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THE EUROPEAN BANKS UNDER THE SHOCK OF THE RUSSIAN INVASION OF 2022: AN EVENT STUDY APPROACH

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Abstract: This paper evaluates the reaction of systemically important banks in Europe to the shock of the Russian invasion of Ukraine in 2022. Using the event study methodology and three of the most commonly used models for estimating theoretical returns (CAPM, Fama-French with 3 factors, Fama-French with 5 factors), we show that banks react differently relative to the event date (February 24, 2022) depending on the country. Overall, systemically important banks recorded massive cumulative abnormal returns in the event window. The results differ at the country level depending on the exposure of the respective banks to Russia, the dependence of countries on Russian gas and oil, and the level of informational efficiency of the markets on which they are traded.

JEL classification: G12, G14, G15, H56.

Keywords: Event study, G-SIB's, war, Russia, Fama-French models.

1. Introduction

Both war and terrorism have been repeatedly proven to create uncertainty in economies and financial markets, making them collateral victims. A few months after the deployment of military bases near the border with Ukraine, Russia officially attacked Ukraine on February 24, 2022, marking an abrupt escalation of the Russo-Ukrainian war, which began in 2014. In academic literature, war is one of the most significant events, along with financial crises, health crises, natural disasters, political elections, and terrorist attacks, that influence global capital markets. Military conflicts increase investor uncertainty about the future profitability of companies, which leads to fluctuations in stock prices (Rigobon and Sack, 2005).

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With the escalation of this conflict, companies and administrations have imposed sanctions on the Russian Federation in an effort to boycott the invasion. The most notable are those in the finance and payment systems sector: Paysera, Apple Pay, and Google Pay were the first companies to take actions to restrict services in the Russian Federation, starting on February 24 and 26, respectively. The Prime Minister of Norway, Jonas Gahr Stoere, declared that he had chosen to freeze the fund's investments and liquidate assets related to the Russian Federation, namely shares in 47 companies and government bonds worth approximately $3 billion.

The most prominent effect of this conflict is felt in the energy market, given that 41% of Russia's natural gas exports are directed towards the European Union (EU). In order to impose financial sanctions on the Russian Federation, the EU wants to become independent of Russian imports through the REPowerEU project, which aims to achieve this independence by 2030.

The Russian banking sector was directly targeted in terms of the Russian Federation's sanction effort. So far, seven Russian banks and their subsidiaries have been excluded from the SWIFT system, according to the organization's announcement dated March 20, 2022. European banks, according to calculations made by the Financial Times, have a cumulative exposure to the Russian Federation of $96 billion. The sanctions that private banks in the EU have taken are minimal, but banks such as Société Générale, Deutsche Bank, and BNP Paribas want to end their activity in Russia or minimize future investments, in an effort to reduce their exposure in the event of a deterioration in the Russian economy.

European banks entered 2022 on an unprecedented wave of optimism, due to the prospect of rising interest rates, the end of the COVID-19 pandemic, and growing profits. However, the crisis in Ukraine quickly dampened this optimism. The Russian invasion triggered an exodus of Western companies from the country, led to a rise in commodity prices, hit the euro currency, and even threatened a global recession. Assessing the potential damage to individual banks is complicated due to the variety of ways they are exposed. Some hold Russian bonds and stocks, others have stakes in Russian banks, while others are sensitive to the secondary effects on the European economy.

In Europe, French, Italian, and Austrian banks have the highest exposure to Russia, according to data from the Bank for International Settlements (Table 1).

Table 1. Banks' exposure to Russia (September 2021)

Country	$ Million
Italy	25,300
France	25,156
Austria	17,500
US	14,673
Germany	8,076
Switzerland	3,725
UK	3,042
Spain	812
Other	764

Source: Bank for International Settlements

Western banks have significantly reduced their exposure to Russia since the Crimea invasion in 2014. But that doesn't mean they are not exposed to substantial losses due to its isolation from the global financial system.

The purpose of this paper is to investigate if and to what extent systemic important banks in Europe have experienced significant changes in abnormal returns due to the invasion of February 24, 2022. We applied the event study methodology on a sample of 32 listed systemic important banks from 12 developed European countries to evaluate changes in market capitalization of these banks. The banks were grouped by country and their reaction to the event was observed on intervals, 5 days before the event, on the day of the event, and 5 days after the event. We also extend the evaluation to a series of political statements and major events during the Ukrainian crisis (February-March 2022). We also look at a particular case, that of neighboring countries to Ukraine, to try to observe if a small geographic distance from the conflict has an amplified impact.

In this paper, we focus on the reaction of financial markets to the Russia's invasion of Ukraine, particularly on the response of European systemically important banks.

This paper contributes to the literature by analyzing a particular sector, that of European systemically important banks, grouped by country, in an attempt to understand how investors incorporate the new information related to Russia's invasion of Ukraine. The main results of this paper suggest that the war affects systemically important banks in Europe differently depending on the country.

