

RELATIONSHIP BETWEEN THE DYNAMICS OF REFUGEES FROM UKRAINE AND THE VOLATILITY OF TOURISM STOCKS: A TIME-FREQUENCY ANALYSIS

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Abstract. The Russia-Ukraine war has determined the reconfiguration of the tourism industry at the global level. This study explores the link between refugees from Ukraine and tourism stocks listed on the Bucharest Stock Exchange. The analysed period was between 01.01.2022 and 31.12.2022 to capture the extent of the studied phenomenon. The time series were processed by wavelet analysis. The main results are: i) there is a link between the dynamics of refugees in Ukraine and the volatility of tourism stocks; ii) volatility was significant in the first weeks after the start of the conflict in most of the analysed companies; iii) the highest volatility was recorded in companies located near the Ukraine border; iv) in 2023, the volatility generated by refugees from Ukraine is insignificant.

Keywords: Russia-Ukraine war, refugees, volatility, wavelet, tourism.

JEL Classification: D22, E32, G32, K37, M20, O16.

1. Introduction

Tensions between Ukraine and Russia escalated into a war on 24 February 2022, leading to a humanitarian crisis, and social, economic, and political instability. The conflict forced the civilian population to leave their homes and seek protection and shelter in neighbouring states. Fear of war, lack of electricity, thermal energy and basic services, water and food shortages, and destruction of civil infrastructure in war-affected areas were the main causes that determined the displacement of Ukrainians (OCHA, n.d.; International Committee of the Red Cross, n.d.). According to the United Nations, the deluge of refugees from Ukraine was "the largest movement of people in the European Region since the Second World War" (United Nations Ukraine, n.d.). The war in Ukraine is the second largest humanitarian crisis after 1960 if the number of people is considered and the fifth if the fraction of the population is considered (White et al., 2022). Refugee flows lead to permanent resettlement in neighbouring states (Boubaker et al., 2022). Women and children account for 90% of all refugees (Wiśniewska-Drewniak et al., 2023). The mass of refugees included the elderly, disabled and ethnic minorities (UNICEF, n.d.).

Numerous Ukrainians sought refuge in the neighbouring states of Poland, Hungary, Slovakia, Moldova and Romania, while others relocated within the Ukrainian borders. More than 5.3 million people fled to neighbouring states, and 6.5 million were internally displaced as the war continues by the end of 2022 (World Health Organization, n.d.).

The migration crisis brought on by the Ukrainian War forced a strategic approach, organisational solutions, and appropriate social mechanisms. Some countries faced the refugee crisis for the first time (Jakub et al., 2022). Such a complex situation prompted the intervention of international agencies to provide support to host countries to ensure the swift and safe movement of refugees according to international law.

In the last two years, researchers have tried to provide answers to the challenges posed by the Russia-Ukraine war to national economies. Their efforts were directed towards Mental Health and Psychosocial Support (Costanza et al., 2022), refugee assistance efforts and long-term integration policies (Elinder et al., 2023), medical assistance (Zimba & Gasparyan, 2023; Su et al., 2022), shelter (Lee et al., 2023), socio-political consequences (Duszyk et al., 2023), humanitarian assistance (Cullen-Dunn

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& Kaliszewska, 2023), legal aspects (Ociepa-Kicińska & Gorzałczyńska-Koczkodaj, 2022), and integration (Rataj & Berezovska, 2023; Gotlib et al., 2023).

Of the Ukrainian refugees under temporary protection, over 90% live in urban and peri-urban areas. Based on the evaluation carried out in October 2022, almost 70% of refugee households are under the 50/20 programme, which provides 50 lei (Romanian currency) per person daily for accommodation and 20 lei per person daily for food (The UN Refugee Agency, n.d.).

