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DEVELOPING AND DEVELOPED MEDITERRANEAN STOCK EXCHANGES: INTERDEPENDENCE IN PERIODS OF CRISIS AND STABILITY

Dusica STEVCEVSKA SRBINOSKA[1], Shenasi MEMISHI[2]

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ABSTRACT. This research aims to explore how the stock exchange indexes of developed and developing Mediterranean countries are interrelated, both during times of crisis and stability. Specifically, it examines the association between Macedonia's MBI10 index and the stock exchange indexes of Serbia (BELEX15), Italy (FTSE MIB), and Spain (IBEX35) from 2005 to 2022 using monthly data. To understand how crises impact the relationships between these markets, the study breaks down the timeframe into four distinct periods: before the Great Financial Crisis (pre-GFC), during the GFC, after the GFC (post-GFC), and during the Covid-19 pandemic and energy crisis. Through Pearson correlation and linear regression analyses, the findings show that the MBI10's correlation with the BELEX15, FTSE MIB, and IBEX35 indexes was strongest during the GFC. However, this correlation dropped significantly during the Covid-19 pandemic and energy crisis.

Keywords: Mediterranean, stock exchange, Great Financial Crisis, interdependence, Covid-19, energy crisis

JEL Classification: F02, F21, G15

[1] Corresponding author. School of Business Economics and Management, University American College Skopje, North Macedonia. E-mail: dusica@uacs.edu.mk
[2] Municipality of Tetova, North Macedonia. E-mail: shenasi.memishi@tetova.gov.mk

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Introduction

The pivotal role of stock exchanges in the global economy cannot be overstated, as they serve as hubs for fostering economic growth and innovation worldwide. Particularly in recent times, stock exchanges have been instrumental in bolstering investment, facilitating capital allocation, and driving economic development. Research has demonstrated their crucial function during financial and economic crises, rendering them susceptible to and influential upon downturns. Their responses to such crises, coupled with governmental interventions and adjustments, play a vital role in stabilizing markets and restoring investor confidence. However, it is evident that the influence of economic crises on stock exchanges can have enduring adverse impacts on the global financial system and economy. In this regard, the Great Financial Crisis of 2008 precipitated significant turbulence in financial markets and widespread economic deceleration (Dhal, 2009). In light of these circumstances, numerous scholars and policymakers have endeavored to assess the extent of the interplay between economic uncertainty and asset yields (Garcia *et al.,* 2014), the impact of financial crises on stock exchanges worldwide, yielding mixed empirical findings that contribute to the literature in this domain. Liu (2013) identified several key factors that drive the interdependence between financial markets in developed and developing countries. These factors include information dissemination quality, industrial structure correspondence, economic and financial consolidation, which tend to be relevant only within the same cluster of either developed or emerging markets. Samadder & Bhunia (2018) conclude that investors can enjoy notable gains from diversifying their portfolios internationally in the short term, but the long-term advantage of such diversification are limited. Recognizing that global macroeconomic and financial crises can cause major changes in the economy, public revenues, and investor risk behavior, numerous studies have explored how stock market correlations behave during such crises (Sharma, 2011; Srikanth & Aparna, 2012; Hwang *et al*., 2013; Yarovaya & Lau, 2016; Jiang *et al*., 2017; Das *et al*., 2019; Ji *et al*., 2020).

Regarding the Macedonian Stock Exchange (MSE), it is noteworthy that it is relatively young and exhibits liquidity deficit and lack of market depth. In the pre-crisis period, foreign investor participation in the exchange reached

40% in 2008, followed by a swift withdrawal post-crisis, which significantly impacted MSE stock prices. Additionally, there was evidence of a remarkable 905% increase in the main stock index MBI10 from 2005 to 2007, followed by a 75% decline in 2011. Furthermore, compared to other developing countries, the recovery period for MSE was notably sluggish. Consequently, this paper aims to explore the nexus between emeging and developed stock exchanges (Macedonian Stock Exchange (MBI10), Belgrade (BELEX15), Italian (FTSE MIB), and Spanish (IBEX35) stock exchange index) by analyzing monthly data from 2005 to 2022. Moreover, this study aims to add to the existing literature by exploring the interrelationships among Mediterranean stock exchanges, emphasizing the importance of time-varying factors in financial market integration.