2. Literature Review

2.1. Historic

The event study methodology introduced by Fama et al. (1969) has gained popularity over time as an econometric technique and has become the standard method for measuring the reaction of financial asset prices to certain announcements or events. These unexpected announcements and events subject financial markets to a high level of stress, and market participants may lose their ability to rationally evaluate the implications of these events.

There is a large amount of research in the financial and economic literature that seeks to measure abnormal stock returns. Most of the articles that study abnormal returns are based on the efficient market theory developed by Fama et al. (1969) and Fama (1970), which argues that stock prices reflect all available information and that superior returns can only be obtained by chance. Considering the two characteristics of efficient markets: 1) how quickly and completely any new information is incorporated into asset prices; 2) which information is considered relevant and which is not, informational efficiency can be weak, semi-strong, or strong.

Informational efficiency in weak form is present when asset prices traded on a market reflect instantaneously and completely the entire history of their prices. Specifically, this translates into the impossibility of consistently earning excess profits from transactions inspired by studying the history of asset prices.

Informational efficiency in semi-strong form is manifested when the relevant information, in addition to price history, is formed from all publicly available information such as financial situations and details of these financial situations, statements made

by the company's representatives regarding profit on smaller periods of one year, announcements made by the company about its activities, other public information related to the general economic outlook and the national economy. To the extent that this information becomes public, it is instantaneously and completely integrated into the current price of assets, and consistent excess profits cannot be obtained from transactions based on this type of information.

Informational efficiency in strong form represents the most advanced level of efficiency, whose existence is considered only theoretical. The relevant information incorporated by the present course of assets is, in this case, both public and private privileged information, which means that even managers, financial analysts, traders, and all those who have access to such inside information cannot consistently earn excess profits by trading based on it.

Event studies are largely based on the analysis of so-called "normal" and "abnormal" returns, which are calculated using an estimation model.

2.2. Estimation models used in practice

Over time, a variety of models have been proposed, analyzed, and/or used in practice to measure theoretical profitability, which is then used to calculate abnormal returns.

1. Market Model: assumes that returns follow a market model with a single factor of form:

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it} \quad (1)$$

where Rit is the return of company i's stock on day t; R_{mt} is the market return on day t; εit represents the error term (a series of independent and identically distributed random variables with mean 0 and independent of the market return). The regression coefficient βi is a measure of Rit's sensitivity to the reference market. Abnormal returns are then calculated using the formula:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i * R_{mt}) \quad (2)$$

Although this model is generally accepted as the standard model, there are also criticisms of it.

2. Adjusted Market Model: in this model, the observed market return on day t, R_{mt}, is subtracted from the observed return Rit on day t. The abnormal return is then obtained by the formula:

$$AR_{it} = R_{it} - R_{mt} \quad (3)$$

3. Empirical Mean Method: in this case, the abnormal return during the event window is the return of observation i on day t minus the average return of observation i in the estimation window:

$$AR_{it} = R_{it} - \bar{R}_i \quad (4)$$

4. CAPM Model includes the risk-free rate in the estimation and thus represents a more detailed approach than the market model:

$$R_{it} = R_{ft} + \alpha_i + \beta_i * \left(R_{mt} - R_{ft}\right) + \varepsilon_{it} \quad (5)$$

5. Multifactor Models: in an attempt to improve the variance explained by the single-factor model (thereby favoring the detection of AR), sometimes the theoretical return is estimated using multiple factors, using a multifactor model (MFM) such as the three or five-factor model introduced by Fama and French in 1992 and 2014, respectively. The Fama-French three-factor model is an asset pricing model developed in 1992 that extends the capital asset pricing model (CAPM) by adding size (SMB) and value (HML) risk factors in addition to the market risk factor from CAPM. The equation for this model is:

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{mkt} * \left(R_{t,mkt} - R_{ft}\right) + \beta_{SMB} SMB + \beta_{HML} HML + \varepsilon_{it} \quad (6)$$

In 2014, Fama and French formulated a five-factor model, adding profitability (RMW) and investment behavior (CMA) as risk factors.

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{mkt} * \left(R_{t,mkt} - R_{ft}\right) + \beta_{SMB} SMB + \beta_{HML} HML + \beta_{RMW} RMW + \beta_{CMA} CMA + \varepsilon_{it} \quad (7)$$

2.3. Review of specialized literature

The academic interest in evaluating the financial effects of unforeseen events has increased recently due to the health crisis triggered by the COVID-19 pandemic. The literature on the causes and economic consequences of wars has stimulated a large number of studies in economics. Research findings (Murdoch and Sandler, 2002) show that wars reduce economic growth across regions formed by neighboring countries.

