 2023, p. 14). Additionally, Martins, Correia and Gouveia (2023, p. 10) find the equity to total assets ratio, i.e. financial stability, and the operational efficiency ratio to be statistically significant in explaining CARs during the invasion event window. Operational efficiency measures the firm’s cost efficiency, where a lower value indicates a better cost management relative to revenue. Hence, the liquidity ratio, financial stability and operational efficiency are employed as additional explanatory variables in this regression model.

Furthermore, since economic sanctions impacted companies with operations in Russia, a variable measuring the trade dependence with Russia is incorporated. Trade dependence is measured as a firm's percentual revenue from Russia operations or subsidiaries to the total revenue. The data for this variable is not available from one source only (e.g. Bloomberg or Datastream). Hence, the data is gathered from both Bloomberg databases and manually collected from companies' annual reports of 2021 and press releases. The Bloomberg data is validated by cross-referencing firm's annual reports and press releases. Hence, this ratio ranges between 0 and 1, representing the share of the company's revenue derived from operations in Russia. It is worth noting, that all companies do not simply report these numbers in any format. Hence, this data may not be complete but represents the revenue from Russia to the extent that is available to retrieve from databases and public sources. This form of dependency assessment suits all sectors, since individual sectors may have their own unique dependencies to Russia (e.g. tourism inbound flow for tourism and hospitality sectors as found by Martins et al., 2023). This factor is not observed to be accounted for in any published papers of the Russia-Ukraine crisis and its impact on the stock markets, at least at the time when this thesis was conducted. Hence, this thesis contributes to the existing literature by examining how revenue from Russia's operations or subsidiaries impact the company's performance in the post-attack period, namely in Finland.

The model is constructed as follows. The firm specific event window's CAR is used as a dependent variable $\mathrm{CAR_i(EW)}$. Regarding the independent variables, *"Past"* represents the 30 trading-day AAR prior to the war (that is isolated from the event window CAR to control for the endogeneity). *"Size"* is measured as a natural logarithm of total assets, while *"Leverage"* is defined as the debt-to-EBITDA ratio. *"Profitability"* is measured through the return on assets ratio (ROA), and *"BtM"* represents the book-to-market ratio, investigating the difference between value- and growth stocks. *"Liquidity"* is measured as the current assets to total assets ratio, *"Stability"* represents the equity to total assets ratio, and *"Efficiency"* is measured using the cost-to-income ratio, representing the cost efficiency. Finally, *"Russia"* denotes the percentage of revenue derived from Russia to total revenue, serving as a proxy for the trade dependence. The regression model is estimated separately for each of the three event windows, represented as $CAR_i(EW)$ in the regression equation, while keeping the explanatory variables constant. Consequently, the regression model is estimated three times, each time using a different event window's CAR as the dependent variable. The model is by its nature in line with Abbassi et al. (2023), Martins, Correia & Cró (2023) and Martins, Correia & Gouveia (2023), who use firm-specific variables to explain the event window CARs. This model takes advantage of the previous literature's models in explaining event window CARs by combining their variables alongside with modifying a few to enhance the validity of the model (i.e. controlling for the endogeneity concern regarding the momentum factor and using sector-balanced measurement of leverage). The model is presented as follows.

$$\begin{aligned} \boldsymbol{CAR_i(EW)} = {} & \boldsymbol{\alpha_{ew} + \beta_1 Past_i + \beta_2 Size_i + \beta_3 Leverage_i + \beta_4 Profitability_i} \\ & \boldsymbol{+ \beta_5 BtM_i + \beta_6 Liquidity_i + \beta_7 Stability_i + \beta_8 Efficiency_i} \\ & \boldsymbol{+ \beta_9 Russia_i + \varepsilon_{ew}} \end{aligned}$$

5 Empirical findings

5.1 Descriptive statistics

Table 2. Cumulative Abnormal Returns descriptive statistics.

	Event (1)	Anticipation (30)	Adjustment (30)	Adjustment (60)	Adjustment (90)	EW(31)	EW(61)	EW(91)
Mean	-1,38 %	-3,57 %	2,70 %	-3,30 %	-5,49 %	1,32 %	-4,68 %	-6,87 %
Median	-1,15 %	-3,07 %	1,88 %	-2,83 %	-6,88 %	1,15 %	-3,31 %	-6,14 %
Standard Deviation	0,042	0,126	0,186	0,196	0,259	0,191	0,204	0,267
Variance	0,002	0,016	0,034	0,038	0,067	0,037	0,042	0,071
Kurtosis	0,937	2,449	33,820	4,948	4,606	27,174	3,758	4,229
Skewness	-0,052	-0,392	4,184	0,731	0,526	3,459	0,466	0,258
Range	25,08 %	80,11 %	195,27 %	146,29 %	204,24 %	202,88 %	149,79 %	211,28 %
Minimum	-12,83 %	-53,53 %	-46,66 %	-51,07 %	-86,95 %	-59,49 %	-59,78 %	-99,20 %
Maximum	12,25 %	26,59 %	148,60 %	95,22 %	117,29 %	143,39 %	90,01 %	112,07 %
Sum	-1,562	-4,035	3,048	-3,731	-6,206	1,486	-5,293	-7,768
Count	113	113	113	113	113	113	113	113

Table (2) presents the descriptive statistics for the cumulative abnormal returns across the event windows and sub-periods examined in this thesis. The mean and median CARs reveal that first during the 31-day event window companies experienced positive returns, compared to the 30-day anticipation window that precedes it where returns are found to be generally negative. However, the 61-day event window exhibits negative mean and median CARs, which further worsens during the 91-day event window. This trend indicates that on average the Finnish stock market experienced prolonged negative CARs in response to the Russia-Ukraine war. Regarding the observed standard deviation, it is found to increase as the event window extends, suggesting that the uncertainty in abnormal returns increased over time. The maximum and minimum CAR observations indicate that some companies experienced substantial positive abnormal returns, whereas some companies experienced extremely severe CARs (particularly during the 91-day event window). Together the increase in the standard deviation with the extreme maximum and minimum observations indicate a prolonged and negative impact.

The skewness of the event windows ranges from a 3,46 (31-day EW) to 0,26 (91-day EW). The positive skewness, particularly during the 31-day event window, suggests that some companies experienced exceptionally high CARs, whereas the near zero skewness in the longer event windows implies a more symmetric return distribution over time. The high skewness of the 31-day event window is supported by a high kurtosis value of 27,17, indicating that the return distribution exhibits long tails, i.e. extreme positive and negative returns occurred more frequently than under a normal distribution. However, kurtosis approaches a normal distribution when the event window extends from the 31-day event window towards the 61- and 91-day event windows but still suggests a presence of wider tails than would be present under a normal distribution. These conclusions are also supported by the maximum and minimum observations during each window.

Descriptive statistics of the event window CARs reveal that the initial market reaction to the Russia-Ukraine crisis was volatile. Market participants priced in the expectations of the war during the anticipation window where the mean and median CARs are found to be negative, which seems to have corrected during the 31-day event window when returns are observed to be positive. However, as the time progressed, CARs turned to negative which suggests a prolonged negative impact driven by the war's progression and economic sanctions. The presence of long tails and a high skewness during the 31-day window suggests a significant variation between the responses of the companies, indicating that some firms experienced significant returns while some firms faced substantial losses. Nevertheless, the negative mean and median CARs during the 61- and 91-day event windows suggest that the Russia-Ukraine crisis had an overall negative effect on the Finnish stock markets.

Table 3. Firm-specific variables descriptive statistics.

