Folia Oeconomica Stetinensia
Volume 24 (2024) Issue 1
DOI: 10.2478/foli-2024-0002 | 22–40
ISSN (print): 1730-4237 | ISSN (online): 1898-0198
www.wnus.usz.edu.pl/fos

THE 2020 COVID-19 FINANCIAL CRISIS IMPACT ON THE EUROPEAN STOCK MARKETS AND ECONOMIES. A PRELIMINARY ANALYSIS

Jennifer Foo

Stetson University
e-mail: jfoo@stetson.edu
ORCID: 0000-0002-8789-5593

Dorota Witkowska

University of Johannesburg
e-mail: mariaw@uj.ac.za
ORCID: 0000-0001-9538-9589

Received 27.07.2023, Revised 25.02.2024, Accepted 26.02.2024

Abstract

Research background: In mid-April 2020, the global financial markets plunged into financial crisis from the unprecedented worldwide lockdowns for an extended period.
Purpose: This paper looks at the COVID-19 pandemic impact on the selected European stock markets and economies in comparison to USA, Israel, and China. The goal of the research is to find out if the pandemic affected different national economies and capital markets in the same way.
Research methodology: An empirical investigation is conducted for daily returns from stock indexes characterizing 5 developed and 4 post-communist European stock markets together with the above mentioned 3 non-European ones, using statistical inference and a correlation analysis.
Results: Our study shows that the COVID-19 pandemic financial crisis had a similar impact on all of the analyzed economies. Although, the GDP growth rate and inflation differ among countries. GDP growth rates in 2021 did not offset the declines from the previous year in Czechia, Germany, France, Italy and the UK. GDP growth and inflation rates in 2021 are bigger in European post-communist countries than in developed countries. All markets apart from the NASDAQ100, SSE, DAX and MSCI Europe reported negative annual rates of return in 2020. The highest risk was observed in the pandemic shock period. In the pandemic stabilization period expected returns from all stock indexes (except FTSE100 and TA35) were significantly positive.

Novelty: A comparison of selected markets and economies in different stages of the pandemic. Our study shows that financial markets should now incorporate such an event caused by a pandemic as part of financial crisis studies.

Keywords: capital markets, COVID-19 pandemic, economic crises, rates of return

JEL classification: C12, G15

Introduction

The 2020 Covid Financial Crisis (CFC20) experienced extended periods of lockdowns of businesses and people worldwide lasting several months. Like the 2008 U.S. subprime mortgage financial crisis, a global financial contagion was also observed during the CFC20 crisis (Liu *et al*., 2022(b)) especially in the European capital markets. The external shock from the pandemic lockdowns disrupted all real aggregate sector economic activities and triggered unprecedented global stock market volatility. The crisis CFC20 not only resulted in countries facing significant inflation after the lockdowns were lifted but now they are expected to face stagflation from the expected recession (World Bank: World Bank Experts Answers, 2022).

This paper aims to investigate the impact of the COVID-19 pandemic on selected European capital markets in comparison to US, Israeli, and Chinese markets. The study will answer the question if the pandemic affected different national economies and capital markets in the same way. The novelty of this research is the comparison of selected markets and economies in different stages of the pandemic. This unprecedented event from an external shock never experienced before reverberated throughout the world requiring expertise in all areas of economics, finance, supply chains, health, and government authorities to deal globally with the sudden uncertainty and scramble for solutions.

All of the analyzed markets are characterized by stock indexes quoted in the period from the end of September 2019 to the end of 2020. Among the European countries, a detailed empirical investigation is conducted for 4 of them representing “old” (Italy, Germany, the UK, France) and 4 representing “new” (Poland, Hungary, Czechia and Croatia) European Union member states. Blue-chip stock indexes DAX, CAC40 and the FTSE100 together with the

aggregated index MSCI Europe[1] represent the most developed capital markets in Europe. Index FTSEMIB was chosen for our research since Italy was the first country that was seriously affected by the pandemic in Europe. Blue-chip stock indexes BUX, PX, WIG20 and CROBEX represent the post-communist economies. The Warsaw Stock Exchange is the biggest in that part of Europe, the stock exchanges in Prague, Budapest and Zagreb have been operating in an alliance with the Vienna Stock Exchange. These markets are used to being considered as less developed or even emerging, and, for sure, the economies in the post-communist countries are not as strong and rich as in the ones classified as the most developed. There are also 3 non-European markets which are used for comparison. The selection of the USA is obvious since it is still the biggest capital market and the majority of the comparisons are made using the US as a benchmark. China represents the biggest economy in terms of GDP PPP value and the COVID-19 pandemic started there. Whereas Israel was the first country which started a massive vaccination (against COVID-19) program.