An event whose impact has been extensively studied is the September 11, 2001 attacks. Carter and Simkins (2004) examined the reaction of investors to the stock prices of aviation companies on American markets. They concluded that their results suggest that the market perceived the long-term consequences of the attacks, and the effect of the attack on US airlines was more pronounced than on the stock of cargo airlines or foreign airlines outside the US.

Rigobon and Sack (2005) found that the risk of war in Iraq has a negative effect on the US stock market, so the war risk factor is useful in estimating stock price variations during war.

Panagiotis and Spyridon (2010) studied the reaction of the stock prices of Greek banks during three major terrorist attacks (the September 11, 2001 attack, the Madrid bombing of March 11, 2004, and the London bombing of July 7, 2005). They showed that during the September 11 attack, the market overreacted to the set of information that the attack conveyed, which caused an excessive decrease in the stock prices of Greek banks.

Martins et al. (2023) looked at the immediate impact of the military conflict between Russia and Ukraine on the stock market performance of the largest European banks. According to their findings, banks with a high exposure to Russia and those that are listed in Russia experienced a more significant negative reaction in the stock market.

Kumari et al. (2023) examined the market reaction as well to the Russian invasion of Ukraine, employing the event study method, cross-sectional and network analysis. The results show a negative impact on the leading European Union stock market indices. Further, Poland, Denmark, and Poland exhibit positive cumulative abnormal returns post-event, showing that the developed markets and NATO nations are insignificant to the war event.

Moreover, Izzeldin et al. (2023) showed that, in broad terms, stock markets and commodities responded most rapidly to the Russian invation, but the post-invasion crisis intensity is noticeably smaller compared to both the Covid-19 and the 2008 global financial crisis.

In other studies, Boungou and a Yatié (2022) have employed a research on the daily data on stock returns for a sample of 94 countries over the period from 22 January to 24 March and the results show significant negative effects of the Ukraine-Russia war on global stock indices.

In most of the studies, the 2022 Russian invasion of Ukraine was found to have a significant impact on global stock market indices, resulting in negative cumulative abnormal returns. However, the effects were found to be heterogeneous, as reported by Boubaker et al. (2022) in their recent empirical study.

3. Data & Methology

The event study methodology according to Fama (1970) is based on the efficient market hypothesis, which states that when new information appears in the market, investors immediately evaluate its current and future impact. This evaluation results in price changes so that they reflect the effect of this new information on the future performance of the evaluated asset. Thus, significant changes in financial asset prices can be attributed to specific events that led to the appearance of this new information. This is where the power of the event study methodology is observed, namely its ability to identify these significant changes based on the general evaluation of investors.

3.1. Description of the methodology

According to MacKinlay (1997), conducting an event study typically involves following a procedure divided into the following steps:

1. Defining the event window.
2. Calculating theoretical returns:
    a. Defining the estimation window.
    b. Choosing the estimation model.
3. Estimating abnormal returns.
4. Testing the statistical significance of abnormal returns.

The procedure begins by defining the period during which the event should influence the returns of the analyzed companies. Generally, an event window spans over several days before and after the event date. To define abnormal returns, the analysis proceeds to the second step and calculates theoretical or expected returns.

This step requires defining the estimation window, which represents a sample before the event window. Equation (8) defines abnormal returns (AR) in a generic way:

$$AR_{it} = R_{it} - E(R_{i,t|X_t}) \quad (8)$$

where Ri,t is the realized actual return, and E(Ri,t|Xt) is the theoretical return conditioned on information X in period t, without any relation to the event.

We have seen that abnormal returns estimation can be carried out by different models. The most commonly used is the single-index model (SIM) (MacKinlay 1997; Sorokina et al., 2013):

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad (9)$$

According to this SIM model, theoretical returns depend on the parameters αi and βi (calculated in the estimation window) and the market return $R_{m,t}$.

In this study, we calculated theoretical returns both with the single-factor model (market factor) and with more complex models with multiple factors (the Fama-French three-factor model and the Fama-French five-factor model). After theoretical returns are calculated, abnormal returns can be obtained. For the period around the event, we are interested in calculating the difference between the observed stock return and the stock return as it should have been according to the estimation model.

To observe the impact on a certain number of companies (banks in our case) over intervals around the event date, abnormal returns are aggregated. The cumulative average abnormal return (CAAR) is calculated using the average abnormal return (AAR).

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \quad (10)$$

where $AR_{i,t}$ represents the estimated abnormal return for bank i.

To observe the average effect over an interval of several days, it is necessary to calculate the cumulative average abnormal returns (CAAR) by adding the average abnormal returns (AAR) over the interval.

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t \quad (11)$$

Thus, for each day t, the abnormal returns (AARt) are calculated for all banks, which provide information on the evolution of the sample on each day of the analyzed period. Then, for each analyzed interval, the cumulative average abnormal returns (CAAR) are calculated by adding AAR over the analyzed interval. These provide information on the overall performance of banks around the event date.