	Past	*Size*	*Leverage*	*Profitability*	*BtoM*	*Liquidity*	*Stability*	*Efficiency*	*Russia*
Mean	-0,12 %	12,954	3,904	4,48 %	0,494	0,463	0,403	0,958	3,22 %
Median	-0,10 %	12,715	1,860	5,35 %	0,407	0,476	0,411	0,944	0,00 %
Standard Deviation	0,004	2,041	20,224	0,089	0,434	0,198	0,279	0,208	0,080
Kurtosis	2,449	-0,284	104,347	7,632	2,595	-0,602	32,808	47,393	13,378
Skewness	-0,392	0,353	10,014	-2,009	0,572	0,092	-4,261	5,842	3,472
Range	2,67 %	10,192	230,013	64,36 %	3,065	0,873	2,656	2,095	49,08 %
Minimum	-1,78 %	8,617	-17,124	-41,17 %	-1,211	0,063	-1,782	0,633	0,00 %
Maximum	0,89 %	18,809	212,889	23,19 %	1,854	0,936	0,874	2,728	49,08 %
Sum	-0,135	1463,783	441,201	5,067	55,820	52,324	45,487	108,293	3,641
Count	113	113	113	113	113	113	113	113	113

Table (3) presents the descriptive statistics of the independent explanatory variables in the regression analysis, i.e. the firm-specific characteristics data, and reveals insights into the data. For instance, the past returns exhibits both negative mean and median values, suggesting a slightly negative average abnormal returns for the companies during the anticipation window. However, the skewness of -0,39 indicates a distribution that is skewed to the left, suggesting that the negative AARs are more common than positive AARs. Regarding size, the mean and median values suggest that the data is symmetrical, with a slight variability in the data through a standard deviation of 2,04. Leverage exhibits difference between a mean of 3,9 and a median of 1,86, highlighting the skewed distribution of 10,01. This indicates that most of the companies are low leveraged, but some have an extremely high leverage ratio. This suggestion is also supported by a kurtosis of 104,34, indicating a presence of extreme outliers. The profitability variable is highly peaked, as suggested by a kurtosis of 7,63 and relatively close mean and median values, indicating that the data is clustered around the mean with possible extreme outliers.

Regarding Book-to-Market ratio (BtM), that is a proxy of value versus growth companies, the mean and median values of below 0,50 indicate that the sample is growth-stock dominated, with fewer companies meeting the value stock criteria of high book-to-market ratios. Liquidity variable has a balanced distribution indicated by a close mean and median values. The negative kurtosis of -0,6 indicates a slightly left-skewed distribution, i.e. some relatively lower values are found in the sample. However, stability has a distribution exhibiting extreme outliers, as indicated by a high kurtosis of 32,8. Stability's outliers are skewed to the left tail as being indicated by a skewness of -4,26, suggesting that the outliers are extremely low observations. Opposite to the stability, the cost-efficiency ratio exhibits a long right-tail with extreme outliers (kurtosis of 47,4 and skewness of 5,8). Since this ratio is interpreted as the lower the value the better the cost management is, this implies that the outliers are companies with extremely poor cost management and their costs approach or surpass the total revenue.

Lastly, regarding the trade exposure to Russia, denoted as "Russia", a mean of 3,2% and a median of 0% indicate that most of the companies have little to no revenue derived from Russia. Variability in trade exposure is low, as suggested by the standard deviation of 0,08. Skewness of 3,47 and kurtosis of 13,37 indicate that some companies are found as outliers with a significant exposure to Russia through a revenue derived from Russia.

Table 4. Firm-specific variables correlation matrix.

	Past	*Size*	*Leverage*	*Profitability*	*BtoM*	*Liquidity*	*Stability*	*Efficiency*	*Russia*
Past	1 -	0,188** (2,020)	0,086 (0,913)	0,063 (0,666)	0,240*** (2,605)	-0,160* (-1,708)	0,108 (1,145)	-0,128 (-1,360)	-0,176* (-1,880)
Size	0,188** (2,020)	1 -	0,040 (0,423)	0,281*** (3,088)	0,231** (2,504)	-0,153 (-1,627)	0,139 (1,474)	-0,227** (-2,456)	-0,093 (-0,984)
Leverage	0,086 (0,913)	0,040 (0,423)	1 -	-0,039 (-0,414)	0,179* (1,917)	0,124 (1,317)	-0,037 (-0,389)	-0,033 (-0,353)	-0,040 (-0,426)
Profitability	0,063 (0,666)	0,281*** (3,088)	-0,039 (-0,414)	1 -	0,074 (0,777)	0,122 (1,297)	0,654*** (9,111)	-0,714*** (-10,759)	-0,067 (-0,702)
BtoM	0,240*** (2,605)	0,231** (2,504)	0,179* (1,917)	0,074 (0,777)	1 -	-0,062 (-0,654)	0,367*** (4,151)	-0,073 (-0,768)	-0,050 (-0,524)
Liquidity	-0,160* (-1,708)	-0,153 (-1,627)	0,124 (1,317)	0,122 (1,297)	-0,062 (-0,654)	1 -	0,145 (1,543)	-0,135 (-1,436)	0,174* (1,862)
Stability	0,108 (1,145)	0,139 (1,474)	-0,037 (-0,389)	0,654*** (9,111)	0,367*** (4,151)	0,145 (1,543)	1 -	-0,419*** (-4,856)	0,036 (0,378)
Efficiency	-0,128 (-1,360)	-0,227** (-2,456)	-0,033 (-0,353)	-0,714*** (-10,759)	-0,073 (-0,768)	-0,135 (-1,436)	-0,419*** (-4,856)	1 -	-0,024 (-0,248)
Russia	-0,176* (-1,880)	-0,093 (-0,984)	-0,040 (-0,426)	-0,067 (-0,702)	-0,050 (-0,524)	0,174* (1,862)	0,036 (0,378)	-0,024 (-0,248)	1 -
Significance levels		***: 1 %		**: 5 %		*: 10 %			

Table (4) presents the correlation matrix, in which the number in brackets is the t-statistic calculated for each correlation value, giving insights into the statistical significance of the observed correlation. Stars represent the p-value, providing additional input to the significance evaluation. Correlation matrix of the firm-specific characteristics suggests that no extreme multicollinearity is present in the data. The strongest correlation is observed to be between the profitability and efficiency (-0,71 at a 1% significance), which might suggest some level of multicollinearity, but is later tested with a Variance Inflation Factor test. What this matrix reveals, is that more stable firms are more profitable (correlation of 0,65 and significance at a 1%), and that larger firms tend to have a higher book-to-market ratios (correlation of 0,23 and significance at a 5%). Also, a negative correlation reveals that more profitable firms are also more cost-efficient (-0,71), since with the efficiency variable a higher value means less cost efficient (costs relative to revenue). Hence, the negative correlation indicates that the better the cost management of the company is, a more profitable it is. Same applies to the efficiency and stability (-0,42 and a significance at a 1% level): more stable firms tend to be more cost-efficient. Lastly, the correlation of -0,17 between Russia and past returns indicates that companies that had a greater trade exposure to Russia had slightly lower abnormal returns during the anticipation window compared to companies that had no operations in Russia. This is supported by the significance at a 10% level, suggesting that this observation has statistical significance.

5.2 Hypothesis test

The sign test serves as a method to conclude whether a statistically significant presence of negative CARs is found from the sample or not, to either accept or reject the H_1. The sign test is conducted with the equation (10), with a 10%, 5% and 1% significance levels. Following table (5) presents the test statistics for all three event windows, and critical values for different significance levels from a standard normal distribution table.

Table 5. The sign test statistics.

EW	θ_1	α(10%)*	α(5%)**	α(1%)***
EW(31)	*-0,847*	*1,282*	*1,645*	*2,326*
EW(61)	*1,411**	*1,282*	*1,645*	*2,326*
EW(91)	*1,976***	*1,282*	*1,645*	*2,326*

The 31-day event window yields a value of -0,85, 61-day event window 1,41 and 91-day event window a value of 1,98. When these are compared to the critical values, it is found that we fail to reject the H_1, suggesting that a statistically significant presence of negative CARs is found on the Helsinki stock market around Russia's attack on Ukraine. However, this is found to depend on the event window's length. The 31-day event window shows statistical insignificance at every significance level, and through a negative value suggest that positive CARs are more common than negative CARs. However, the 61- and 91-day event windows exhibit a statistical significance. The 61-day window shows significance at a 10% significance level, whereas the 91-day window at a 5% level. Hence, H_1 is accepted, and it is concluded that the presence of negative CARs is statistically significant when the event window is extended from the 31-day event window to a 61- or 91-day event window. The acceptance of H_1 is also supported when the event window descriptive statistics are examined on the table (2). Together with the sign test's findings of significant presence of negative CARs, the negative mean and median values suggest a prolonged and significant negative impact of the war, namely during the longer windows.

5.3 Cross-Sectional analysis

Table 6. Regression analysis results.