The analysis for selected countries and markets is provided for distinguished periods such as (I) pre-pandemic, (II) pandemic shock and (III) pandemic stabilization, using statistical inference and a correlation analysis, employing data from the World Bank and Stooq.

The paper is organized as follows. The first section contains the literature review. The second one discusses the situation in 30 world-wide economies in the years 2019–2021, whereas the third section explains – the situation on capital markets. The fourth section informs about the methods of analysis. The empirical analysis concerning daily rates of return from 12 selected stock indexes is presented in the fifth section. The last section concludes the paper.

1. Literature Review

A number of studies have looked at the risk spillover effects on global stock market volatility from the close integration connectedness of financial markets (Guo *et al*., 2021; Nyugen *et al*., 2021; Contessi, De Pace, 2021). Another group of researchers used daily event-based studies to examine the CFC20 induced shock on stock market volatility (Liu *et al*., 2020a; Zhang *et al*., 2020, Chowdhury *et al*., 2020; Liu *et al*., 2022b). Others have looked at the impact of the number of confirmed deaths and positive cases from the health crisis on stock market performance (Ashraf, 2020, Kotishwar, 2020, Matos *et al*., 2021; Seven, Yilmaz, 2021). On the one hand, Siriopoulos *et al*. (2021) found that the reports of the number of deaths and

[1] The MSCI Europe Index captures large and mid-cap representation across 15 developed market countries in Europe i.e., Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK.

cases of health crises have had little effect on European financial markets volatility (7%), rather the volatility is due to the contagion and transmission from the Chinese stock market (34%).

Some studies have explored whether investment herding behavior is triggered and is more pronounced during the crisis CFC20 leading to financial volatility. Espinos-Mendez and Arias (2021) together with Fang *et al*. (2021) found robust evidence of herding behavior in the European markets and in the Eastern European stock markets from the COVID-19 pandemic. Bogdan *et al*. (2022) found that herding behavior is more pronounced in emerging, followed by frontier markets and developed European stock markets and recommend the strategy of risk diversification. Using endogenous structural break models and a factor-augmented event study, Ahmad *et al.* (2021) looked at whether the CFC20 crisis impact on the US, the UK, and European stock markets is a Black Swan phenomenon with little opportunities for investment.

A panel study by Klose and Tillmann (2021) looks at the response of European financial markets to government policies and support packages during the COVID-19 pandemic and found that the monetary policies of asset buybacks are effective and fiscal policies are more effective when monetary announcements occur on the same day with sizable cross-border effects. Li *et al*. (2020) used the Infectious Disease EMV tracker (IDEMV) and Chicago Board Volatility Index (VIX) to investigate the predictive ability of European stock market volatility during the COVID-19 pandemic. A study by Estrada *et al*., (2021) presents an assessment of the economic "stagpression", a concept of overlapping recession and depression, and the financial impact of the COVID-19 pandemic on ten global stock indices, primarily Asian stock markets. The study shows that the pandemic had a similar negative economic impact similar to the Great Depression of 1929 and the stock markets distress spreading through the markets as the pandemic progresses.

The research provided for European post-communist capital markets applying GARCH models concludes that the response to the pandemic was stronger for the stock indexes of the post-communist countries than observed in the most developed European markets, represented by DAX, CAC40, FTSE and MSCI Europe. However, over time, the response to the pandemic was more significant in the considered developed markets (Żebrowska-Suchodolska *et al*., 2021).

2. Economic Crises Indicators

The global COVID-19 pandemic was unprecedented in disrupting the normal economic activities of a country by the global lockdowns of people and business for an extended period causing a stop in worldwide trade, shutdowns, and supply chain problems. For the US the

lockdowns lasted for almost 5 months, with California imposing the first lockdown on 19.03.2020 with the last state, New Mexico, lifting the lockdown on 28.08.2020 (USA Today, 2022). Europe introduced a lockdown even early on 18.03.2020 after Italy experienced the first major outbreak which lasted almost 6 months with Ireland lifting the last lockdown on 31.08.2020. Most countries experienced negative real GDP economic growth followed by higher inflation.