In general, geopolitical events as wars have a negative influence on tourism (Seraphin, 2017; Demir et al., 2019; Jeon, 2021; Jiang et al., 2022; Pandey & Kumar, 2023). During the Covid-19 pandemic, tourism was one of the most affected areas (Salisu et al., 2021; Wang et al., 2021; Lin & Falk, 2022). After a prolonged period of lockdown, tourism is in full recovery. At a time when investors needed confidence to buy shares of tourism companies, the war broke out in Ukraine (Gofran et al., 2023). After the outbreak of the war in Ukraine, tourism was among the most affected economic sectors (Abdullah et al., 2023; Martins et al., 2023; Tomej et al., 2023; Nazli, 2023; Sánchez-Bayón, 2023). Previous research shows that wars have negative effects on long-term tourism stock market volatility (Mensi, 2019; Zopiatis et al., 2019; Aharon, 2022; Liu et al., 2023).

As a methodological approach, this research uses wavelet analysis, as it allows researchers to establish the link between refugees and tourism stocks in the time-frequency domain. The results consist of dynamic images that reflect the co-movement between the variables and allow a graphical comparison of the links.

The analysis of the literature shows that only a few studies focused on the influence of conflict on tourism (Smith, 1998; Tomej et al., 2023). Another limitation of the literature is that it has not addressed the relationship between refugees and the dynamics of the stock market for companies in the tourism industry. Additionally, part of the research concerns tourism in Ukraine during the war.

This study bridges the gap in the existing literature in the following aspects. It is the first to evaluate the impact of Ukrainian immigrants on tourist companies listed on the Bucharest Stock Exchange (BSE). Secondly, it confirms the existence of a link between the sudden increase in population and the reaction of the financial markets in Romania. Thirdly, the wavelet analysis provides results regarding the time and frequency of the influence of refugees on Romanian tourism companies.

This work is organised as follows. The first section contains a synthesis of the literature on the volatility generated by the Ukraine war and its effects on stocks. The second describes the research approach and data. The third furnishes the research outcomes and a set of discussions closely related to thereto. The last section includes conclusions, limitations, and directions for future study.

2. Synthesis of literature

Recent literature on migrants and refugees focuses on events in Syria (2012–present) and Palestine (1948–present) (Taylor et al., 2016; Knudsen, 2018; Fakhoury, 2019; Atrooz et al., 2022; Stillman et al., 2022). Apart from these political events, research on refugees is sporadic. Wen et al. (2023) designed a post-WW2 tourism retrospective. The authors examined the implications, challenges, and marketing politics relevant to the post-war period. Though interactions between tourism and war have been sparingly investigated, the literature indicates that tourism is negatively affected by war (Smith, 1998). Williams et al. (2023) explored the complex relationship between war tourism, volunteerism, and voyeurism in online and offline environments, considering the recent war in Ukraine. Nazli (2023) studied the influence of the Russia-Ukraine War and the Covid-19 pandemic on tourism in Turkey. The author concluded that tourism investors must adapt business models to ensure long-term survival. Cheng (2023) investigated how online communities can be activated through social networks to intervene in support of Airbnb's initiatives towards Ukraine.

Several researchers have been concerned with tourism in or related to Ukraine. The current state of tourism in Ukraine under war conditions was assessed by Zhuravka et al. (2023), who found that many restaurants and hotels have adjusted their business strategies due to increased expenses and reduced profits. Kostynets and Kostynets (2023) also assessed the current trends of the global market concerning the functioning of tourism in the combat conditions in Ukraine. The authors identified prospects for the recovery of tourist services in Ukraine. Simpson and Schuler Scott (2023) observed an increase in the number of trips abroad to participate in non-combat and combat tourism in Ukraine. The study included international non-governmental organisations that employ people to provide humanitarian aid in war zones.

Another direction of related research consisted of the identification of operators that followed the influence of the conflict in Ukraine on the stock market indicators relating to listed tourism companies. Nicolau et al. (2024) analysed the influence of solidarity facts with Ukraine on the market value of tourism firms and revealed an increase in the value of companies that manifested such a stance. The authors recommended that tourism companies initiate actions of medium intensity, depending on the opportunity costs. Driessen (2022) and Abdullah et al. (2023) adopted a comparable strategy, investigating the link between tourism stocks, green stocks, gold, oil and cryptocurrencies during the period December 2018 to September 2022. The authors found that gold is the most productive asset, tourism stocks are more effective compared to green stocks, and the connection between the studied assets increases during major events.