This paper has the following structure: After the introduction, the Literature Review section examines existing literature pertaining to stock exchanges, with particular emphasis on the great financial crisis of 2008, the Covid-19 pandemic, and the global energy crisis, and their interrelations. The subsequent section, Data and Methodology, delineates the methods employed for data collection, processing, and analysis. The fourth section, Findings and Discussion, offers a detailed analysis of the empirical results. Finally, the Conclusions section synthesizes the findings of the empirical research, providing insights derived from the analysis.

Literature review

The examination of stock exchange markets has been a focal point for numerous researchers and scholars, particularly in assessing their dynamics during periods of crisis and stability. Olbryś & Majewska (2017) suggest that the association between S&P500 and France-CAC, as well as British FTSE and German DAX markets, intensified during the GFC in comparison to the period before the crisis, an assertion confirmed by Slimane *et al*. (2013) in view of the Germany, France, and UK linkage. Meanwhile, Wang (2014) investigated the correlations between six East Asian stock exchanges and their interactions with the US market during the GFC, finding that the crisis bolstered connections between East Asian markets, albeit with reduced responsiveness to US shocks post-crisis. Additionally, Meric *et al*. (2012) studied the relationship among US, European, and Australian stock exchanges during the GFC, concluding an increased integration between them during this period.

Choi (2022) analyzed volatility dynamics in South Korea, China, Japan, and the US during the GFC and the COVID-19 pandemic, aiming to discern how volatility shocks propagate among these nations during regular periods and

crises. The study revealed temporal variations in overall interdependence and net interconnection among the volatilities of the four stock markets, with the GFC demonstrating higher total connectedness in comparison to the COVID-19 period. Basuony *et al.* (2021) examined how the COVID-19 pandemic affected equity returns, conditional fluctuations, probability distribution asymmetry, and the probability of adverse market conditions. They found that major equity markets experienced a negative impact, with a significant surge in conditional volatilities and bad state probabilities across the board. However, the extent of this impact varied by country: China and Germany showed lower conditional volatility, whereas Italy, the United States, and the United Kingdom saw higher volatility and bad state probabilities. The spike in conditional volatility during the pandemic gradually diminished once markets absorbed the initial shock.

Abuzayed et al. (2021) investigated the transmission of systemic distress risk between worldwide and single stock exchanges amidst the COVID-19 pandemic. Utilizing conditional value at risk (CoVaR) and delta conditional VaR (CoVaR) measures alongside the bivariate dynamic conditional correlation (DCC) conditional autoregressive heteroscedastic (GARCH) model, their findings revealed a heightened spread of systemic risk between the worldwide stock market and individual stock markets during the COVID-19 pandemic. North American and European markets were particularly affected, showing higher levels of risk transmission and reception in contrast to Asian markets, indicating a greater integration of ultimate distress risk during the pandemic.

In contrast, Goetzmann *et al.* (2001) examined how major global equity markets correlated over 150 years, highlighting a period of prosperity in the late 1990s. Their findings supported the "U" shaped hypothesis on globalization, indicating that about half of the diversification benefits for international investors during that time came from the increasing number of global markets, while the other half stemmed from lower average correlations among these markets.

Das *et al.* (2019) investigated how global crises affected the relationships between stock markets, specifically focusing on G7 countries and analyzing data dating back to the 1800s. Their research shed light on the varied impacts of global crises on the changing correlations between the US stock market and its counterparts in the G7 nations, indicating strengthened associations between the US market and those of the UK and Canada during crises, with contrasting trends observed concerning European and Japanese markets.

Pagano *et al.* (1999) investigated push factors influencing European companies to exchange abroad, highlighting increased co-integration among European stock exchanges with the EU's growth. Similarly, Syriopoulos & Roumpis (2009) and Kenourgios & Samitas (2011) found that EU accession facilitated the consolidation of Balkan and developed stock markets, particularly

European and US markets. Conversely, Horvath & Petrovski (2012) noted limited connections between stock markets in Central and South Eastern Europe with those in developed Western Europe, except for Croatia, which showed a notably high level of integration.

Recent studies have confirmed the interrelationship between Balkan stock exchanges (Karagoz & Ergun, S, 2009; Gradojević & Dobardžić, 2013; Şahin, 2015; Zdravkovski, 2016; Angelovska, 2017; Srbinoska *et al*., 2021). Notably, Angelovska (2017) suggested bidirectional causality between the Macedonian and Croatian stock markets, while Zdravkovski (2016) observed increased integration among Balkan stock markets during the GFC. Additionally, Srbinoska *et al*. (2021) detected a heightened association between the Macedonian, Belgrade and Euronext Paris equity markets, in conjunction with a diminished association with Six Swiss in periods of financial crises.