Once abnormal returns (AR) are calculated, regardless of the chosen calculation method, it is necessary to study their statistical significance. In order for the analysis to have economic relevance, it is necessary to analyze the statistical significance of these abnormal returns; that is, their difference from zero must be verified. In this paper, we performed the implicit test implemented in the Stata

software by the estudy command (explained in Chapter 2.3), which assumes that stock returns and hence AR are normally and homoscedastically distributed in the estimation window and event window.

3.2. Data

The data are represented by daily closing prices for 32 systemically important banks in 12 developed European countries, for the period from May 19, 2021, to March 30, 2022, and were extracted from the yahoofinance.com website. The values of the factors used in the Fama-French models with 3 and 5 factors for developed markets were extracted from the database of Prof. Kenneth French. We chose an estimation window of approximately 180 trading days prior to the event (February 24, 2022) in accordance with Afik et al. (2021), with a buffer window of 30 days between the event day and the estimation window. We used 4 intervals for observing cumulative average abnormal returns (5 days before the event, the event day, 5 days after the event, and the entire -5..0..+5 interval).
Data processing was performed in Stata software using the "estudy" command as explained by Pacicco et al. (2018).

4. Results

In this section, the results of the analysis regarding the impact of the invasion in Ukraine on the systemically important banks in Europe are presented.

4.1. Results for the invasion date of 24.02.2022

For the invasion date of 24.02.2022, the results obtained are displayed in Table 3 for the Fama-French model with 3 factors in the form of cumulative average abnormal returns (CAAR) grouped by country for the 4 intervals of interest (5 days before the event, the event day, 5 days after the event, and the entire -5..0..+5 interval). Evaluating these results is complicated due to the variety of ways in which banks and countries are presented.

Table 2. Dependence on Russian gas (percentage of total)

Country	Percentage
Finland	94%
Austria	64%
Germany	49%
Italy	46%
Poland	40%
France	24%
Netherlands	11%

Source: Statista 2020

The abnormal returns obtained in the three tables do not differ significantly, confirming the results of Brown and Warner (1980, 1985) that the use of more sophisticated models does not greatly reduce the variance of abnormal returns. The

results show massive abnormal returns achieved overall by systemic banks in Europe caused by the Russian invasion of Ukraine on 24.02.2024. However, these abnormal returns are manifested differently in the event window depending on the country.

Sweden, Spain, and the United Kingdom show statistically significant CAARs only on the event day, specific to markets with a high level of informational efficiency that develop a high speed in incorporating this new information. Thus, after the information about the Russian invasion reaches the market, prices react on that day, realizing significant abnormal returns, thus incorporating this new information into the price, and in the following days, returns return to normal values on a new level of equilibrium.

Table 3. Cumulative average abnormal returns (CAAR) relative to the Fama-French 3-factor model; event date: 24.02.2022, with 4 specified intervals

Country	Bank	CAAR (-5,-1)	CAAR (0,0)	CAAR (1,5)	CAAR (-5,5)
Austria	EBS	**-11.55%*** **	**-10.67%*** **	-5.72%	**-27.95%*** **
	RBI	**-21.03%*** **	**-24.24%*** **	**-20.38%*** **	**-65.65%*** **
	CAAR group	**-16.25%*** **	**-17.23%*** **	**-12.93%*** **	**-46.40%*** **
Denmark	DANSKE	**-9.47%*** **	**-7.40%*** **	-4.02%	**-20.90%*** **
	JYSK	-7.30%*	-4.57%**	-8.11%**	**-19.98%*** **
	SPNO	-5.51%	-4.27%**	-1.50%	-11.28%**
	SYDB	**-11.46%*** **	3.54%**	-9.43%**	**-17.35%*** **
	CAAR group	**-8.39%*** **	**-3.09%*** **	**-5.61%*** **	**-17.09%*** **
Finland	NDA	1.01%	-0.21%	-2.43%	-1.63%
France	BNP	-5.49%	**-8.03%*** **	-9.08%**	**-22.60%*** **
	ACA	-7.07%**	-0.81%	-8.37%**	**-16.25%*** **
	GLE	-9.01%**	**-13.30%*** **	**-17.95%*** **	**-40.26%*** **
	CAAR group	**-7.16%*** **	**-7.25%*** **	**-11.55%*** **	**-25.96%*** **
Germany	CBK	-0.01%	**-13.59%*** **	-11.74%**	**-25.34%*** **
	DB	-10.12%**	**-10.91%*** **	**-12.67%*** **	**-33.70%*** **
	CAAR group	-5.00%	**-12.24%*** **	**-12.18%*** **	**-29.42%*** **
Italy	BAMI	-7.19%	**-9.26%*** **	**-14.99%*** **	**-31.44%*** **
	ITS	-7.01%**	**-8.46%*** **	**-14.71%*** **	**-30.19%*** **
	UNI	-9.25%**	**-15.33%*** **	**-15.06%*** **	**-39.65%*** **
	CAAR group	**-7.80%*** **	**-10.97%*** **	**-14.83%*** **	**-33.60%*** **
Netherlands	ING	-7.20%**	**-8.06%*** **	**-14.64%*** **	**-29.90%*** **
Poland	BHW	-2.56%	**-16.40%*** **	3.01%	-15.95%**
	PEO	**-14.49%*** **	**-15.89%*** **	1.76%	**-28.62%*** **
	MBK	**-18.64%*** **	**-15.72%*** **	3.63%	**-30.73%*** **
	SPL	**-10.50%** **	**-14.92%*** **	5.74%	**-19.68%*** **
	CAAR group	**-11.46%*** **	**-15.73%*** **	3.79%	**-23.40%*** **
Spain	SAN	-5.03%	**-8.51%*** **	-3.98%	**-17.52%*** **
	BBVA	-3.79%	**-6.36%*** **	-3.78%	-13.93%**
	SAB	-8.94%*	**-8.20%*** **	-10.84%**	**-27.98%*** **
	CAAR group	-5.89%**	**-7.69%*** **	-6.16%**	**-19.74%*** **
Sweden	SWED	-3.03%	**-3.05%*** **	-3.39%	**-9.46%*** **
	SEB	-3.37%	**-3.23%*** **	-1.25%	-7.84%**
	SHB	-2.38%	-2.31%**	2.66%	-2.04%
	CAAR group	-2.92%**	**-2.86%*** **	-0.65%	-6.43%***