Some of the researchers have shown a different temporal connection between stock markets determined by a

state of economic uncertainty. Analysing 165 companies in the hospitality and tourism industry, Martins et al. (2023) observed a significant negative reaction of the stock price at and around the onset of the war. Using the event study method, Pandey and Kumar (2023) investigated the influence of the 2022 Russia-Ukraine war on global tourism stocks. The authors demonstrated a different impact, depending on the position of the markets. Thus, abnormal returns on the day of the event were negative for companies throughout Africa, the Middle East, Europe, Pacific, and insignificant for those in America and Asia. Balli et al. (2022) studied the impact of the Ukraine war on the hotel sector in 26 countries and revealed a significant increase in return connectivity at the start of the war.

We have not identified any work on representative research portals concerning the impact of the Ukrainian War on Romanian tourism. Therefore, there is no basis for comparison. This research was prompted by these limitations.

3. Methodology and data

3.1. Methodology

Daily data are used for all tourism companies and the number of migrants from Ukraine who chose Romania as a transit country or temporary destination. The analysis period is 01.01.2022–31.12.2022 and was set to capture the dynamic connection between volatility and refugees. Before this period, the market was operating normally, without major disruptions. A longer period of time was initially considered, but preliminary results show that in 2023 the link between refugees and volatility was insignificant.

The BSE comprises the Main Market dedicated to mature companies, the AeRO market created for SMEs, and a market dedicated to foreign companies. The Main Market and AeRO contain two categories: premium and regular. The stocks of tourism companies were considered regardless of the market or section. Tourism companies were chosen because some of them were among the first organisations to offer shelter and food to Ukrainian refugees. A number of 19 tourism companies listed on the BVB were included in the analysis. There is no tourism company listed on the international market. For each company, the trading symbol was used, and an alphanumeric code was established as per the BSE's internal regulations. The distribution of the number of companies by markets and segments is as follows, standard main: CASA DE BUCOVINA-CLUB DE MUNTE, (BCM); SIF HOTELURI, (CAOR); TURISM, HOTELURI, RESTAURANTE MAREA NEAGRĂ, (EFO); and TURISM FELIX, (TUFE) and standard AeRO: ROMANTA ESTIVAL 2002, (ANTA); ARO-PALACE, (ARO); BALNEAR BUZIAS, (BALN); BTT, (BIBU); BALEA ESTIVAL 2002, (BLEA); CICERO, (CICE); HOTEL CLUB ESTIVAL 2002, (CLUB); DORNA TURISM, (DOIS); NEPTUN OLIMP, (NEOL); NORD, (NORD); PALACE, (PACY);

GRAND HOTEL, (RCHI); TUSNAD, (TSND); TURISM COVASNA, (TUAA); TURISM FELIX, (TUFE) and CLABUCET ESTIVAL 2002, (UCET) (Bursa de Valori București, n.d.).

Daily increases were calculated for each of the given variables. The return series R_t can be obtained considering that P_t is the price of a share unit in t and P_{t-1} is the price of the share on the previous day, thus:

$$R_t = \ln P_t - \ln P_{t-1}. \quad (1)$$

Wavelet analysis was selected for data processing. The method decomposes a time series into different frequency bands and is suitable for examining movements among refugees and the individual volatilities of tourism stocks. Continuous wavelet transform (CWT) has been applied to the study of stock volatility during the Ukrainian war (Będowska-Sojka et al., 2022, Pata et al., 2023; Shahzad et al., 2023). The choice was based on its advantages compared to other methods used in the study of volatility. Thus, the wavelet enables the study of long-term volatility and bidirectionality between variables (Susovon et al., 2023).