Data and methodology

Sample

The analysis utilized secondary data collected from the Internet sites of the selected stock exchanges and stock trading web pages, specifically investing.com and finance.yahoo.com. The dataset comprises four selected stock exchanges: the Macedonian (MBI10) index, the Belgrade (BELEX15) index, the Italian (FTSE MIB) index, and the Spanish (IBEX35) index, spanning from 2005 to 2022. Monthly index values of the stock exchanges are denominated in their respective national currencies. The timeframe is segmented into four sub-periods: pre-GFC, during the GFC, post-GFC, and during the Covid-19 and energy crises.

Table 1 presents a summary of the main stock indices for the countries included in our study. The paper explores how investors react during normal times, crises, and recovery phases by examining the interconnections among two developing and two developed European stock markets. The data is segmented into four periods: pre-GFC spanning from November 2005 to July 2007, GFC from August 2007 to November 2011, post-GFC sub-sample covering December 2011 to January 2020, and the pandemic and energy crisis from February 2020 to October 2022.

Table 1. Stock exchanges and their indices

Country	Stock Exchange	Index	Index date of inception
North Macedonia	Macedonian Stock Exchange	MBI10	November, 2001
Serbia	Belgrade Stock Exchange	BELEX 15	September, 2005
Italy	Italian Stock Exchange	FTSE MIB	September, 2004
Spain	Spanish Stock Exchange	IBEX35	January, 1992

Source: authors' compilation

Hypotheses

The primary goal of this study is to investigate how integrated the Macedonian Stock Exchange (MBI10) is with the Belgrade Stock Exchange (BELEX15), the Italian Stock Exchange (FTSE MIB), and the Spanish Stock Exchange (IBEX35) across different periods: pre-, during, and post-GFC, as well as during the Covid-19 pandemic and energy crisis. To explore the existence of correlations between emerging and developed stock markets during these times, three hypotheses have been formulated:

H1: During crises (GFC and Covid-19 and energy crisis), the correlation between the Macedonian Stock Exchange (MBI10) and the Belgrade Stock Exchange (BELEX15) is greater compared to the pre- and post-crisis periods.

H2: During crises (GFC and Covid-19 and energy crisis), the correlation between the Macedonian Stock Exchange (MBI10) and the Italian Stock Exchange (FTSE MIB) is greater compared to the pre- and post-crisis periods.

H3: During crises (GFC and Covid-19 and energy crisis), the correlation between the Macedonian Stock Exchange (MBI10) and the Spanish Stock Exchange (IBEX35) is greater compared to the pre- and post-crisis periods.

Methodology

To investigate the correlations among developing (Macedonian and Belgrade stock markets) and developed stock markets (Italian and Spanish Stock Exchanges) before the Great Financial Crisis (GFC), during GFC, post-GFC, and during the Covid-19 and energy crisis, the methodology outlined by Srbinoska *et al*. (2021) was followed. Linear regression analysis was employed, along with Pearson correlation and ANOVA tests, to ascertain the interrelationship between these stock exchanges across the four sub-categories of the time period.

Empirical findings and discussion

Descriptive statistics

Table 2 provides a summary of descriptive statistics, including the count of observations, the average, lowest and highest values of the indexes, and their standard deviation.

Table 2. Descriptive statistics

Variable	Number of observations	Minimum value	Maximum value	Mean value	Standard Deviation
Entire period November 2005 to October 2022					
MBI10	204	1581.87	10014.82	3302.856	1711.634
BELEX15	204	380.83	3283.62	865.0996	531.3279
FTSEMIB	204	12873.84	43755	23168.32	7136.371
IBEX35	204	6089.8	15890.5	9941.266	1964.669
Pre-crisis period November 2005 to July 2007					
MBI10	21	2237.32	7046.15	3880.669	1568.34
BELEX15	21	1028.27	3283.62	1720.11	775.4421
FTSEMIB	21	34090	43755	39100.29	2690.436
IBEX35	21	10557.8	15329.4	12964.76	1568.437
Crisis period August 2007 to November 2011					
MBI10	52	1789.33	10014.82	3722.794	2148.691
BELEX15	52	380.83	2869	1002.617	666.503
FTSEMIB	52	14836.33	40512	23783.81	7073.293
IBEX35	52	7620.9	15890.5	10934.04	2011.756
After-crisis period of GFC December 2011 until January 2020					
MBI10	33	3529.17	6265.86	5192.41	747.175
BELEX15	33	636.53	858.86	767.8245	65.01666
FTSEMIB	33	6452.2	9148.9	8062.576	786.0426
IBEX35	33	17050.94	27346.83	22706.01	2988.367
Covid – 19 and energy crisis period February 2020 until October 2022					
MBI10	98	1581.87	4645.17	2319.935	809.2387
BELEX15	98	430.99	808.22	641.6709	99.07123
FTSEMIB	98	6089.8	11521.1	9399.216	1110.856
IBEX35	98	12873.84	23979.37	19583.41	2761.314