	EW(31)			EW(61)			EW(91)		
Variables	**Coefficient**	**T-stat**	**P-value**	**Coefficient**	**T-stat**	**P-value**	**Coefficient**	**T-stat**	**P-value**
Intercept	0,144	0,825	0,411	-0,042	-0,245	0,807	0,110	0,483	0,630
Past	14,616***	3,535	0,001	17,129***	4,195	0,000	27,116***	5,036	0,000
Size	-0,022**	-2,548	0,012	0,006	0,717	0,475	-0,005	-0,456	0,649
Leverage	-0,001	-1,085	0,280	-0,002***	-3,019	0,003	-0,004***	-3,331	0,001
Profitability	0,692**	2,046	0,043	0,050	0,149	0,882	0,194	0,440	0,661
BtoM	0,082*	1,850	0,067	0,115***	2,610	0,010	0,097*	1,683	0,095
Liquidity	-0,146*	-1,672	0,098	-0,151*	-1,750	0,083	-0,218*	-1,911	0,059
Stability	-0,044	-0,499	0,619	-0,045	-0,524	0,602	-0,051	-0,444	0,658
Efficiency	0,213*	1,865	0,065	-0,012	-0,102	0,919	0,012	0,081	0,936
Russia	-0,340	-1,601	0,113	-0,444**	-2,118	0,037	-0,366	-1,325	0,188
R^2	0,268			0,374			0,361		
Adjusted R^2	0,204			0,319			0,305		
F-statistic	4,183			6,838			6,470		
Standard Error	0,171			0,168			0,222		
Observations	113			113			113		
Significance levels	***:1 %			**: 5 %		*: 10 %			

Regression analysis reveals interesting results and trends. When focusing on the shortest event window (i.e. 31 trading days), it is found that the model explains 20,4% of the variance in the dependent variable (event window CAR) through an adjusted R square of 0,204. When the focus is set on the explanatory variables, several variables exhibit statistical significance. The most important of them is found to be the past returns at a 1% significance level, aligning with the findings of Abbassi et al. (2023). This finding provides evidence of the momentum phenomenon explaining the event window CARs. That is, the AAR experienced before the war significantly explains the event window's abnormal returns. This finding is also by its nature in line with the conclusions of Fama (1998, p. 304), who finds that pre-event returns may influence the post-event performance. Hence, investor sentiment priced into the asset before the outbreak of the war influenced the trend after 24th of February 2022, when the invasion began.

At a 5% significance level, several variables are significant. First, size has a negative coefficient of -0,022, suggesting a negative impact on the abnormal returns. This indicates that a larger size is associated with negative abnormal returns, implying that smaller companies overperformed to larger companies. This finding aligns with the findings of Abbassi et al. (2023), but contradicts the findings of Martins, Correia and Cró (2023). Another variable at a 5% significance level is the profitability. Coefficient of 0,69 indicates a positive impact on the abnormal returns, suggesting that companies with higher return on assets experienced higher CARs compared to companies with a lower ROA. This finding contradicts both Abbassi et al. (2023) and Martins, Correia and Cró (2023) who find profitability to have a negative impact on the abnormal returns. This differing finding may be driven by the nature of the crisis combined with the differing point of focus of this thesis, compared to the existing literature. For instance, this thesis focuses on the Helsinki stock exchange, which has more close relations with Russia (e.g. geographically) compared to companies reviewed in the existing literature. Different characteristics of the Helsinki stock exchange may be the driver of the differing results.

Lastly, at a 10% significance level, the book-to-market, liquidity and efficiency variables are found to explain the cumulative abnormal returns. Book-to-market ratio and efficiency are found to have a positive relationship with the CARs. Regarding book-to-market ratio, findings indicate that value stocks (higher BtM) experienced better abnormal returns whereas growth stocks (lower BtM) lower returns. The finding of efficiency is interesting, since a higher ratio indicates a poorer cost management, it suggests that during the shortest event window, a higher cost-to-income ratio correlated positively with the abnormal returns, which is contradicted to findings of Martins, Correia and Gouveia (2023). Lastly, liquidity has a marginally negative impact on CARs, suggesting that companies with a higher liquidity ratio experienced worse abnormal returns, which is a contradictory finding. This may be explained by firms with higher liquidity ratios being concentrated in sectors that are more exposed to geopolitical risks and is further discussed in table (10).

When focusing on the 61-day event window, the explanatory power of the model is further enhanced to an adjusted R square of 0,32. It is found that at a 1% significance level, past returns remain as a significant variable with an even higher coefficient of 17,13. In addition, leverage (debt-to-EBITDA) is found to correlate negatively with the CARs at a 1% significance level. Its negative coefficient suggests that a higher financial leverage negatively affected the CARs during the event window, which is in line with the findings of both Abbassi et al. (2023) and Bradford et al. (1997). Findings about the book-to-market ratio remain the same but is enhanced to a 1% significance level compared to a 10% significance level during the 31-day event window. When it comes to a 5% significance level, the trade dependence with Russia is introduced. This variable has almost a 10% significance level during the 31-day event window (0,11) but now exhibits a strong p-value of 0,037. A negative coefficient of -0,44 suggests that during the medium-length event window, the trade dependence with Russia had a negative impact on the abnormal returns. This aligns with the implementation of the economic sanctions during the 60-day adjustment window, which affected companies with exposure to the Russian markets. At a 10% significance level only the liquidity variable exhibits statistical significance, and the interpretation remains the same as with the 31-day event window.

Lastly, during the 91-day event window the explanatory power is slightly decreased to an adjusted R square of 0,305, although surpassing the 31-day event window's explanatory power. The impact of the past returns at a 1% significance level suggests that the most significant driver of the abnormal returns during all event windows is the momentum phenomenon driven by the investor sentiment. Also, the negative impact of the leverage variable remains at a 1% significance level. This remains in align with the findings of Abbassi et al. (2023) and Bradford et al. (1997), suggesting that the leverage explains CARs during longer event windows. At a 10% significance level, two variables are found to be significant: the book-to-market ratio and liquidity. Coefficients remain the same as being found earlier, suggesting a similar impact as discussed previously.

Hence, it is found that the impact of the variables shifts with the event window, demonstrating time-dependent effects. Although the findings are similar during each window (e.g. variables with persistent explanatory power), some variables lose their explanatory power whereas some are introduced only during the longer event windows (i.e. leverage). Some of the findings regarding the Finnish stock market align with previous literature (e.g. Abbassi et al., 2023 & Martins et al., 2023), while some are contradictory. In general, the findings are similar to those in the previous literature, with some exceptions. This may be explained by the different area of focus of the previous literature, smaller size of the Finnish markets, or the geographical distance to Russia and hence differing exposure. Finnish stock market may have characteristics that are not present in the G7 indices examined by Abbassi et al. (2023) or European tourism & hospitality sectors examined by Martins et al. (2023), hence causing slightly differing results.

Based on the findings presented in table (6), the findings do not materially change between the event windows, but few variables indicate highly time-sensitive effects. The past returns, book-to-market and liquidity are found to explain abnormal returns across all event windows, suggesting a persistent impact on the companies' performance around Russia's attack on Ukraine. As stated, some variables are time sensitive, e.g. trade dependence with Russia is only significant during the 61-day event window and nearly significant during the 31-day window, but deeply insignificant during the longest 91-day event window. Additionally, leverage is relevant only during the medium- and long-term event windows but irrelevant during the shortest, suggesting that the capital structure of the company has a limited impact during the immediate aftermath of the war. Hence, the results highlight an evolving nature of the market reactions to armed conflict events, where certain factors are relevant only during certain time windows.

5.4 Robustness check

To assess the validity of the regression model, a series of robustness checks is conducted. The purpose is to evaluate whether the model satisfies the key regression assumptions, e.g. the linearity, homoskedasticity and independence of errors. First, residual plots are presented and analyzed, and then Durbin-Watson test and VIF analysis are conducted.