Wavelet analysis involves the processing of a time series, denoted $x(t)$ in a series of frequencies through discrete Fourier transformation. If $\psi(t)$ is the mother wavelet function that satisfies the conditions $\int_{-\infty}^{+\infty} \psi(t) dt = 0$ și $\int_{-\infty}^{+\infty} |\psi(t)|^2 dt < \infty$ then another function called daughter wavelet $\psi_{\tau,s}(t)$, defined as such (Grossmann & Morlet, 1984; Mallat, 1989):

$$\psi_{\tau,s}(t) = \frac{1}{\sqrt{|s|}} \psi\left(\frac{t-\tau}{s}\right); \tau \in R, s \neq 0, \quad (2)$$

where $\tau \in R$ is a location parameter, and $s \neq 0$ is a scale parameter. Variable τ ensures the displacement of the function on the time axis $\psi(\tau) = \psi(t - \tau)$, and s allows the matching of the wavelet function with the transformed time series $\psi(s) = \psi\left(\frac{t}{s}\right)$. The scaled and translated wavelet will have the following form:

$$\Psi_{\tau,s}(t) = \psi\left(\frac{t-\tau}{s}\right). \quad (3)$$

If τ is kept constant and the parameter s is changed, then a translation of the wavelet is obtained along the time series. Moving and scaling the two signals makes them resonate at some point, which means that they overlap. Such an overlap is called a convolution and can be expressed with the relation (Agyei, 2023; Shaik et al., 2023):

$$W_x(\tau,s) = \frac{1}{\sqrt{|s|}} \int_{-\infty}^{\infty} x(t) \Psi^*\left(\frac{t-\tau}{s}\right) dt, \quad (4)$$

where $*$ denotes the conjugated complex form.

Next, the phenomenon is repeated for different values of τ . By modifying, scaling, and translating the

parameters, one can scan the time series to identify the prominent frequencies and when they appear.

This research uses Morlet's wavelet, usually used for financial time series data (Aguiar-Contraria & Soares, 2014; Ning et al., 2022; Xuefeng et al., 2022; Sundarasan et al., 2023) expressed as:

$$\psi(t) = \frac{1}{4 \times \pi^{1/4}} \times e^{i \times \omega_0 \times t} \times e^{-\frac{t^2}{2}}, \quad (5)$$

where $4 \times \pi^{1/4}$ has the meaning of wavelet wave energy under form of a central band, $e^{i \times \omega_0 \times t}$ is the imaginary part of the wavelet function centred at the point $(0, \omega_0/2\pi)$, $e^{-\frac{t^2}{2}}$ is the Gaussian envelope.

3.2. Data description

A time series of daily stock price values was compiled for each tourism company. The statistical data are presented in Table 1. The data relating to the companies in the field of activity "Hotels and restaurants", CAEN (Classification of Activities in the National Economy) codes 55 and 56 (National Trade Register Office, n.d.), were collected from the BSE electronic platform (Bursa de Valori București, n.d.). A total of 19 Romanian companies whose object of activity is tourist services were identified. The time series constructed for refugees and returns are of equal lengths. For the refugees, a series was built consisting of the daily number of refugees in Romania.

Since the escalation of the war, Romania has been one of the main states to receive refugees (Figure 1).

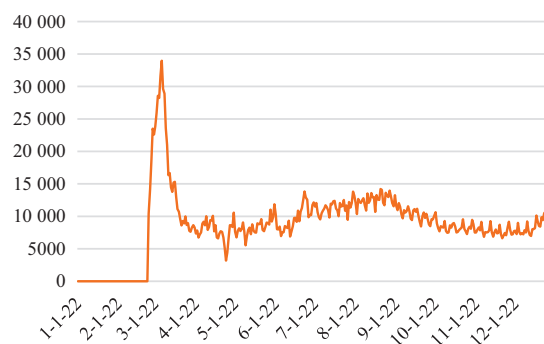


Figure 1. Dynamics of Ukrainian refugees in Romania (source of data: The UN Refugee Agency, n.d.)

Over 101,000 Ukrainians have been granted access in Romania to a variety of services and rights under the Temporary Protection Directive (TPD). As per the TPD, in tune with international law, Romania continuously offers refugees access to shelter, education, health, employment and other social services (Operational Data Portal, n.d.-a).

The data were taken from the websites of national and international authorities (Operational Data Portal, n.d.-a; Frontex, n.d.). The statistical data were compiled with the software EViews 13 (Quantitative Micro Software, USA) și MATLAB version: 9.13.0 (R2022b).