Source: authors' analysis

From the above statistics, we can see that MBI10 and BELEX15 are the indexes with the highest percentage of variability and fluctuations. Descriptive statistics are also shown for the pre-GFC period, during GFC and the aftermath, and during Covid-19.

Additionally, Figure 1 depicts the trends of the four indices during the whole time – period by showing the fluctuations of the stock exchange markets before GFC, during GFC, post-GFC and Covid-19 and energy crisis. The sharpest decline took place during the crisis period between 2007 – 2009.

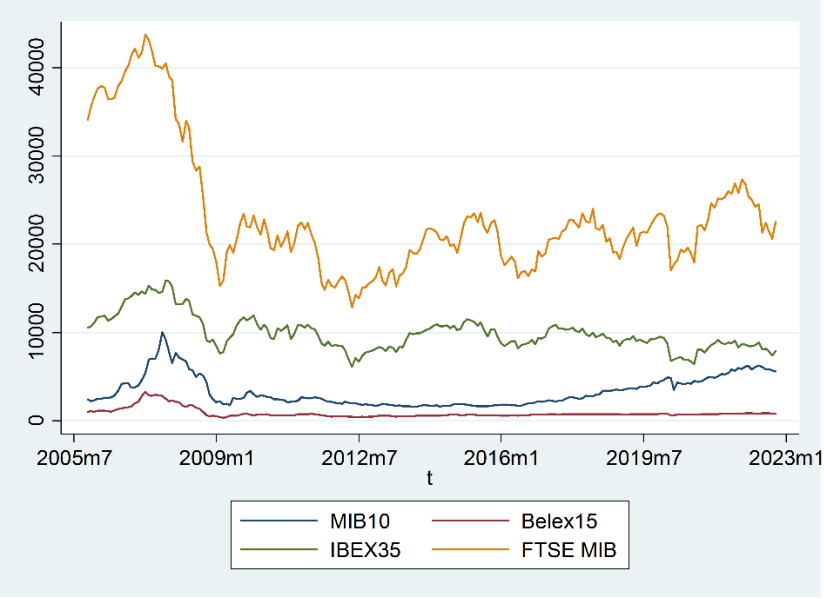

Figure 1. Trends of the Macedonian (MBI10), Belgrade (BELEX15), Italian (FTSE MIB) and Spanish (IBEX35) stock exchange index
Source: authors' analysis

Correlation(s)

H1: During crises (GFC and Covid-19 and energy crisis), the correlation between the Macedonian Stock Exchange (MBI10) and the Belgrade Stock Exchange (BELEX15) is greater compared to the pre- and post-crisis periods.

For our first hypothesis, we aimed to determine whether the association between the Macedonian Stock Exchange (MBI10) and the Belgrade Stock Exchange (BELEX15) is stronger during times of crisis compared to both before and after the crises (Tables 3 and 4). The regression results from our empirical

analysis support the hypothesis during the Great Financial Crisis timespan, but not during the Covid-19 pandemic and energy crisis. Specifically, we found a significant increase in correlation between these exchanges during the GFC, whereas during the Covid-19 and energy crisis, the correlation was observed to be very low.

Conversely, in the GFC aftermath, we observed a diminished correlation between these markets, which may indicate a longer recovery period required for the Macedonian Stock Exchange. Our findings align with prior studies by Zdravkovski (2016) and Srbinoska *et al.* (2021) concerning the GFC period, and with Choi (2022) regarding the Covid-19 pandemic and energy crisis findings.