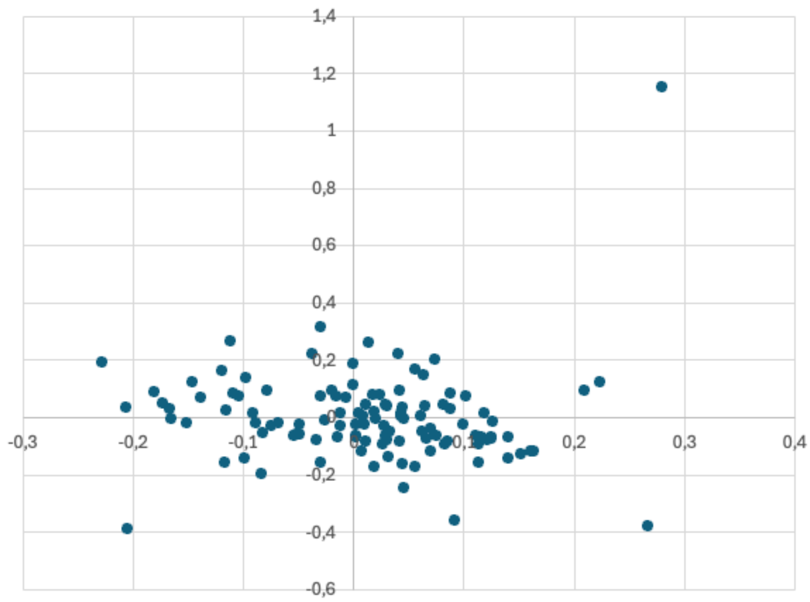

Figure 9. 31-day Event Window residual plot.

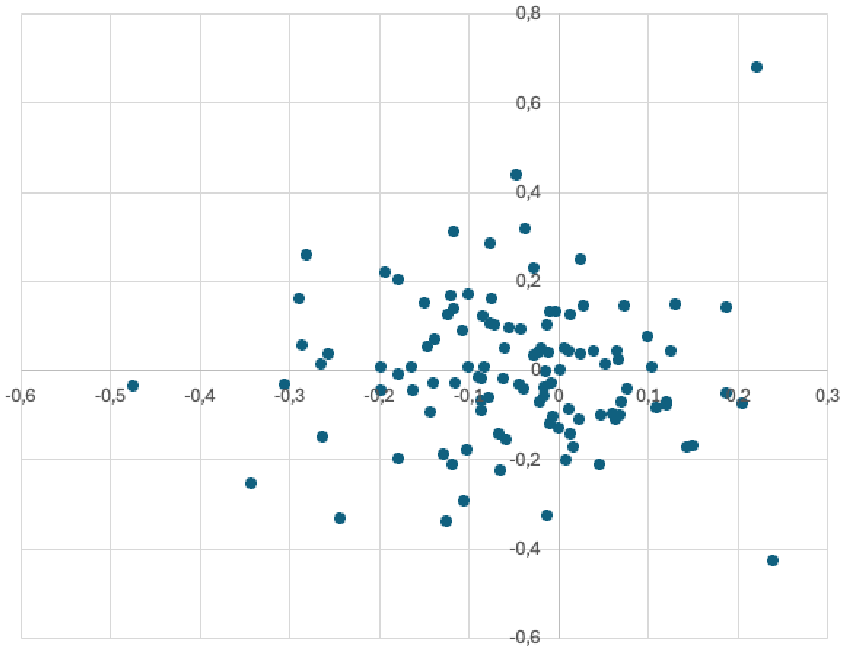

Figure 10. 61-day Event Window residual plot.

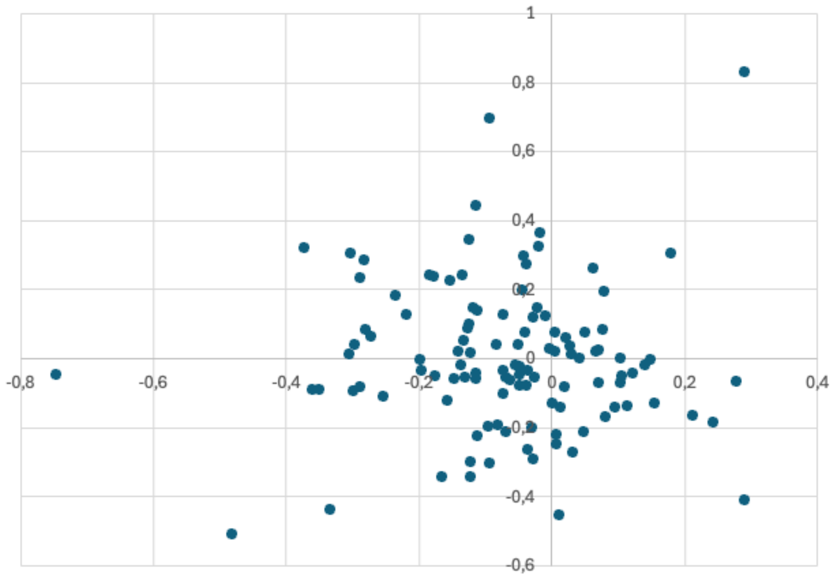

Figure 11. 91-day Event Window residual plot.

Residual plots of the event windows do not exhibit a clear systematic pattern, suggesting that the linearity assumption is satisfied. As there are no clear patterns, it indicates that a linear regression model is sufficient for explaining the CARs experienced around the

Russia-Ukraine war. However, minor signs of heteroskedasticity are present, particularly during the 31-day event window, in which the residuals exhibit a slightly increasing spread as the values increase or decrease. Nevertheless, during the 61- and 91-day event windows the variance of the residuals is more stable, as they exhibit a clearer randomness and are concentrated around zero. Hence, the residual spread increases with the event window's length, suggesting that the variance of the CARs increases as the event window is extended.

Regarding outliers, a few extreme residuals are present in each event window, suggesting a presence of potentially influential points (i.e. companies with extreme positive or negative CARs). However, these do not appear to dominate the distribution of the residuals, and their presence is consistent with all three event windows. Additionally, as discussed about the linearity assumption, no observable patterns are observed in the residual plots, suggesting that strong autocorrelation is not present in the data. This indicates that the errors are independent, which satisfies one of the key assumptions of a regression analysis, i.e. the independence of errors. To further confirm the absence of autocorrelation, a Durbin-Watson test is conducted.

The Durbin-Watson test statistic (DW) is a test for the residuals of a regression analysis, that determines whether autocorrelation is present within the residuals. The value ranges between 0 and 4, where a value below 2 indicates a positive autocorrelation, and from 2 to 4 a negative autocorrelation. Hence, a value of around 2 indicates that the sample has no autocorrelation. The DW statistic is calculated for each event window's residuals by summing the squared differences between consecutive residuals and dividing this sum by the total sum of squared residuals (Durbin & Watson, 1951, p. 161). The Durbin-Watson test statistics are presented in the following table (7).

Table 7. Durbin-Watson test.

Event window	Durbin-Watson value	Interpretation
31-day	1,53	Moderate positive autocorrelation.
61-day	1,84	Weak positive autocorrelation.
91-day	1,77	Weak positive autocorrelation.

In this context, as the event window's CAR represents a single point in time, the DW captures whether residuals within the cross-section of the companies are systematically related. The Durbin-Watson test statistics suggests a moderate positive autocorrelation during the 31-day event window, as the DW statistic is notably below the ideal value of two (1,53). The 61- and 91-day event windows indicate a weak positive autocorrelation and approach the ideal value. This suggests that during the shortest event window, ab-normal returns are not purely random but follow a slight pattern (as being found in figure 9). Longer event windows exhibit weaker autocorrelation, suggesting that the plausible abnormal return patterns disappear as the time progresses, making residuals more in-dependent. Test result conclusions are supported when observing the residual plot graphs in figures (9) to (11), where the 31-day event window exhibits slightly increasing spreads, and the 61- and 91-day event windows exhibit a more independent pattern.

Lastly, to test for the multicollinearity, the Variance Inflation Factor (VIF) is calculated for each independent variable. The presence of a high multicollinearity may invalidate the results of a regression analysis and hence is a crucial test for any linear regression model (Salmeron et al., 2018, p. 2365). Range for the VIF is determined as 1,0 to 2,5 being low multicollinearity, 2,5 to 5,0 representing a moderate multicollinearity and a value of 5,0 to 10,0 indicates a severe multicollinearity (Johnston et al., 2018, p. 1958). The Variance Inflation Factor values are presented in the following table (8).

Table 8. Variance Inflation Factor (VIF) Analysis.