The decline in GDP growth worldwide from the COVID-19 pandemic was unprecedented in the sudden shutdown of almost all economic activities and productivity and the supply chain of imports and exports, especially from China representing 17% of the world economy in 2020 (Global Times, 2021). The COVID-19 pandemic impacted not only advanced countries but emerging countries as well that depended heavily on the export of natural resources and foreign trade but had little fiscal or monetary capability to support the economic impact of the crisis with smaller rescue packages.

The severe decline in real GDP worldwide resulted from travel bans affecting countries reliant on tourism, recreation, and other related hospitality sectors for revenue and economic growth. Caught by the surprise of the lockdowns, businesses scrambled to remain productive with significant layoffs, closures and bankruptcies, especially restaurants and retail sale sectors, with the extended lockdowns. Although the economies experienced recovery in 2021, countries experienced significantly higher inflation due to the huge injection of government spending during the pandemic. However, according to Contessi and De Pace (2021), the recovery was not homogenous.

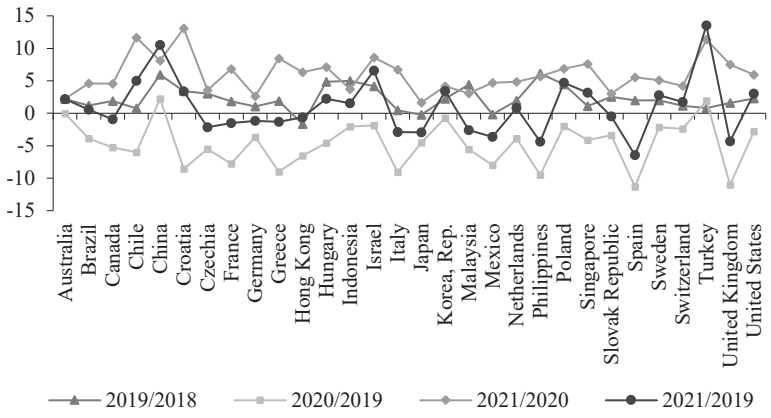


Figure 1. GDP growth (annual %)

Source: own elaboration based on World Bank data.

In 2019 the annual GDP growth rate (Figure 1) was positive in all countries apart from Hong Kong and Mexico. In 2020 GDP growth rate was negative in all countries except China and Turkey. Whereas in 2021 it was positive in all countries which is quite obvious because the comparison is made to declined GDP in the previous year. Thus, calculating the GDP growth rate in 2021 in comparison to the pre-pandemic year (i.e., 2019) it is noticeable that for 14 countries (among 30) GDP did not offset the declines recorded in 2020 in comparison to GDP observed in 2019. The countries with the highest losses of GDP growth are Spain 6.4%, the Philippines 4.4% and the UK 4.3%. Whereas countries which recovered in 2021 better than others (having negative GDP growth rates in 2020) are Israel with the GDP growth rate of 6.6%, Chile 5.0% and Poland 4.4%.

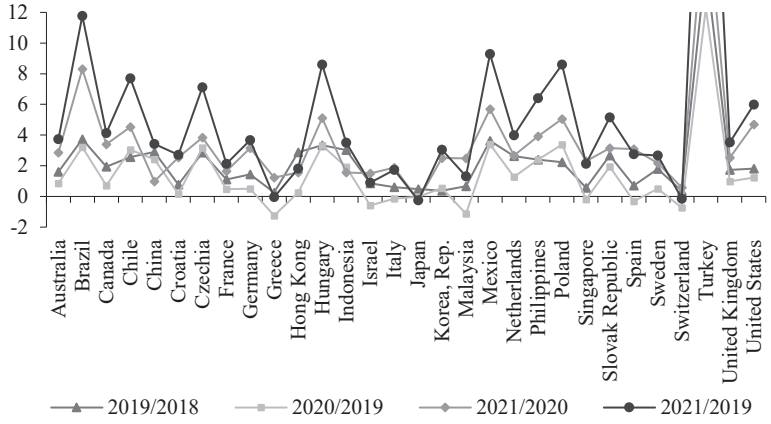


Figure 2. Inflation (annual %)

Source: own elaboration based on World Bank data.