Country	Bank	CAAR (-5,-1)	CAAR (0,0)	CAAR (1,5)	CAAR (-5,5)
	CS	-6.53%*	-2.24%	-4.31%	-13.08%**
Switzerland	UBS	**-7.81%*** **	**-6.07%*** **	-5.45%*	**-19.34%*** **
	CAAR group	**-7.17%*** **	**-4.14%*** **	-4.86%**	**-16.17%*** **
	BARC	2.45%	**-5.80%*** **	-4.52%	-7.88%
	HSBA	0.97%	**-3.98%*** **	-1.71%	-4.73%
UK	LLOY	3.24%	**-8.20%*** **	-1.12%	-6.08%
	STAN	7.83%**	**-7.14%*** **	-0.38%	0.31%
	CAAR group	3.66%**	**-6.27%*** **	-1.91%	-4.52%*

*** p-value < .01, ** p-value <.05, * p-value <.1

According to the banks' exposure to Russia, Austria stands out with the highest CAAR among all observed countries, manifested in all analyzed intervals (Raiffeissen Bank with -65% cumulatively in the event window). Although in Table 1 Austria appears after Italy and France in total exposure, this exposure is much larger relative to the size of the Austrian economy.

Nordea, the domestic systemic importance bank in Finland, has absolutely no reaction in all analyzed intervals, surprising at first glance given that Finland has a significant border with Russia and imports 94% of its gas from Russia (Table 2). But this gas accounts for only about 5% of total energy consumption. The most plausible explanation for the Finnish bank's lack of reaction is that its exposure to Russia is very small after it decided to close its operations in Russia in 2019.