Variable	R^2	VIF	Interpretation
Past	0,134	1,16	Low multicollinearity
Size	0,185	1,23	Low multicollinearity
Leverage	0,080	1,09	Low multicollinearity
Profitability	0,711	3,46	Moderate multicollinearity
BtM	0,301	1,43	Low multicollinearity
Liquidity	0,133	1,15	Low multicollinearity
Stability	0,569	2,32	Low to moderate multicollinearity
Efficiency	0,539	2,16	Low to moderate multicollinearity
Russia	0,089	1,10	Low multicollinearity

The VIF analysis indicates that multicollinearity is not a concern in this linear regression model, since all VIF values remain below 5,0. The highest VIF is found for the profitability variable (3,46), followed by a stability of 2,32 and efficiency of 2,16. Given that the profitability and efficiency exhibited a correlation of -0,71 in the correlation matrix presented in table (4), this level of multicollinearity is expected. All other variables have VIF values below 2,5, indicating low correlation with other variables. Hence, no evidence of multicollinearity distorting the regression coefficient estimates is found, suggesting that the interpretation of the results remains valid. To test for the potential impact of the profitability variable, the models are run without it. The result is that the explanatory power during the 31-day event window is slightly decreased (0,20 to 0,18) and slightly increased during the 61- and 91-day event windows (0,319 to 0,326 and 0,305 to 0,311, respectively). All the signs of the estimates remain the same. Hence, despite of the moderate VIF value for the profitability variable, it does not distort the model or its estimates.

The robustness checks indicate that the regression model remains structurally valid and interpretable, despite of some statistical concerns. The linearity assumption is satisfied, and although heteroskedasticity is present to some extent during the shortest event window, it is not severe enough to invalidate the results. Also, a moderate positive autocorrelation is observed through a Durbin-Watson analysis during the 31-day event window. Additionally, a slightly moderate multicollinearity is found for some variables through a VIF analysis, but since it remains at a moderate level, no evidence is found suggesting that the variable interaction would materially bias the coefficient estimates. Overall, the regression results remain stable with all event windows despite of some discussed potential issues. Hence, the model can be considered robust and valid, while simultaneously considering the discussed potential issues.

5.5 Discussion & findings

The objective of this thesis is to find whether Russia's attack on Ukraine affected Finnish publicly listed companies' abnormal returns, and to what extent did firm-specific characteristics explain those observed returns. Regarding the objective, the first research question is to find how abnormal returns of the Finnish publicly listed companies behaved during the event windows surrounding Russia's attack on Ukraine. Hence, a hypothesis H_1 is formulated as "statistically significant presence of negative cumulative abnormal returns is found from the event windows compared to the estimation window.". In the sub-chapter 5.2 it was concluded through a sign test that the H_1 was accepted, as the presence of the negative CARs exhibit a statistical significance. The shortest event window exhibits insignificance, whereas the medium-length and long event windows exhibit significance at a 10% and a 5% significance levels, respectively.

Acceptance of H_1 is also supported when observing the event window descriptive statistics in table (2). The event window mean and median values first exhibit positive returns but then turn to negative. Mean of 1,32% during the 31-day event window decreases to a mean of -4,68% during the 61-day event window, and further worsens to a -6,87% during the 91-day event window. This suggests that the initial reaction to the attack was generally positive, which may be explained by behavioral aspects. The negative returns during the anticipation window (mean of -3,57%) suggests that investors priced in the attack before it started, and the market corrected these pricings in the immediate aftermath of the attack. However, the impact of the sanctions and the war's progression caused the mean returns to turn to negative during the 61- and 91-day event windows, suggesting a prolonged negative impact. Further analysis is conducted to find how did specific sectors react to the Russia-Ukraine crisis, and whether some sectors exhibit higher resilience. Table (9) regarding the sector specific CARs is presented to further analyze the presented findings. Industry codes for each company are retrieved from the Datastream, which are used to group the sample into ten different sectors to examine mean CAR observations.

Table 9. Mean sector specific abnormal returns.

		EW(31)	*EW(61)*	*EW(91)*
Sector	**n**	**Mean CAR**	**Mean CAR**	**Mean CAR**
Industrials	34	-3,79 %	-10,09 %	-13,96 %
Consumer Services	25	-2,53 %	-7,34 %	-6,25 %
Technology	15	3,87 %	-8,70 %	-9,84 %
Basic Materials	12	23,18 %	18,42 %	8,18 %
Consumer Goods	9	-4,57 %	-11,63 %	-12,02 %
Health Care	9	1,81 %	-3,64 %	-2,42 %
Telecommunications	4	6,52 %	5,51 %	1,88 %
Financials	2	-4,41 %	-4,72 %	-6,48 %
Utilities	2	-8,44 %	-3,82 %	-10,66 %
Energy	1	28,81 %	39,23 %	60,36 %
All companies	113	1,32 %	-4,68 %	-6,87 %

As discussed in the literature review, Ahmed et al. (2023, p. 1113) find that a negative impact in the STOXX600 index companies was experienced in the consumer goods, consumer services and industrials sectors. The findings presented in table (9) support these conclusions, as the same reaction is observed in Finland. As Finland imported a lion's share of its energy from Russia (see Tilastokeskus, 2024), the negative effect of the war seems to impact the sectors that are more energy intensive, e.g. industrials. Both Obi et al. (2023) and Ahmed et al. (2023) also find that the energy sector experienced positive CARs due to rising energy costs, which is also found on the Helsinki stock market, although the number of observations is only one company, limiting the generalizability. In addition, Ahmed et al. (2023) and Hasan et al. (2024) find that the technology sector experienced positive CARs. This is partly found on the Helsinki stock market, since the technology sector exhibits positive returns during the 31-day event window but turns to severely negative in the longer event windows. As the Helsinki stock market is a significantly smaller market than those observed by Ahmed et al. (2023) and Hasan et al. (2024), it was expected that the results may differ in Finland. Nevertheless, the results do not materially differ and for the most part align with the findings of the previous literature, at least when it comes to the most severely affected sectors. Hence, it is found that the worst returns in Finland are experienced in the consumer goods, industrials and utilities sectors, and the highest returns in the energy and basic materials sectors, suggesting notable differences between sectors.

The second research question of this thesis examines which firm-specific characteristics are most relevant in explaining the cumulative abnormal returns and whether their importance shifts depending on the event window's length. To address this, the second hypothesis H_2 is formulated as: "Firm-specific characteristics of the Finnish publicly listed companies explain the abnormal excess returns observed during the event windows". Based on the presented results, it is concluded that the firm-specific characteristics play a significant role in explaining CARs, leading to the acceptance of H_2. Key finding is that the past returns, book-to-market ratio and liquidity ratio exhibit consistent significance across all event windows, indicating their persistent impact on market reactions to the Russia-Ukraine crisis. Although some variables demonstrate time-sensitivity, results do not materially differ between the event windows. Same explanatory characteristics are present in each event window, and few are truly time-dependent (i.e. leverage and trade dependence with Russia). For the most part, results align with the previous literature, e.g. Abbassi et al. (2023) and Martins et al. (2023). The differences in results, for instance regarding the ROA variable, may be driven by the different geographical focus, differing data and overall different characteristics of the observed markets (e.g. Finnish stock market versus the G7 indices or European-wide sectoral analysis).

During the 31-day event window, the explanatory variables are found to be the past returns, book-to-market ratio, liquidity, size, profitability and efficiency. Additional significant variables arise in the 61-day event window, introducing the leverage and trade dependence with Russia, suggesting that the capital structure of the company and the economical exposure to the war-waging country are highlighted over a longer time window. During the 91-day event window alongside with the persistent variables, leverage remains significant at a 1% significance level, while other variables lose their explanatory power. Hence, the significance of some variables evolves over time, and the more event window expands, the less explanatory variables are found. This may be a statistical result as longer event windows increase the variance of the CARs (e.g. see figure 11), or that the effects are sector-driven impacting the results of different event windows. Table (10) presents the mean values of the explanatory variables grouped by sectors, offering insights into the presented regression results in table (6).

Table 10. Mean sector specific explanatory variables.