Annual inflation rate (Figure 2) was below 4% in all of the considered countries in the years 2019 and 2020, except for Turkey where inflation was 12.3% and 15.2% in these years. It is noticeable that in 2020 deflation was observed in Greece, Israel, Italy, Japan, Malaysia, Singapore, Spain and Switzerland. In 2021 inflation from 4.5% to 8.3% was observed in Chile, the United States, Poland, Hungary, Mexico, Brazil, and 19.6% in Turkey. However, comparing prices in 2021 with prices observed in 2019, they exceeded 4% in 11 countries (in addition Canada, Czechia, the Philippines and Slovakia) with a maximum of 11.8% in Brazil and 34.3% in Turkey.

Table 1. Descriptive statistics of GDP growth and inflation rates (%) in 2021 in comparison to 2019

Rates	Countries	Min	Max	Average	Standard deviation	Range
GDP growth	European	–6.43	4.69	–0.33	3.01	11.12
	European post-communist	0.48	4.86	2.30	1.21	4.37
	Non-European	–4.36	13.51	2.15	4.84	17.87
Inflation	European	–0.15	8.61	3.75	2.67	8.76
	European post-communist	2.71	8.61	6.44	2.25	5.89
	Non-European	–0.26	34.28	6.20	7.89	34.54

Source: own calculation using World Bank data.

Table 1 contains synthetic information concerning GDP annual growth and inflation rates (evaluated for 2021 in comparison to 2019) in 14 European countries (among them 5 are post-communist) and 16 non-European using detailed data presented in Figures 1 and 2. Comparing the after-covid recovery of European countries to non-European ones, it is visible that for both inflation and GDP growth rates, variability for non-European states is bigger than for European ones. The average GDP growth rate is the biggest in the European post-communist countries (2.3%), then for non-European (2.15%) and negative for European (developed) states. In the case of inflation, the average for post-communist states is also the biggest (6.4%), a little bit smaller in the non-European ones (6.2%), and quite small in the European countries (3.75%).

3. Stock Market Impact and Recovery

Italy was the first European country that experienced a major shock from the number of positive COVID-19 cases and reported deaths. The financial markets contagion that followed transmitted from the US and China stock market had spillover effects to the major world equity market, especially the European stock markets (Contessi, De Pace, 2021; Liu *et al*., 2022b). The financial crises led to falling stock values, interest rates and declining economic growth which was reflected in sharp declines in stock market performance and market capitalization. Investors were alarmed by the conflicting government responses and policies in containing the unknown pandemic and the reported amounts of rising deaths and cases in March 2020 in Europe, triggering portfolio liquidation in expectations from the adverse economic fallout from the pandemic.

Figure 3 shows the nominal annualized stock rate percentage returns in the years 2019–2021 for the developed markets. In 2020, negative rates of returns were observed only

in 6 (among 23) countries, Norway, Austria, Spain, Belgium, the UK and the USA from –0.9% to –32.7%, whereas in 2021only in Hong Kong (–3.9%), and New Zealand (–16.8). The recovery of the stock returns after the removal of the lockdowns from the COVID-19 crisis is mild and positive for most of the countries. Comparing the 2021 recovery to the pre-covid year, the decline in the stock returns is noticeable only in Spain (–2.9%), Belgium (–4.9%) and the USA (–28.5%).

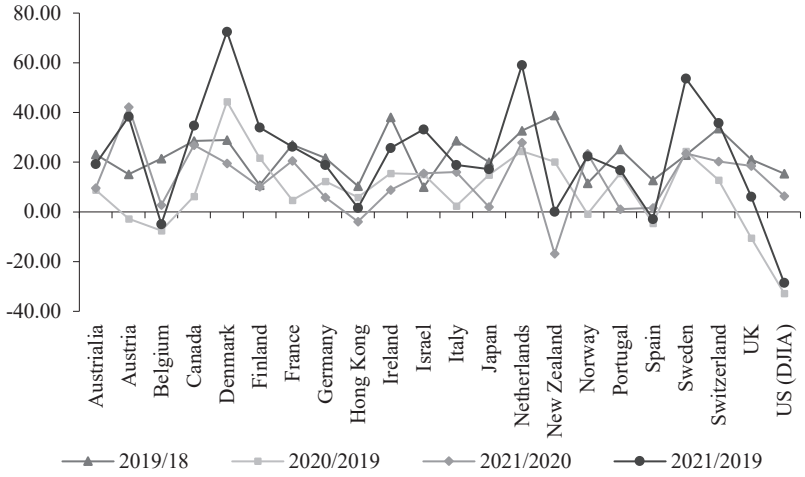


Figure 3. Global Nominal Annualized Stock Rate Returns (%)

Source: own elaboration based https://www.mindfullyinvesting.com/historical-returns-of-global-stocks.