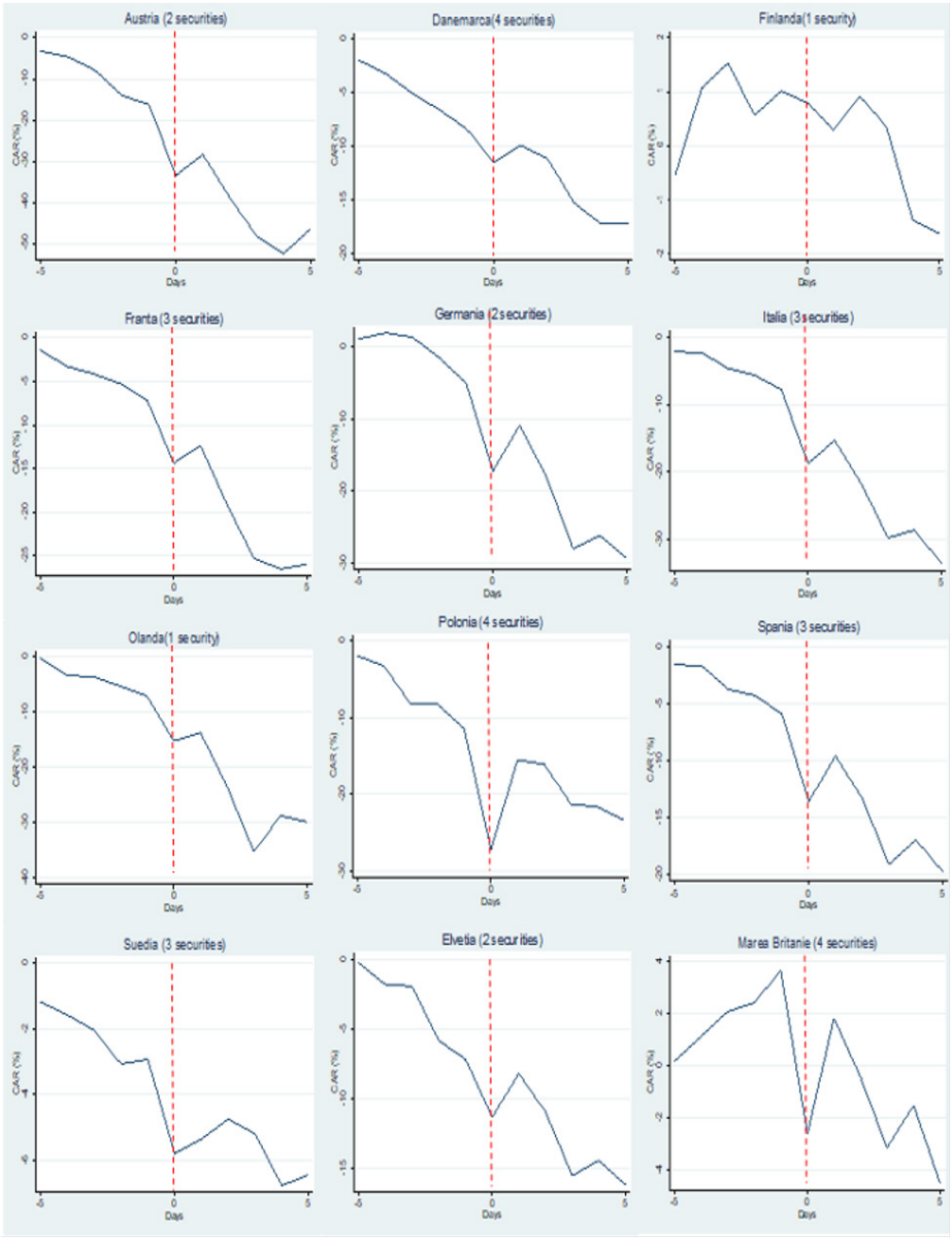
Netherlands and Germany have significant CAARs on the event day and in the post-event interval, suggesting an underreaction on the event day. Both Germany's dependence on Russian gas and oil, as well as the significant exposure of the German banking system, result in a cumulated reaction of approximately -30% in abnormal returns manifested in the event window.

Italy and France, as a group, show significant reactions on all intervals with certain exceptions at the level of individual banks (Credit Agricole and BNP Paribas in France, and Banco BPM in Italy). And in this case, the magnitude of these CAARs corresponds to the exposure of these banks to Russia. Italy and France are the countries with the highest bank exposure to Russia (Table 1).

Poland records statistically significant CAARs before the event and on the event day, suggesting that the event was anticipated to some extent. Additionally, after the event day, in this case, we have positive returns suggesting the phenomenon of overreaction.

For all these results, in Figure 1, we have the graphical representation over time of the average abnormal returns at the country level.

Figure 1. Graph of cumulative average abnormal returns (CAAR) grouped by country



4.2. Expansion of analysis - events and political statements around the date of the invasion

We present an extension of observing the reaction of banks to a series of political statements and major events during the Ukrainian crisis (February - March 2022): 1. Bilateral meeting between French President Emmanuel Macron and Putin, followed by controversial press statements: while Emmanuel Macron declares that Russia will not escalate the crisis, the Kremlin spokesperson states that no agreement can be reached (08.02.2022); 2. The first warning sign: Biden's national security adviser warns that a potential Russian invasion is underway before the end of the Beijing Olympics on February 20 (11.02.2022); 3. The second warning sign: Biden and Blinken stated that Russia is failing to withdraw its troops from its side of the border, while also accusing a possible false flag operation in eastern Ukraine. American officials warn that Russia is about to invade Ukraine (17.02.2022); 4. The first round of economic sanctions from NATO (22.02.2022); 5. Strengthened sanctions (28.02.2022); 6. The EU details the exclusion of Russian SWIFT banks, an action that will take effect from March 12. The exclusion of banks is a coordinated international action that includes the US and the UK (02.03.2022); 7. Russian forces bomb the Zaporizhzhia nuclear power plant (04.03.2022); 8. The US and the UK ban Russian oil (08.03.2022); 9. The EU extends sanctions, the UK targets oligarchs, and Canada and Australia ban certain energy imports from Russia (10.03.2022); 10. Russia targets Western Ukraine (14.03.2022).

Due to the large number of announcements and important events that occurred in a relatively short period of time, we narrowed the event window to two days before and after the respective event. Thus, the new observed intervals of interest are two days before the event date, the event day itself, two days after the event date, and the entire interval -2..0..+2. Of course, due to this large number of announcements and important events, the relevance of the obtained results may suffer, greatly increasing the risk of contamination of one event window with the effect of other events.