Sector	n	Past	Size	Leverage	Profitability	BtoM	Liquidity	Stability	Efficiency	Russia
Industrials	34	-0,290 %	12,685	8,414	3,961 %	0,428	0,556	0,342	0,999	5,077 %
Consumer Services	25	-0,102 %	12,641	2,227	4,812 %	0,547	0,423	0,422	0,956	2,776 %
Technology	15	-0,101 %	11,133	0,822	3,194 %	0,172	0,467	0,318	0,943	1,996 %
Basic Materials	12	0,292 %	14,735	1,852	6,872 %	0,906	0,358	0,523	0,907	1,850 %
Consumer Goods	9	-0,268 %	13,749	2,564	4,475 %	0,754	0,426	0,483	0,963	6,347 %
Health Care	9	0,068 %	12,669	0,935	3,413 %	0,306	0,486	0,490	0,959	1,111 %
Telecommunications	4	-0,080 %	15,285	1,968	6,443 %	0,492	0,374	0,426	0,892	0,500 %
Financials	2	-0,083 %	12,639	3,776	2,155 %	0,747	0,175	0,404	0,850	0,000 %
Utilities	2	-0,315 %	16,081	8,649	2,982 %	0,458	0,498	0,208	0,962	0,403 %
Energy	1	-0,134 %	16,331	0,678	14,315 %	0,210	0,505	0,564	0,908	0,000 %
All companies	113	-0,12 %	12,954	3,904	4,48 %	0,494	0,463	0,403	0,958	3,22 %

As stated earlier, an interesting finding is that the liquidity variable has a negative impact on the abnormal returns, remaining as a significant explanatory variable persistently across all event windows (see table 6). This finding contradicts the basic financial theories, that liquidity offers a buffer to shocks in a company's operating environment. However, table (10) reveals an explanation to this finding. It was concluded that from all the sectors, the industrials, consumer goods and utilities experienced the worse CARs consistently in all event windows. Table (10) reveals that the liquidity ratio exhibits the highest mean value in the industrials sector, which is also the most represented sector in the sample through 34 observations. When the number of observations of the industrials sector is combined with the findings that this sector experienced the most adverse returns and that the liquidity represents the highest mean value in this sector, the negative impact of the liquidity appears to be sector driven. Same finding applies to the utilities and consumer goods sectors. This suggests that a higher liquidity ratio is concentrated in sectors that are more exposed to geopolitical risks, hence exhibiting a negative coefficient in the regression results table (6).

Further, it is found that some explanatory variables shift when the event window is changed, suggesting time-sensitive effects. For instance, the financial leverage is observed to significantly impact the CARs during the 61- and 91-day event windows (at a 1% significance level) but shows insignificance during the shortest 31-day event window. This finding aligns with prior literature (i.e. Abbassi et al., 2023, and Bradford et al., 1997), suggesting that highly leveraged companies are vulnerable to geopolitical crises, especially on a longer time window. Trade dependence with Russia nearly exhibits significance at a 10% level during the 31-day event window but increases to a 5% significance level in the 61-day event window. This pattern suggests that the trade exposure to Russia initially plays a role in explaining share price reactions to the Russia-Ukraine crisis, but its significance weakens over time (as being found to be a deeply insignificant variable during the 91-day event window). This indicates that the Finnish stock market slowly adjusted to the new geopolitical reality, or that the trade exposure was offset by another economic factors that are not included in the regression analysis.

Overall, these results strengthen the findings from the existing literature, e.g. Abbassi et al. (2023) and Martins et al. (2023), which highlights the varying importance of the firm-specific characteristics to geopolitical risks over different time windows. Also, the sectoral findings of Ahmed et al. (2023) are supported by the findings presented in table (9), as different sectors exhibit different CARs within the Helsinki stock market. The presence of the momentum factor throughout all event windows suggests that market participants' reactions to the Russia-Ukraine crisis were influenced by prior share price movements, indicating that behavioral patterns are associated with geopolitical shocks. These insights contribute to the understanding of how firm-specific characteristics influence market reactions during geopolitical crises and highlight the importance of time-dependent effects when assessing company's exposure to geopolitical shocks.

Hence, the financial resilience of the company, as being measured by the company's share price reaction to the crisis (Pagano et al., 2023), seems to depend on multiple factors. Based on the regression results, companies that are resilient during the 91-day event window may not be considered resilient during the 31-day event window and vice versa. This suggests that the resilience is relative to the time window over which it is determined, indicating that it may not be a company trait but a result of a changing investor perception and market sentiment. In addition, what seems to matter is the sector of the company. Table (9) reveals that different sectors exhibit different levels of resilience, and table (10) further suggests that the impact of a specific variable is sector-dependent, suggesting that the factors that matter also differ between sectors. Therefore, the resilience of the company to geopolitical risks cannot be calculated or determined straightforward, but requires an examination of its sector, fundamentals and an analysis of the market sentiment around the event. In addition, as some of the findings presented in this thesis differ from the existing literature (e.g. Abbassi et al., 2023 & Martins et al., 2023), it can be concluded that the factors that matter across broad indices (e.g. G7 indices) or in a specific cross-country sector (e.g. tourism and hospitality sectors), do not necessarily matter when observing one stock market of an individual country. Hence, the resilience to geopolitical risks has multiple dimensions and factors that affect it, that materially differ between countries, sectors and indices. Therefore, there does not exist a single formula for a geopolitical resilience.

5.6 Practical implications

Although the presented findings may apply specifically to Russia-related crises and only within Finland, several practical implications for the market stakeholders can be concluded. First, investors may find these findings useful, as the presence of the momentum phenomenon is found to significantly impact the returns during each event window. When geopolitical tensions begin to increase, investors should monitor the share price movements and trends of individual companies closely. Under the findings of this thesis, the companies that experience price decline when the tensions begin to increase, are more likely to continue declining when the tensions escalate. Vice versa, the shares that remain stable or experience a price increase, are likely to demonstrate resilience or even outperformance when the crisis escalates. These suggestions align with Fama (1998), who finds that pre-event returns may continue during the post-event period. This indicates that technical analysis may offer useful insights around armed conflict events, especially before the rising tensions escalate. Nevertheless, this suggestion does not align with the Efficient Market Hypothesis, as the past information should already be included in the share price, and predictable patterns like this should not exist (Fama, 1970, p. 388).

Second, considering both the investors and other company stakeholders, such as managers, the findings suggest that geopolitical shocks have firm-specific impacts, even when the company has no relations to either side of the war-involved countries, aligning with the conclusions of Hasan et al. (2024). Fundamental analysis of the company plays a crucial role in assessing the firm-level vulnerability to Russia-related shocks. For instance, under the findings of this thesis, a higher book-to-market ratio provides additional resilience to share price reactions, whereas a higher financial leverage correlates negatively with the abnormal returns. The analysis of the company's fundamentals also includes the sectoral analysis, as it is found that specific sectors are more vulnerable to armed conflict crises, such as the industrials, consumer goods and utilities sectors. Regarding the industrials sector, it appears to be more Russia-risk exposed sector, potentially due to its energy intensity as being concluded by Koskinen and Voutilainen (2022). In addition, the supply chain disruptions that Ahmed et al. (2023) find to impact the

STOXX600 index appear to also impact the consumer goods sector negatively in Finland. These suggestions indicate that company managers should put effort into the business continuity planning by diversifying the energy sources and supply chains. Securing the company's operational capabilities around geopolitical shocks enhance the operational resilience of the company by ensuring that the sudden shocks in its operating environment do not materially harm its business. Hence, company managers should not neglect the geopolitical risk scenario analysis and must ensure that the energy politics and supply chains are accounted for in the business continuity planning.

Lastly, from the perspective of the government officials, the findings indicate that Finland is vulnerable to geopolitical crises even when not directly involved in the conflict. This highlights the importance of a national resilience planning. For instance, the sectors most affected by the crisis appear to be highly exposed to energy and supply chains disruptions. It is essential that government officials ensure that the energy politics do not depend too much on any single country as it did in 2021, when Finland imported 34% of its total energy consumption from Russia (see Tilastokeskus, 2024). Hence, government officials should assess the critical economic dependencies, e.g. energy and logistics, that could cause disruptions during a shock event. Although assessing and reducing these dependencies may come at a significant cost, it raises a broader question: is long-term economic resilience worth more than short-term cost savings? This thesis suggests that the answer should be yes. Therefore, government officials should prioritize reducing the over-reliance to geopolitically risky and unpredictable countries, such as Russia, and through this enhance Finland's economic independence and resilience.

6 Conclusions

This thesis investigated the impact of the Russia-Ukraine war on Finnish publicly listed companies by conducting an event study with three different event windows: 31-, 61- and 91 trading day event windows, respectively. Furthermore, a cross-sectional regression model was employed to assess the impact of different firm-specific characteristics on the firm-specific cumulative abnormal returns (CARs). This methodology aimed to answer two key research questions of this thesis: how did Finnish publicly listed companies react to the Russia-Ukraine war in terms of the CARs, and what firm-specific characteristics explain those observed returns.