There are significant differences between the highs and lows of stock prices, indicating that the war caused momentous changes in market prices. The values of the standard deviation of the assets are greater during the war compared to the previous period, as further evidence

Table 1. Summary statistics of stock daily returns (source: author's own calculation)

Symbol	Mean	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
ANTA	-0.00041	0.00000	-0.08550	0.00558	-13.7972	194.7402	570704.1	0.00
ARO	0.00022	0.18620	-0.15690	0.01403	2.79267	130.8505	249066.0	0.00
BALN	-8,49E-05	0.02880	-0.08530	0.00504	-12.19175	231.3816	802281.0	0.00
BCM	-6.77E-04	0.00100	-0.01250	0.00076	-13.23068	200.6023	604483.9	0.00
BIBU	-0.00903	1.51500	-2.15020	0.15741	-5.79921	127.5933	238132.4	0.00
BLEA	0.00013	0.05000	0.00000	0.00261	19.02637	363.0027	1993052	0.00
CAOR	0.00172	0.48850	-0.35180	0.00000	5.10847	111.5605	180823.5	0.00
CICE	-0.00062	0.00000	-0.22820	0.03715	-19.02637	363.0027	1993052	0.00
CLUB	0.00532	1.94370	0.00000	0.01194	19.0263	363.0027	1993052	0.00
DOIS	0.00178	0.51010	-0.31430	0.10173	8.67975	136.0618	273853.3	0.00
EFO	8.68E-04	0.02270	-0.01090	0.03939	5.06767	70.14545	70129.22	0.00
NEOL	0.00028	0.10490	-0.13850	0.00192	-1.34042	76.34663	81926.00	0.00
NORD	0.00019	0.99140	-1.60430	0.01214	-4.59910	86.19824	106558.0	0.00
PACY	0.00028	0.05680	-0.06110	0.13801	2.19390	70.98944	70594.29	0.00
RCHI	-2.85E-04	0.04080	-0.03900	0.00618	0.51456	135.6239	267516.8	0.00
TSND	0.00015	0.04500	-0.05330	0.00320	0.10433	103.6028	153923.0	0.00
TUAA	1.21E-04	0.01720	-0.01140	0.00444	7.54583	200.5227	596820.4	0.00
TUFE	-0.00024	0.01130	-0.01980	0.00109	-6.01962	58.45049	48966.28	0.00
UCET	0.00055	0.20140	0.00000	0.00192	19.0263	363.0027	1993052	0,00

that the volatility and degree of risk of the assets were intensified by the war. There is also a significant variation evident in the skewness and kurtosis statistics, which measure the distribution of the series. The unit root tests used are robust, confirming that the series is stationary.

4. Results

For each tourism company, two paired time series of equal length were formed, consisting of the daily number of refugees and the daily volatility of each stock. Figure 2 shows a contour map for each analysed company, which contains wavelet coherence. The intensity of the phase difference is between the minimum values coloured dark blue and the maximum values coloured dark red. The areas coloured blue show low coherence between the pair of variables, while the areas highlighted in red have the opposite meaning.

In Figure 2, two axes, eight unidirectional arrows, and a cone of influence appear as distinctive elements. The analysed period was represented on the Ox axis, and on the Oy axis, the normalised frequency was expressed as a coefficient with values between 0 and 1. The direction in which the arrows point indicates the phase difference. When the arrows are oriented (↗) or (↘), it means that the first variable has a determining role and drives the second time series. If the arrows are directed (↖), it indicates a negative correlation or an out-of-phase association between the series under the main effect of any primary series, (↙) (has the opposite explanation), or a main role for the second variable (stock return) (Agyei, 2023; Haq et al., 2023). Arrows pointing (↑) or (↓) show that there is a lag of $\pi/2$ between refugees and stock return. The cone of influence (COI) presents the important dynamics of the interaction between the pairs of analysed variables. It appears as a faded area that follows the dynamics of the lead-lag on the scalogram. The interior of the COI shows significant dynamics and the exterior shows insignificant dynamics.

CWT charts depict the volatility of travel stocks over both frequency and time. The areas inside the figures represented in darker colours show minimal volatility and as the colour becomes less intense it shows higher volatility. The islands formed by arrows with a light shade have a special significance, as they indicate the significance of the power spectrum (volatility).