Among the announcements and events listed above, after running the estudy command for each of them separately, a few results stand out. The announcement of the tightening of sanctions against Russia on 28.02.2022 triggered a new wave of abnormal returns (Table 4), but this time only for the countries whose banks have a high exposure to Russia (Austria, France, Germany, Italy, Netherlands).

Another interesting event in terms of the obtained results is the bombing of the Zaporizhia nuclear power plant on 04.03.2022, which caused a reaction among the European systemically important banks by showing significant abnormal returns on that day. Looking at the results of the announcement on 08.03.2022 regarding the ban on Russian oil by the UK and US, they appear rather irrational at first glance (significant negative abnormal returns are observed in the period before the announcement, and significant positive abnormal returns are observed on the day of the announcement and the following days). The explanation is that the results of this announcement are contaminated by the event on 04.03.2022, which occurred very close in time (March 5 and 6, 2022 were weekend days). Thus, the significant negative abnormal returns obtained in the two days preceding the announcement on 08.03.2022 are rather a continuation of investors' concerns about the risk of a

possible major nuclear accident due to the Russian bombings on 04.03.2022. And the significant positive abnormal returns on 08.03.2022 and the following two days are more likely due to positive news about the decreased risk of a nuclear accident at the Zaporizhia plant.

Table 4. Cumulative Average Abnormal Returns (CAAR) relative to the Fama-French 3-factor model; event date: 02/28/2022; with 4 specified intervals

Country	Bank	CAAR (-2,-1)	CAAR (0,0)	CAAR (1,2)	CAAR (-2,2)
Austria	EBS	-3.85%*	**-8.11%*** **	**-14.26%*** **	**-26.21%*** **
	RBI	**-20.96%*** **	**-13.07%*** **	**-12.82%*** **	**-46.85%*** **
	CAAR group	**-12.15%*** **	**-10.56%*** **	**-13.54%*** **	**-36.25%*** **
Denmark	DANSKE	-4.16%*	-1.08%	**-5.90%*** **	**-11.14%*** **
	JYSK	-3.41%	-0.97%	**-10.84%*** **	**-15.22%*** **
	SPNO	-0.47%	-0.08%	-8.25%	-8.80%**
	SYDB	1.50%	-3.26%**	0.38%	-1.37%
	CAAR group	-1.53%	-1.34%	**-6.07%*** **	**-8.94%*** **
Finland	NDA	-0.80%	0.54%	-2.29%	-2.55%
France	BNP	-5.12%**	-8.42%***	-5.12%**	**-18.65%*** **
	ACA	-1.71%	-0.96%	**-7.53%*** **	**-10.20%*** **
	GLE	**-9.30%*** **	**-11.32%*** **	**-9.81%*** **	**-30.43%*** **
	CAAR group	**-5.22%*** **	**-6.80%*** **	**-7.36%*** **	**-19.38%*** **
Germany	CBK	-5.83%**	**-7.18%*** **	**-9.75%*** **	**-22.76%*** **
	DB	-6.08%**	**-7.25%*** **	-6.51%**	**-19.84%*** **
	CAAR group	**-5.94%*** **	**-7.21%*** **	**-8.12%*** **	**-21.27%*** **
Italy	BAMI	-6.42%**	-1.97%	**-7.69%*** **	**-16.09%*** **
	ITS	**-5.56%*** **	**-7.43%*** **	**-6.95%*** **	**-19.93%*** **
	UNI	**-10.87%*** **	**-10.09%*** **	-5.98%**	**-26.94%*** **
	CAAR group	-7.57%	-6.44%	-6.87%	-20.87%
Netherlands	ING	**-6.49%*** **	**-9.75%*** **	-5.21%**	**-21.45%*** **
Poland	BHW	-6.94%**	-4.63%**	0.46%	-11.11%**
	PEO	-0.30%	-2.83%	**-8.30%*** **	**-11.43%*** **
	MBK	-4.34%	4.91%*	**-12.26%*** **	-11.70%*
	SPL	-4.81%*	-0.29%	-2.77%	-7.88%*
	CAAR group	**-4.07%*** **	-0.65%	**-5.56%*** **	**-10.28%*** **
Spain	SAN	-3.92%	-4.09%**	-2.33%	**-10.34%*** **
	BBVA	-4.20%	-1.86%	-2.23%	-8.29%*
	SAB	-2.83%	-5.13%**	-6.44%*	**-14.41%*** **
	CAAR group	-3.64%**	**-3.69%** **	-3.65%**	**-10.97%*** **
Sweden	SWED	-3.46%**	-0.30%	-2.19%	**-5.96%*** **
	SEB	-2.96%*	0.59%	-3.28%**	-5.64%**
	SHB	-1.02%	1.37%	-0.58%	-0.23%
	CAAR group	**-2.48%*** **	0.56%	-2.01%**	**-3.93%*** **
Switzerland	CS	-0.26%	-1.77%	-3.63%	-5.66%
	UBS	-1.79%	**-3.58%*** **	-3.41%*	**-8.79%*** **
	CAAR group	-1.00%	-2.67%**	-3.51%**	**-7.19%*** **