Governments began implementing monetary and fiscal financial aid packages to support and allay the uncertainty and fears from the financial contagion, such as the US Coronavirus Aid, Relief, and Economic Security (CARES) Act of March 27, 2020, or Germany's work subsidies, increased childcare payments for low-income households, and grants for small and self-employed businesses. Some studies find that these government efforts did not have any significant impact on emerging financial markets or that information campaigns and announcements instead increase stock market volatility from the perception of impending financial instability (Salisu *et al*., 2020; Zaremba *et al*., 2020). However, Deng *et al.* (2022) found that the monetary policy of interest rate cuts has a greater positive impact on stock market returns. Other studies find that advanced countries that implemented larger fiscal packages experienced stronger recovery than emerging countries with smaller packages and greater dependence on natural resources or tourism income, like Greece, Portugal and Spain (Seven, Yilmaz, 2021).

From the beginning of the lockdowns in mid-March to the end of April 2020, most capital markets made significant recoveries. The S&P 500 went up by 23.2%, the DJIA (USA) by 22%, FTSE 100 (UK) by 18.7%, DAX by 27% (Germany), WIG20 by 23.1% (Poland), and BUX by 7.8% (Hungary) over this period.

4. Methodology and data

We investigated the daily quotations of stock indexes in 9 European and 3 non-European capital markets for the period from the third quarter of 2019 till the end of 2020. The indexes selected for analysis represent (1) European post-communist countries (Poland, Czechia, Hungary and Croatia), (2) the most developed European markets (the United Kingdom, Germany, France, Italy and the synthetic index of developed European markets) and (3) non-European countries (the USA – the biggest market, China – the biggest world economy but emerging capital market where the pandemic started and Israel – the first country which started a massive covid vaccination program).

A paper by (Żebrowska-Suchodolska *et al*. 2021), distinguishes three sub-periods of European capital markets behavior. The first pre-pandemic subperiod (I) contains the time span from 30.09.2019 to the date when the stock index reached the maximum peak value in the first quarter of 2020. The second subperiod of the pandemic shock (II) is defined as the time span between the dates when the maximum and minimum values of the stock index were observed. The last pandemic stabilization period (III) covers the time span from the date of minimal index value to the end of 2020. In our research we follow this idea.

To investigate the events situation of selected capital markets in the above 3 distinguished subperiods, we verify the following hypothesis to identify the market trend.

$$H_0: E(R) = 0 \tag{1}$$

with the test statistics:

$$u = \frac{\overline{y}}{S}\sqrt{T} \tag{2}$$

where:

$E(R)$ – the expected return,

$\overline{y}$ – average rates of return y_i obtained in the sample in a certain period of time,

S – standard deviation in the sample,

T – number of observations.

We also test if there are significant changes in the diverse capital markets in the distinguished subperiods by verifying the following hypotheses:

$$H_0: E(R_1) = E(R_2) \tag{3}$$

$$H_0: D^2(R_1) = D^2(R_2) \tag{4}$$

The test statistics for both hypotheses are as follows:

$$t = \frac{\overline{y}_1 - \overline{y}_2}{\sqrt{\frac{S_1^2}{T_1} + \frac{S_2^2}{T_2}}} \tag{5}$$

$$F = \frac{S_1^2}{S_2^2} = \frac{S_{max}^2}{S_{min}^2} \tag{6}$$

where:

$E(R_1)$, $E(R_2)$, $D^2(R_1)$, $D^2(R_2)$ – are the expected returns, and variances of returns in the two comparable periods,

$\overline{y}_1$, $\overline{y}_2$ –- average rates of return,

S_1^2, S_2^2 – variances,

T_1, T_2 – number of observations in both samples.

We also look at the relationships between the market performance and major economic parameters as GDP growth rate and inflation, applying the Pearson linear correlation coefficient and test for its significance. All hypotheses are verified at the significance level of $\alpha = 0.05$.