5. Discussion

CWT analysis suggests that on short time horizons, the shares of the companies CAOR, BIBU, NORD, PACY, BCM, DOIS, and BALN experienced high volatility, while TUFE, ARO, RCHI, BLEA, CLUB, EFO, NEOL, UCET, and CICE registered low volatility (Table 2).

Next, TUFE, ARO, ANTA, NEOL and TSND recorded medium-low volatility in the low-frequency bands, but over the entire period. Finally, BIBU, TUAA, and BCM exhibited high volatility over long-term horizons, as seen from the red arrow islands.

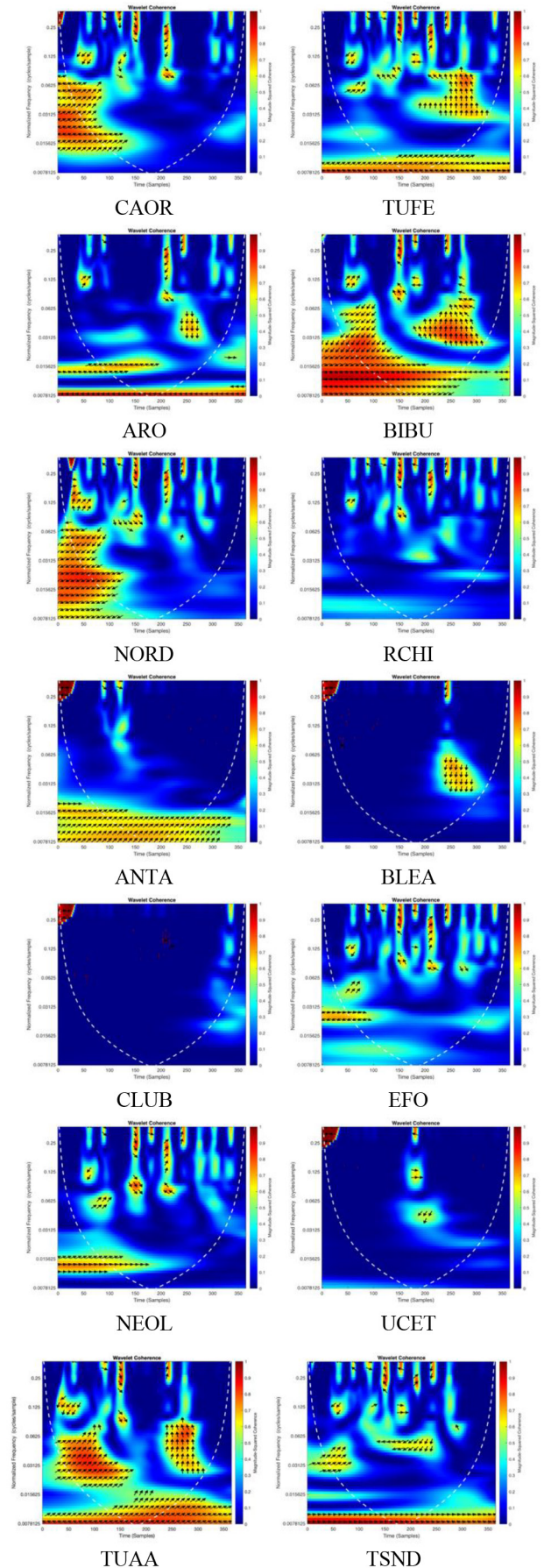


Figure 2. To be continued

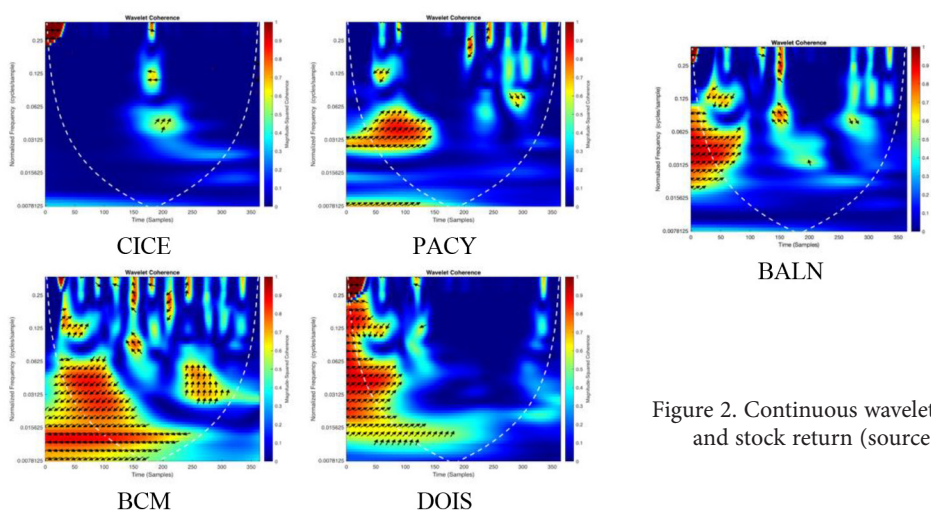


Figure 2. Continuous wavelet transform (CWT) of refugees and stock return (source: author's own calculation)

Table 2. Analysis of significant stock volatilities (source: author's own calculation)

Company	Significant volatility	Time (days)	Normalized Frequency	Magnitude	Horizon	Individuals	Stock trend
CAOR	High	1–150	0.014–0.100	0.5–1.0	long-term	increase	increase
	High	200–220	0.063–0.250	0.7–0.9	short-term	increase	increase
TUFE	Medium-high	1–365	0.050–0.125	0.6–1.0	long-term	increase	decrease
	Medium-high	50–325	0.030–0.300	0.5–1.0	long-term	increase	decrease
ARO	Medium-high	1–365	0.000–0.300	0.6–1.0	long-term	increase	increase
BIBU	High	1–365	0.000–0.300	0.4–1.0	long-term	increase	decrease
NORD	Medium-high	1–240	0.000–0.300	0.4–1.0	long-term	increase	increase
RCHI	Medium-high	50–240	0.080–0.300	0.4–1.0	long-term	increase	increase
ANTA	Medium-high	1–125	0.250–0.300	0.4–1.0	long-term	increase	decrease
	Medium-low	1–340	0.000–0.020	0.4–0.7	long-term	increase	decrease
BLEA	High	1–50	0.070–0.300	0.5–1.0	short-term	stationary	stationary