Country	Bank	CAAR (-2,-1)	CAAR (0,0)	CAAR (1,2)	CAAR (-2,2)
UK	BARC	-2.29%	-2.36%	-1.59%	-6.24%*
	HSBA	-0.62%	-2.60%**	-0.28%	-3.49%
	LLOY	-3.62%*	-1.26%	-3.16%	-8.04%**
	STAN	-0.88%	-2.83%*	0.72%	-2.99%
	CAAR group	-1.83%*	**-2.26%****	-1.07%	**-5.16%****

*** p-value < .01, ** p-value <.05, * p-value <.1

4.3. Analysis of neighboring countries with Ukraine

We conducted a specific analysis on the neighboring countries of Ukraine (Romania, Poland, and Hungary) in an attempt to see if a small geographic distance to the conflict has a significant impact on the systemic importance banks in these countries. The results obtained (Table 5) do not offer clear evidence in this regard. The reaction differs in the three neighboring countries with Ukraine.

In the case of Romania, we have a statistically insignificant reaction on the analyzed intervals. According to the National Bank of Romania (BNR), Romanian banks do not have loans and advances granted, and the deposits attracted have a total value of only 17.9 million lei for Russia and 40.7 million lei for Ukraine (Dec. 2021). No bank in Romania has direct equity holdings originating in Ukraine or the Russian Federation. Thus, the cumulative exposure of Romanian banks is very low.

OTP Bank in Hungary has previous experience of involuntary exit from regional markets following the conflict between Russia and Ukraine. The bank had to leave Crimea after the territory's annexation by Russia in 2014 and parts of eastern Ukraine due to the outbreak of a military conflict between Russian-backed separatists and Ukrainian forces in the same year. Russia and Ukraine accounted for 11.6% of the OTP group's total risk-weighted assets at the end of December 2021. In this case, we have a lack of reaction on the day of the event followed in the next days by obtaining significant negative abnormal returns.

Table 5. Cumulative average abnormal returns (CAAR) relative to the CAPM model; Event date: 24.02.2022; with 4 specified intervals

Country	Bank	CAAR (-5,-1)	CAAR (0,0)	CAAR (1,5)	CAAR (-5,5)
Romania	BRD	-0.30%	1.53%*	-3.76%*	-2.53%
	TLV	-0.50%	1.50%	-1.18%	-0.17%
	CAAR group	-0.39%	1.52%**	-2.47%	-1.34%
Poland	BHW	-2.69%	-15.53%***	4.23%	-14.00%**
	PEO	**-14.55%*****	**-15.99%*****	1.67%	**-28.87%*****
	MBK	**-19.13%*****	**-15.65%*****	4.06%	**-30.72%*****
	SPL	**-11.11%*****	**-14.48%*****	6.74%	**-18.86%*****
	CAAR group	**-11.78%*****	**-15.41%*****	4.43%*	**-22.76%*****
Hungary	OTP	-1.05%	-0.16%	**-11.29%*****	**-12.50%*****

5. Conclusion

In this paper, we have shown the significant impact that the war in Ukraine has on systemically important banks in Europe, manifested by significant cumulative abnormal returns during the analyzed period. The country-level analysis shows a different reaction of these banks depending on their exposure to Russia, the dependence of their respective countries on Russian gas and oil, and the level of informational efficiency of the markets in which they are traded.

The results indicate that investors have penalized banks with very high exposure to Russia, followed by those whose countries depend to a significant extent on Russian gas and oil. However, the study does not suggest that geographic distance has a significant impact on the abnormal returns observed.

The variety of ways in which banks are exposed, both at the individual and country levels, represents a vulnerability related to the interpretation of the results obtained in this study. European banks exposed to Russia will continue to be subject to strong pressures to drastically reduce these exposures and exit the Russian market, which will affect their profitability in the short and medium term. Additionally, the European Union's plan to accelerate the abandonment of imports of oil and gas from Russia will have a short-term impact on the economies of countries dependent on these resources and indirectly on the profitability of banks in these countries.

The impact of wars on stock markets is an important topic for investors, portfolio managers, and regulatory authorities. Therefore, this study, with its empirical evidence of the financial effects of the Russo-Ukrainian armed conflict on European banks, can be used in making portfolio rebalancing decisions or developing effective hedging strategies.

In conclusion, as a direction for future research, given that the market volatility on that particular day was extremely high, we suggest an analysis on intraday data collected on the day of the invasion.

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