5. Empirical results

Tables 2 and 3 contain general information about the selected European stock indexes and time frames of the 3 described subperiods above. For all of the analyzed indexes, minimal values were observed after the lockdown between 12.03.2020 and 23.03.2020, whereas the highest quotations before the lockdown appeared from 17.01.2020 to 19.02.2020. It seems that on emerging markets maximal index values were observed earlier than on developed ones (except MSCI Europe and FTSE100). Among stock indexes describing the capital markets, only 4 of them (NASDAQ100, SSE, MSCI Europe and DAX) show full recovery in 2020 whereas the rest of the markets achieved maximal values after the lockdown smaller than maximums before the lockdown (from 8.17% for CAC 40 to 14.38% for TA35).

Table 2. COVID-19 stock index values in the period 30.09.2019–31.12.2020

BUX	PX	WIG20	CROBEX	SEE	MSCI Europe
Dates of maximal quotation before the lockdown in 2020 end of the pre-covid period (subperiod I)					
Feb 1	Jan 24	Feb 1	Jan 23	Jan 13	Jan 17
Maximum quotations before the lockdown					
46,230	1,143	2,200	2,055	3,116	1,801
Dates of minimal quotations in 2020 end of the pandemic shock period (subperiod II)					
Mar 18	Mar 18	Mar 12	Mar 23	Mar 23	Mar 23
Minimum quotations in 2020					
29,464	690	1,306	1,365	2,660	1,153
Maximum quotation after the lockdown in 2020					
42,108	1,031	2,016	1,766	3,473	1,856
Changes of maximal quotation before and after the lockdown (%)					
–8.92	–9.80	–8.6	–14.07	11.46	3.05

Note: The table contains stock indexes: BUX – Hungary, PX – Czechia, WIG20 – Poland, CROBEX – Croatia, SSE – China, MSCI Europe developed European market.

Source**:** own elaboration on the basis of https://stooq.pl.

Table 3. COVID-19 stock index values in the period 30.09.2019–31.12.2020

NASDAQ100	TA35	FTSEMIB	DAX	CAC40	FTSE100
Dates of maximal quotation before the lockdown in 2020 end of the pre-covid period (subperiod I)					
Feb 19	Feb 12	Feb 19	Feb 19	Feb 19	Jan 17
Maximum quotations before the lockdown					
9,719	1,752	25,478	13,789	6,111	7,612
Dates of minimal quotations in 2020 end of the pandemic shock period (subperiod II)					
Mar 20	Mar 23	Mar 12	Mar 18	Mar 18	Mar 23
Minimum quotations in 2020					
6,994	1,171	14,894	8,442	3,755	4,907
Maximum quotations after the lockdown in 2020					
12,845	1,500	22,352	13,790	5,612	6,604
Percentage changes of maximal quotation before and after the lockdown					
32.16	–14.38	12.27	0.01	–8.17	–13.24

Note: Table contains stock indexes: TA35 - Israel, NASDAQ100 - USA, FTSEMIB – Italy, DAX – Germany, CAC 40 – France, FTSE 100 – the United Kingdom.

Source**:** own elaboration on the basis of https://stooq.pl.

The major characteristics of the daily rates of returns describing the European and Israeli markets behavior (Tables 4 and 5), show that the variability of returns differs from the smallest in the pandemic shock period to the biggest when the whole analyzed period is taken into account. The value of the variability coefficient V is (1) from 4.2 for BUX to 40.1 for the WIG20 in the first period, (2) from 1.5 for DAX to 3.6 for BUX in the second period, (3) from 6.3 for PX to 10.6 for FTSE100 and TA35 in the third period, and (4) from 32.7 for MSCI Europe to 237.4 for PX in the whole period of analysis. Whereas for the US and Chinese markets the situation is different since variability in both first subperiods is nearly the same (in fact in the pre-covid subperiod variability is slightly smaller than in the pandemic shock period). It can be also noticed that variability in the whole period is very small on both of these markets (V equals 11.4 for NASDAQ100 and 18.2 for SSE).