Table 3. Regression Results: MBI10 and BELEX15

	Pre-crisis (Period before Great Financial Crisis)	**During GFC**	**Post-crisis (Period after the Great Financial Crisis)**	**Covid – 19 and energy crisis**
R Square	0.799	0.927	0.8340	0.4644
Adjusted R Square	0.789	0.926	0.8287	0.4588
Standard Error	390.22	147.23	309.25	595.33
Observations	21	52	33	98

Source: authors' analysis

Table 4. ANOVA: Regression Analysis, MBI10 and BELEX15

Regression analysis MBI10-BELEX15, pre-GFC					
	Df	SS	MS	F	Significance F
Regression	1	39341200.5	39341200.5	75.87	0.000
Residual	19	9852596.92	518557.733		
Total	20	49193797.4	2459689.87		
Regression analysis MBI10-BELEX15, GFC period					
	Df	SS	MS	F	Significance F
Regression	1	218418198	218418198	640.81	0.000
Residual	50	17042223.8	340844.476		
Total	51	235460422	4616871.01		
Regression analysis MBI10-BELEX15, post-GFC					
	Df	SS	MS	F	Significance F
Regression	1	14899858.4	14899858.4	155.79	0.000
Residual	32	2964796.78	95638.6058		
Total	33	17864655.2	558270.474		
Regression analysis MBI10-BELEX15, during Covid-19 and energy crisis					
	Df	SS	MS	F	Significance F
Regression	1	29498257.1	29498257.1	83.23	0.000
Residual	96	34023867.4	354415.285		
Total	97	63522124.5	654867.263		

Source: authors' analysis

H2: During crises (GFC and Covid-19 and energy crisis), the correlation between the Macedonian Stock Exchange (MBI10) and the Italian Stock Exchange (FTSE MIB) is greater compared to the pre- and post-crisis periods.

The second hypothesis explores whether the association between the Macedonian Stock Exchange (MBI10) and the Italian Stock Exchange (FTSE MIB) is higher during the GreatFinancial Crisis (GFC) and Covid-19 crises compared to before and after these crises (Tables 5 and 6). This analysis also aims to assess if the impact of crises affects developing and developed markets similarly.

Table 5. Regression Results: MBI10 and FTSE MIB

	Pre-crisis (Period before Great Financial Crisis)	**During GFC**	**Post-crisis (Period after the Great Financial Crisis)**	**Covid – 19 and energy crisis**
R Square	0.600	0.896	0.4885	0.1649
Adjusted R Square	0.578	0.894	0.4720	0.1562
Standard Error	1016.6	697	542.91	743.34
Observations	21	52	33	98

Source: authors' analysis

Table 6. ANOVA: Regression Analysis, MBI10 and FTSE MIB

Regression analysis MBI10- FTSE MIB, pre-GFC					
	df	SS	MS	F	Significance F
Regression	1	29557340.3	29557340.3	28.60	0.000
Residual	19	19636457.1	1033497.74		
Total	20	49193797.4	2459689.87		
Regression analysis MBI10- FTSE MIB, GFC period					
	df	SS	MS	F	Significance F
Regression	1	211169673	211169673	434.67	0.000
Residual	50	24290748.8	485814.976		
Total	51	2354604422	4616871.01		
Regression analysis MBI10- FTSE MIB, post-GFC					
	df	SS	MS	F	Significance F
Regression	1	8727499.87	8727499.87	29.61	0.000
Residual	31	9137155.29	294746.945		
Total	32	17864655.2	558270.474		
Regression analysis MBI10- FTSE MIB in the period of Covid – 19 and energy crisis					
	df	SS	MS	F	Significance F
Regression	1	10476496.7	10476496.7	18.96	0.000
Residual	96	53045627.8	552558.623		
Total	97	63522124.5	654867.263		

Source: authors' analysis

During the Great Financial Crisis, we observed a slight increase in correlation between these two stock markets, which supports this hypothesis for that period. However, our findings lead us to reject the hypothesis for the Covid-19 pandemic and energy crisis period, consistent with Choi's findings (2022). These observations are consistent with previous studies by Tudor (2011), Nistor *et al.* (2012), and Srbinoska *et al.* (2021).

H3: During crises (GFC and Covid-19 and energy crisis), the correlation between the Macedonian Stock Exchange (MBI10) and the Spanish Stock Exchange (IBEX35) is greater compared to the pre- and post-crisis periods.