Regarding the first research question of the war's impact on the CARs, the findings confirm that the Russia's attack on Ukraine had an adverse impact on Finnish publicly listed companies' abnormal returns, but the degree of the impact is found to vary across event windows and sectors. The results align with prior literature (e.g. Hasan et al., 2024 & Ahmed et al., 2023), which finds that the Russia-Ukraine crisis had a negative impact on the stock markets. Regarding the second research question of the role of the firm-specific characteristics, it was found that certain firm-specific factors consistently impacted the abnormal returns, whereas some exhibited time-dependent effects. The momentum factor (past returns), book-to-market ratio and liquidity emerged as persistent explanatory variables across all event windows, while other variables, such as leverage and trade dependence with Russia, exhibited statistical significance only in specific event windows. These findings align with the previous literature (e.g. Abbassi et al., 2023 & Martins et al., 2023) on firm-specific factors explaining CARs during the Russia-Ukraine crisis.

A key finding is that the reaction of the Finnish publicly listed companies was not uniform, highlighting the importance of the company's sector and firm-specific factors in determining the financial resilience to geopolitical shocks. Some sectors experienced significant positive CARs, whereas some adverse negative returns. This suggests a sectoral difference in the resilience to geopolitical shocks. Also, the momentum factor played a significant role in post-attack abnormal returns, suggesting that the investor sentiment plays a vital role in the post-attack trends and returns. Overall, this thesis contributes to the broader literature on geopolitical risk and stock market reactions by demonstrating how firm-specific characteristics matter in terms of abnormal returns. In addition, this thesis contributes to filling the existing literature gap regarding the Finnish stock market and its sensitivity to geopolitical shocks, particularly its sensitivity to Russia-risk. The results are useful for investors, company stakeholders and government officials, highlighting the importance of the assessment of the company's fundamentals, time window, and sectoral exposure when managing the risk exposure to geopolitical shocks. Findings suggest that the investors may benefit from technical analysis of the companies around armed conflict events, and that company managers should consider the energy and supply chain dependencies in the business continuity planning.

6.1 Limitations and future research

Although this thesis provides valuable insights, some limitations should be acknowledged. First, the exclusion of financial institutions from the sample limits the generalizability of the findings. Hence, future research could address this gap by extending the analysis to include financial institutions to examine the broader market reaction. Second, the choice of the event windows acts as a limitation. Although they are designed to capture the short-, medium-, and long-term effects, they may not fully reflect the long-term economic consequences of the Russia-Ukraine crisis on the Finnish stock market. Future research could extend the post-attack analysis to provide insights into how companies reacted and adjusted over time, and whether the Russia-Ukraine crisis has long-term consequences that can be observed over a longer period.

Third, although the prior literature supported the selection of the firm-specific variables, macroeconomic factors were not included in the regression model. As a result, the war's impact is not isolated from the broader macroeconomic changes and developments. Future research could include external macroeconomic factors into the model, such as changes in inflation or interest rates, to better isolate the impact of the Russia-Ukraine war on stock market returns. For instance, highly leveraged companies may be sensitive to the changes in interest rates, that were not accounted for in the regression model. For example, the 12-month Euribor rate increased from -0,477% in January 2022 to 0,992% in July 2022, that may have impact on the companies with a high debt-to-EBITDA ratio (see Suomen Pankki, 2025). Including these factors could further offer insights into the interplay between geopolitical crises and firm-level vulnerabilities.

Lastly, this thesis focused specifically on the Russia-Ukraine crisis, which may have unique characteristics. Although the findings presented in this thesis may be applicable to other armed conflict crises, the generalizability to different types of geopolitical crises, such as trade wars, remains unclear. Since Finland has a rather unique relationship with Russia, the findings may be applicable only to Russia-related shocks and only within the Finnish stock market. Hence, future research could focus on different types of geopolitical crises and different regions to test whether similar firm-level vulnerabilities are found on other crises and regions. For instance, a cross-country analysis between the Nordic and Baltic countries could reveal whether geographic distance to Russia plays a significant role in the observed stock market reactions and whether the relevance of the firm-specific characteristics change depending on the country.

6.2 Final remarks

This thesis sheds light on how firm-specific characteristics impact the stock market performance and abnormal returns in Finland around the Russia-Ukraine war, contributing to the existing gap in the literature. Additional contribution is provided by the trade dependence variable (revenue derived from Russia), that was not observed to be accounted for in the existing literature at the time when this thesis was conducted. Findings indicate that the investor sentiment and firm-specific factors, such as book-to-market ratio and financial leverage, are key determinants of the stock market performance and financial resilience during armed conflict events. Some variables are found to be persistent, while some demonstrate time-sensitivity. Although this thesis confirms the importance of the firm-specific characteristics, it also introduces future research questions about the impact of the broader macroeconomic factors and long-term observations in the aftermath of the Russia-Ukraine crisis.

The current U.S. President Donald Trump's administration's intentions to limit the monetary and military aid to Ukraine and its actions to force Zelenskyi to negotiate a peace treaty with Russia continue to cast a dark shadow over Europe (see Shalal & Hunder, 2025). The volatile politics of the Trump's administration indicate that the geopolitical uncertainty continues to be a critical factor for the global financial markets. Hence, the understanding of the interplay between firm-specific characteristics and geopolitical shocks remains as a valuable area of research. Market participants, company stakeholders and government officials must continue to adapt to the changing and increasingly unpredictable geopolitical landscape. Although the invasion of Ukraine is an attack towards a civilized modern world, lessons from this crisis can be taken to enhance the resilience of the EU to other geopolitical turmoil that may emerge in the future. The global geopolitical events that have taken place in the 2020's suggest that the world as we knew it may have ceased to exist, and that the new themes for the upcoming decade may be national security, preparation and resilience.

References

Abbassi, W., Kumari, V., & Pandey, D. K. (2023). What makes firms vulnerable to the Russia–Ukraine crisis? *The journal of risk finance, 24*(1), 24-39. https://doi.org/10.1108/JRF-05-2022-0108

Adams, A., Booth, P., Bowie, D., & Freeth, D. (2003). *Investment Mathematics* (1st ed.). Wiley. ISBN: 978-0-471-99882-2

Ahmed, S., Hasan, M. M., & Kamal, M. R. (2023). Russia–Ukraine crisis: The effects on the European stock market. *European financial management : the journal of the European Financial Management Association, 29*(4), 1078-1118. https://doi.org/10.1111/eufm.12386

Ayala, J., García-Torres, M., Noguera, J. L. V., Gómez-Vela, F., & Divina, F. (2021). Technical analysis strategy optimization using a machine learning approach in stock market indices. *Knowledge-based systems, 225*, 107119. https://doi.org/10.1016/j.knosys.2021.107119

Boungou, W., & Yatié, A. (2022). The impact of the Ukraine–Russia war on world stock market returns. *Economics letters, 215*(215), 110516. https://doi.org/10.1016/j.econlet.2022.110516

Bradford, B. M., & Robison, H. (1997). Abnormal returns, risk, and financial statement data: The case of the Iraqi invasion of Kuwait. *Journal of Economics and Business, 49*(2), 193-204. https://doi.org/10.1016/S0148-6195(97)81515-9

Bunnenberg, S., Rohleder, M., Scholz, H., & Wilkens, M. (2019). Jensen's alpha and the market-timing puzzle. *Review of financial economics, 37*(2), 234-255. https://doi.org/10.1002/rfe.1033

Burdekin, R. C., & Siklos, P. L. (2022). Armageddon and the stock market: US, Canadian and Mexican market responses to the 1962 Cuban Missile Crisis. *The Quarterly review of economics and finance, 84*, 112-127. https://doi.org/10.1016/j.qref.2022.01.013

CHAN, L. K. C., JEGADEESH, N., & LAKONISHOK, J. (1996). Momentum Strategies. *The Journal of finance (New York), 51*(5), 1681-1713. https://doi.org/10.1111/j.1540-6261.1996.tb05222.x

Corrado, C. J. (2011). Event studies: A methodology review. *Accounting and finance (Parkville), 51*(1), 207-234. https://doi.org/10.1111/j.1467-629X.2010.00375.x

DURBIN, J., & WATSON, G. S. (1951). TESTING FOR SERIAL CORRELATION IN LEAST SQUARES REGRESSION. II. *Biometrika, 38*(1-2), 159-178. https://doi.org/10.1093/biomet/38.1-2.159