Table 4. Daily rates of return characteristics in the sample 30.09.2019–31.12.2020

Subperiods	I	II	III	Whole	I	II	III	Whole
Index	BUX				PX			
Average	0.0022	–0.0079	0.0019	0.0003	0.0012	–0.0129	0.0021	0.0001
Standard deviation	0.0093	0.0281	0.0147	0.0174	0.0058	0.0237	0.0134	0.0146
V	4.2022	–3.5574	7.6212	64.2316	4.7705	–1.8386	6.3169	237.4041
Asymmetry	0.0693	–1.3533	0.4149	–1.2945	–0.4840	–1.3154	0.8669	–0.9251
Kurtosis	–0.5281	3.9067	1.5516	8.5299	1.7177	1.7943	4.9532	8.5206
Index	WIG20				CROBEX			
Average	0.0003	–0.0102	0.0022	–0.0001	0.0006	–0.0093	0.0013	–0.0003
Standard deviation	0.0100	0.0275	0.0178	0.0190	0.0046	0.0283	0.0083	0.0129
V	40.0864	–2.6911	7.9822	–173.1263	7.4634	–3.0415	6.4054	–42.1638
Asymmetry	0.6862	–2.2085	0.3423	–1.1220	0.9483	–1.5016	1.6199	–3.0202
Kurtosis	1.7911	8.0242	1.3388	8.8985	4.6765	3.9814	7.0386	25.2530
Index	SSE				MSCI Europe			
Average	0.0010	–0.0032	0.0015	0.0007	0.0012	–0.0093	0.0025	0.0005
Standard deviation	0.0068	0.0190	0.0113	0.0121	0.0066	0.0263	0.0159	0.0167
V	6.5601	–6.0165	7.7175	18.2493	5.6651	–2.8305	6.3963	32.6792
Asymmetry	–0.2633	–1.3950	0.3006	–0.8771	–0.2445	–2.5998	0.5452	–1.5058
Kurtosis	0.2648	3.9653	4.2698	7.6720	3.6679	9.5392	4.4907	14.7090

Source: own calculations on the basis of https://stooq.pl.

The returns in all of the analyzed markets are characterized by positive asymmetry in the pandemic stabilization period and negative asymmetry during the pandemic external shock

and during the whole period, with the exception of the US market in the second subperiod when asymmetry is positive. In contrast, the rates of return in the pre-pandemic period show negative asymmetry in the developed markets and in China, and a positive one in the post-communist economies. The former means that in the first defined subperiod the rates of return when bigger than the average appeared more often whereas the latter shows that in the new European Union member states returns smaller than average appeared more often.

Table 5. Daily rates of return characteristics in the sample 30.09.2019–31.12.2020

Subperiods	I	II	III	Whole	I	II	III	Whole
Index	NASDAQ100				FTSEMIB			
Average	0.0024	–0.0135	0.0033	0.0018	0.0015	–0.0318	0.0021	–0.0002
Standard deviation	0.0077	0.0514	0.0183	0.0207	0.0091	0.0458	0.0183	0.0200
V	3.2646	–3.8072	5.6105	11.3930	6.0546	–1.4394	8.5852	–100.9411
Asymmetry	–0.3861	0.2280	0.1642	–0.5904	–0.5938	–2.0352	0.3486	–2.2742
Kurtosis	0.5425	0.1838	2.8010	7.7712	1.4366	4.3984	3.6187	19.8472
Index	DAX				CAC40			
Average	0.0011	–0.0236	0.0026	0.0005	0.0008	–0.0234	0.0022	0.0001
Standard deviation	0.0086	0.0348	0.0189	0.0190	0.0079	0.0371	0.0181	0.0186
V	7.6907	–1.4733	7.2036	38.3404	10.2322	–1.5854	8.4262	142.0624
Asymmetry	–0.5424	–1.3192	0.8571	–0.6289	–1.1017	–1.0903	0.6501	–0.9469
Kurtosis	2.2941	2.1669	5.4247	9.8625	3.2576	1.3993	3.3484	9.2073
Index	FTSE100				TA35			
Average	0.0004	–0.0092	0.0016	–0.0003	0.0010	–0.0150	0.0014	–0.0001
Standard deviation	0.0072	0.0237	0.0168	0.0167	0.0068	0.0279	0.0149	0.0154
V	16.8504	–2.5716	10.5896	–64.7508	6.6250	–1.8667	10.5899	–155.2302
Asymmetry	–1.0369	–1.5528	0.5447	–0.5588	–0.6714	–0.0278	0.6723	–0.3602
Kurtosis	4.7843	3.5309	3.4227	6.5147	3.3810	–0.4379	3.0337	4.4043

Source: own calculations on basis of https://stooq.pl.