	Medium-high	240–300	0.025–0.300	0.4–0.8	short-term	decrease	increase
CLUB	High	1–40	0.200–0.300	0.8–1.0	short-term	stationary	stationary
	Medium-low	210–220	0.125–0.170	0.0–0.7	short-term	decrease	stationary
EFO	Medium-high	1–290	0.020–0.300	0.4–1.0	long-term	increase	increase
NEOL	Medium-high	1–240	0.010–0.300	0.4–1.0	long-term	increase	decrease
UCET	Medium-high	1–220	0.050–0.300	0.4–0.9	long-term	increase	increase
TUAA	High	1–365	0.000–0.300	0.4–1.0	long-term	increase	increase
TSND	Medium-high	1–365	0.000–0.300	0.4–1.0	long-term	increase	increase
CICE	High	1–30	0.200–0.300	0.8–1.0	short-term	stationary	stationary
	Medium-high	170–210	0.032–0.300	0.4–1.0	short-term	increase	decrease
PACY	Medium-high	1–150	0.000–0.300	0.4–1.0	long-term	increase	increase
	High	200–250	0.180–0.300	0.8–1.0	short-term	increase	decrease
	Medium	270–300	0.060–0.080	0.4–0.65	short-term	decrease	increase
BCM	High	1–300	0.000–0.300	0.4–1.0	long-term	increase	decrease
DOIS	High	1–180	0.001–0.300	0.4–1.0	long-term	increase	increase
BALN	Medium-high	1–200	0.017–0.300	0.4–1.0	long-term	increase	decrease
	Medium	270–280	0.070–0.080	0.5–0.6	short-term	decrease	increase

The results reveal how the refugees from Ukraine who chose Romania as a destination or transit country influenced the tourism shares listed on the BSE at an unexpected level. Fifteen stocks (78.94%) were influenced by the dynamics of Ukrainian migrants. In the remaining companies (4), a significant negative stock price reaction was observed at the beginning of the military conflict. We thus confirm the results obtained by Martins et al. (2023), respectively, and Nicolau et al. (2024).