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of finance (New York), 25*(2), 383. https://doi.org/10.2307/2325486

Fama, E. F. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of financial economics, 49*(3), 283-306. https://doi.org/10.1016/S0304-405X(98)00026-9

Gaur, A., Settles, A., & Väätänen, J. (2023). Do Economic Sanctions Work? Evidence from the Russia-Ukraine Conflict. *Journal of management studies, 60*(6), 1391-1414. https://doi.org/10.1111/joms.12933

GRAHAM, J. R. (2022). Presidential Address: Corporate Finance and Reality. *The Journal of finance (New York), 77*(4), 1975-2049. https://doi.org/10.1111/jofi.13161

Guidolin, M., & La Ferrara, E. (2010). The economic effects of violent conflict: Evidence from asset market reactions. *Journal of peace research, 47*(6), 671-684. https://doi.org/10.1177/0022343310381853

Hasan, F., Al-Okaily, M., Choudhury, T., & Kayani, U. (2024). A comparative analysis between FinTech and traditional stock markets: Using Russia and Ukraine war data. *Electronic commerce research, 24*(1), 629-654. https://doi.org/10.1007/s10660-023-09734-0

Hudson, R. S., & Gregoriou, A. (2015). Calculating and comparing security returns is harder than you think: A comparison between logarithmic and simple returns. *International review of financial analysis, 38*, 151-162. https://doi.org/10.1016/j.irfa.2014.10.008

Jensen, M. C. (1968). THE PERFORMANCE OF MUTUAL FUNDS IN THE PERIOD 1945–1964. *Journal of Finance, 23*(2), 389-416.

Johnston, R., Jones, K., & Manley, D. (2018). Confounding and collinearity in regression analysis: A cautionary tale and an alternative procedure, illustrated by studies of

British voting behaviour. *Quality & quantity, 52*(4), 1957-1976. https://doi.org/10.1007/s11135-017-0584-6

Kihn, J. (2015). Behavioral Finance 201: Normative Finance Deprogramming. *CreateSpace Independent Publishing Platform.* ISBN: 978-151-7-10469-6

Knüpfer, S., Puttonen, V. (2009). Moderni rahoitus (4th ed.). *WSOYpro OY.* ISBN: 978-951-0-35877-1

Kortelainen, K. (2023, December 6). Suomi maksoi raskaat sotakorvaukset Neuvostoliitolle 1944-52 – henkeä kohti ankarammat kuin millään maalla. *Kauppalehti.* Retrieved 12-10-2024 from https://www.kauppalehti.fi/uutiset/suomi-maksoi-raskaat-sotakorvaukset-neuvostoliitolle-194452-henkea-kohti-ankarammat-kuin-millaan-maalla/053b07b4-d613-4434-9fb2-dd1ec8ca6329

Koskinen, K., Voutilainen, V. (2022, May 4). Kriisistä kriisiin – Yrityksillä jälleen haastava toimintaympäristö edessään. *Euro ja talous.* Retrieved 15-1-2025 from https://www.eurojatalous.fi/fi/2022/1/kriisista-kriisiin-yrityksilla-jalleen-haastava-toimintaymparisto-edessaan/

MacKinlay, A. C. (1997). Event Studies in Economics and Finance. *Journal of economic literature, 35*(1), 13-39.

Malkiel, B. G. (2003). The Efficient Market Hypothesis and Its Critics. *The Journal of economic perspectives, 17*(1), 59-82. https://doi.org/10.1257/089533003321164958

Markowitz, H. (1952). PORTFOLIO SELECTION. *The Journal of finance (New York), 7*(1), 77-91. https://doi.org/10.1111/j.1540-6261.1952.tb01525.x

Martins, A. M., Correia, P., & Cró, S. (2023). Stock market reaction to the military conflict between Russia and Ukraine: An event study for the European tourism and hospitality industry. *Journal of applied economics, 26*(1), . https://doi.org/10.1080/15140326.2023.2261756

Martins, A. M., Correia, P., & Gouveia, R. (2023). Russia-Ukraine conflict: The effect on European banks' stock market returns. *Journal of multinational financial management, 67*, 100786. https://doi.org/10.1016/j.mulfin.2023.100786

Mudrov, S. A. (2022). "We did not unleash this war. Our conscience is clear". The Russia-Ukraine military conflict and its perception in Belarus. *Journal of contemporary Central and Eastern Europe, 30*(2), 273-284. https://doi.org/10.1080/25739638.2022.2089390

Obi, P., Waweru, F., & Nyangu, M. (2023). An Event Study on the Reaction of Equity and Commodity Markets to the Onset of the Russia–Ukraine Conflict. *Journal of risk and financial management, 16*(5), 256. https://doi.org/10.3390/jrfm16050256

Pagano, M., Wagner, C., & Zechner, J. (2023). Disaster resilience and asset prices. *Journal of financial economics, 150*(2), 103712. https://doi.org/10.1016/j.jfineco.2023.103712

Perold, A. F. (2004). The Capital Asset Pricing Model. *The Journal of economic perspectives, 18*(3), 3-24. https://doi.org/10.1257/0895330042162340

Salmeron, R., Garcia, C. B., & Garcia, J. (2018). Variance Inflation Factor and Condition Number in multiple linear regression. *Journal of statistical computation and simulation, 88*(12), 2365-2384. https://doi.org/10.1080/00949655.2018.1463376

Schneider, G., & Troeger, V. E. (2006). War and the World Economy: Stock Market Reactions to International Conflicts. *The Journal of conflict resolution, 50*(5), 623-645. https://doi.org/10.1177/0022002706290430

Shalal, A., Hunder, M. (2025, March 4). Ukraine can hold out on frontline, Kyiv says after Trump's military aid pause. *Reuters*. Retrieved 04-03-2025 from https://www.reuters.com/world/europe/trump-halts-all-us-military-aid-ukraine-white-house-official-says-2025-03-04/

Simola, H (2024, June 11). Venäjän-kaupan romahduksella rajalliset vaikutukset Suomen teollisuuteen. *Euro & talous*. Retrieved 06-10-2024 from https://www.eurojatalous.fi/fi/2024/3/venajan-kaupan-romahduksella-rajalliset-vaikutukset-suomen-teollisuuteen/

Stoxx (2024, June 9). STOXX Europe 600 and Derived Indices. *Stoxx*. Retrieved 25-1-2025 from https://stoxx.com/wp-content/uploads/2024/10/STOXX-Europe-600_202409.pdf

Suomen Pankki (2022, March 11). Sota Ukrainassa heikentää Suomen talouskasvua ja nopeuttaa inflaatiota. *Euro & talous*. Retrieved 06-10-2024 from https://www.eurojatalous.fi/fi/2022/artikkelit/sota-ukrainassa-heikentaa-suomen-talouskasvua-ja-nopeuttaa-inflaatiota/

Suomen Pankki (2025, updated March 28). Euriborkorot kuukausittain. *Reuters*. Retrieved 09-04-2025 from https://www.suomenpankki.fi/fi/tilastot/taulukot-ja-kuviot/korot/kuviot/korot_kuviot/euriborkorot_kk_chrt_fi/

Tilastokeskus (2024, May 17). Venäjältä tuodun energian osuus kokonaiskulutuksesta pudonnut kahdessa vuodessa 34%:sta 7%:iin. *Tilastokeskus*. *Retrieved 12-10-2024 from* https://stat.fi/julkaisu/clvozxw1vc3yi08vz6wagvlc3

TITMAN, S., & WESSELS, R. (1988). The Determinants of Capital Structure Choice. *The Journal of finance (New York), 43*(1), 1-19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

Vihavainen, T. (2010). Ryssland i Finlands historia: Några särdrag som påverkar nutiden. *Nordisk østforum, 24*(2), 185-197. https://doi.org/10.18261/ISSN1891-1773-2010-02-06

Walker, N. (2023, August 22). Conflict in Ukraine: A timeline (2014 – eve of 2022 invasion). *UK Parliament*, *House of Commons Library*. *Retrieved 19-02-2025 from* https://commonslibrary.parliament.uk/research-briefings/cbp-9476/

Welch, I. (2000). Views of Financial Economists on the Equity Premium and on Professional Controversies. *The Journal of business (Chicago, Ill.), 73*(4), 501-537. https://doi.org/10.1086/209653