The third hypothesis assesses if the association between the Macedonian stock market (MBI10) and the Spanish stock market (IBEX35) is stronger during the Great Financial Crisis (GFC) compared to the periods before the GFC, after the GFC, and during the Covid-19 pandemic. As depicted in Tables 7 and 8, the relationship between MBI10 and IBEX35 is significantly elevated before and during the GFC, suggesting a heightened relationship until January 2020. The correlation between MBI10 and IBEX35 shows a notable decrease in the aftermath of the Great Financial Crisis and during the pandemic and energy crisis, indicating divergent market behaviors between the Macedonian and Spanish stock exchanges, which is consistent with Choi's observations (2022).

Table 7. Regression Results: MBI10 and IBEX35

	Pre-crisis (period before Great Financial Crisis)	**During GFC**	**Post-crisis (Period after the Great Financial Crisis)**	**Covid – 19 and energy crisis**
R Square	0.759	0.743	0.4019	0.0009
Adjusted R Square	0.746	0.738	0.3826	0.0008
Standard Error	1469.97	850.235	587.07	813.09
Observations	21	52	33	98

Source: authors' analysis

Table 8. ANOVA: Regression analysis, MBI10 and IBEX35

Regression analysis MBI10- IBEX35, pre-GFC					
	df	SS	MS	F	Significance F
Regression	1	37341734	37341734	59.86	0.000
Residual	19	11852063.4	623792.811		
Total	20	49193797.4	2459689.87		

Regression analysis MBI10- IBEX35, GFC period					
	df	SS	MS	F	Significance F
Regression	1	175062423	175062423	144.92	0.000
Residual	50	60397998.5	1207959.97		
Total	51	2354604422	4616871.01		
Regression analysis MBI10- IBEX35, post-GFC					
	df	SS	MS	F	Significance F
Regression	1	39777966.5	39777966.5	20.92	0.000
Residual	31	245304128	1901582.38		
Total	32	285082094	2192939.18		
Regression analysis MBI10- IBEX35 during the period of Covid – 19 and energy crisis					
	df	SS	MS	F	Significance F
Regression	1	14899858.4	14899858.4	20.83	0.0001
Residual	87	2964796.78	95638.6058		
Total	88	17864655.2	558270.474		

Source: authors' analysis

Conclusion

The purpose of this study was to examine the correlations between the Macedonian Stock Exchange and the Belgrade Stock Exchange, Italian Stock Exchange, and Spanish Stock Exchange across different periods: before, during, and after the Great Financial Crisis (GFC), as well as during the pandemic and energy crises. Using monthly data spanning from November 2005 to October 2022, the study segmented the timeframe into four sub-periods: pre-crisis (Nov 2005 – July 2007), GFC crisis (Aug 2007 – Nov 2011), post-GFC (Dec 2011 – Jan 2020), and the period covering the Covid-19 and energy crises (Feb 2020 – Oct 2022). Initially, the research included a comprehensive review of theoretical background and empirical literature to gain insights into how stock exchange markets interact during periods of crisis and stability.

Drawing from existing research, the paper concluded that correlations among stock exchanges were generally greater during the GFC compared to the pre- and post-GFC timaspans. In contrast, correlations were notably lower during the Covid-19 and energy crises. The analysis using linear regression indicated higher correlations between the Macedonian Stock Exchange (MBI10) and the Belgrade Stock Exchange (BELEX15) and Italian Stock Exchange (FTSE MIB) during the GFC crisis compared to the pre- and post-crisis periods, which was not observed during the Covid-19 and energy crises. Additionally, higher correlations between the Macedonian Stock Exchange (MBI10) and the Spanish Stock Exchange (IBEX35) were observed before and during the GFC.

Given the focus on investigating the interdependency of the Macedonian Stock Exchange with both emerging and developed stock exchange markets, these findings hold practical significance for decision-making, portfolio investment, and policymaking, particularly for Macedonian and regional investors. While both crises impacted investor confidence and market dynamics, differences existed in their origins and effects. The GFC stemmed from financial sector breakdowns, whereas the Covid-19 crisis arose from a global health emergency, affecting multiple industries simultaneously. Consequently, responses to these crises varied, necessitating an understanding of their similarities and differences to evaluate their influence on stock exchange interdependence.

In summary, this study underscores the susceptibility of the Macedonian Stock Exchange to market fluctuations and emphasizes the potential long-term ramifications of even minor fluctuations in various crisis scenarios.

NOTE: This paper continues the study initiated in a previous paper (Srbinoska *et al*., 2021), expanding the timeline to encompass the crises that ensued the GFC: Covid-19 pandemic and energy crisis.

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