The maximum volatility was recorded in the BIBU Company from Bucharest, whose majority shareholder is the Romanian state through the Ministry of Family, Youth and Equal Opportunities (87.92%, or 4762543 shares as of 31.12.2022). The main stock market indicators for this company are a market capitalisation of 3,501,695 EUR, PER = 24.66, P/BV = 0.27, EPS = 0.13, DIVY = 0 (Bursa de Valori Bucureşti, n.d.). The results show a large commotion, as the scalogram is mostly filled with clouds of arrows. This can be attributed to Bucharest receiving the biggest number of Ukrainian migrants, and the company being involved in the accommodation of Ukrainian migrants.

From the perspective of intensity, the BCM company of Gura Humorului, Suceava County, located close to the Ukrainian border, follows. The company has one of the main investment funds in Romania as its majority shareholder, with a share of 69.24%. It has a market capitalisation of 3,066,033 EUR, PER = 26.16, P/BV = 0.42, EPS = 0.00 and DIVY = 14.97 (Bursa de Valori Bucureşti, n.d.). A significant commotion is noted in the first half of 2022.

A similar evolution can be seen in the companies' CAOR (Oradea, Bihor County), NORD (Bucharest), and DOIS (Vatra Dornei, Suceava County). In these companies, the confiscations were registered in the first 3 months after the start of the conflict on all normalised frequency bands. The geographic distance from the main border points with Ukraine appears to be a factor influencing market rate volatility.

BALN and PACY had a similar evolution consisting of commiseration at the beginning of the war for about 2 months on the medium frequency bands. Another category of companies with a close evolution consists of ARO, ANTA, TSND and TUAA, TUFE. A possible explanation could be that the majority stake is held by the same investment fund in all these companies. In their case, the commotions were weak and manifested throughout the period in the band of low normalised frequencies. None of the companies are located near the border with Ukraine.

At 5 companies, there were no commissions during the entire analysed period: BLEA, CICE, CLUB, UCET, and RCHI. The riots are insignificant and cannot be the result of migrants from Ukraine. All of them are located at great distances from the border with Ukraine.

The results can be explained by the immediate refugee assistance actions and long-term integration policies offered by Romania (Operational Data Portal, n.d.-b). The main actions are financial assistance, legal assistance,

documentation, government assistance, education, livelihood, medical assistance, and temporary protection.

6. Conclusions

We used time-frequency analysis to identify the behaviour of tourism stocks during periods of stress in different trading horizons, which are described by frequency bands. The interdependence between the number of migrants and the course of tourism actions was examined. All tourism companies listed on the BSE were selected, regardless of market or segment. Thus, 19 tourism companies were identified, one of which was eliminated due to financial and trading problems.

The interdependence between the price of the share and the number of migrants was found for 15 shares of companies, representing 78.94%. The maximum volatility was recorded at the BIBU Company from Bucharest, the main reason being its participation in refugee accommodation. The empirical evidence and the graphs in Figure 2, combined with the ADF test, show that stock volatilities are influenced by geographic location. The most affected tourism companies were those located near the border with Ukraine. In addition, international events related to the conflict also triggered volatilities in tourism. Each company's specific actions caused different levels of volatility for tourism companies.

We contribute to the existing body of knowledge focused on the assessment of time-frequency covariances between the course of tourism stocks and the number of migrants during the conflict in Ukraine. The interrelationships suggest that the number of migrants significantly influences stock prices and returns. This research contributes to the literature using CWT techniques to analyse the impact of shocks relating to the number of migrants on the course of tourism stocks. Our results have positive implications for policymakers and investors looking to diversify risks and portfolios and regulate information during intervals of turbulence.

There are still many refugee-related topics for future study. This study focuses on stock market performance, but geopolitical tensions can also affect other economic areas. An interesting topic would be a comparative analysis with actions from other fields, such as energy or the defence industry.

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Contribution

The authors state that they contributed equally to the article.

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