High kurtosis increases the probability of obtaining higher rates of return (Dębski, 2014, pp. 616–618). Therefore, investors are willing to pay more for investments having leptokurtic (i.e., kurtosis is positive) distributions than with platykurtic (negative kurtosis) ones. All of the analyzed indexes in all periods (with the exception of BUX in the pre-pandemic period and TA35 in the pandemic shock period) were characterized by positive values of kurtosis with the biggest values observed for the whole period of analysis. For the longest time series, the maximum value of kurtosis was obtained by CROBEX (K = 25.25) and just minimal by TA35

(K = 4.40). However, if all of the positive values of kurtosis are taken into account, the smallest value was obtained by the NASDAQ100 (K = 0.18) in the pandemic shock period.

The significantly positive annual returns in 2020 are observed only for the stock indexes the NASDAQ100, MSCI Europe DAX and SSE (Tables 6 and 7), whereas other markets were characterized by negative returns. Data in Tables 6 and 7 also show that for all but one (SSE) indexes the rates of return generated in the pre-pandemic and pandemic shock periods significantly differ. The same situation is observed when the latter and the pandemic stabilization periods are observed. Whereas returns generated in the first and the third period did not significantly differ. Also, from all but one (SSE) analyzed indexes returns in the second sub-period are significantly negative, and from all emerging markets together with

Table 6. Test statistics to verify hypotheses (1), (3) and (4) and annual returns

Index	Periods	$E(R) = 0$	Compared periods	$E(R_1) = E(R_2)$	$D^2(R_1) = D^2(R_2)$	F_α
Test statistics		(2)		(4)	(6)	
Hungary BUX	I	**1.8433**	I and II	**2.5221**	***9.1819***	1.5637
	II	**–2.0657**	II and III	**–2.4784**	**3.6538**	1.4066
	III	**1.837**	I and III	0.1745	***2.5130***	1.3898
	whole	0.2741	Annual rate of return in 2020			–0.0863
Czechia PX	I	**1.8513**	I and II	**3.6148**	***16.9947***	1.6366
	II	**–3.3528**	II and III	**–3.7893**	**3.1092**	1.4725
	III	**2.2106**	I and III	–0.7940	***5.4659***	1.3532
	whole	0.0743	Annual rate of return in 2020			–0.0793
Poland WIG20	I	0.1948	I and II	**2.5326**	***7.4871***	1.5859
	II	**–2.6011**	II and III	**–3.0195**	**2.3793**	1.4213
	III	**1.7805**	I and III	–1.1034	***3.1468***	1.3853
	whole	–0.1020	Annual rate of return in 2020			–0.0773
Croatia CROBEX	I	1.1604	I and II	**2.256**	***37.3301***	1.6074
	II	**–2.1308**	II and III	**–2.4043**	11.6987	1.4529
	III	**2.1689**	I and III	–0.8384	***3.191***	1.3591
	whole	–0.4176	Annual rate of return in 2020			–0.1379
China SSE	I	1.5013	I and II	1.0209	***7.8009***	1.8787
	II	–0.7796	II and III	–1.1184	**2.8417**	1.6101
	III	**1.8187**	I and III	–0.3998	***2.7452***	1.3265
	whole	0.9741	Annual rate of return in 2020			0.1257

Note: Bold numbers denote the value of the test statistics which let us reject the null hypothesis at the significance level of 0.05. Numbers in italics denote events when the standard deviation in the first period is smaller than the one in the second and third periods.

Source: own calculations based on Tables 4, 5.

indexes DAX, NASDAQ100, CAC40 and MSCI Europe – are significantly positive in the third subperiod. It is also visible that risk, measured by variance of rates of return, was the smallest in the pre-pandemic period in comparison with the rest of the distinguished subperiods.

Table 7. Test statistics to verify hypotheses (1), (3) and (4) and annual returns

Index	Periods	$E(R) = 0$	Compared periods	$E(R_1) = E(R_2)$	$D^2(R_1) = D^2(R_2)$	F_α
Test statistics		(2)		(4)	(6)	
USA NASDAQ100	I	**2.5445**	I and II	**2.0330**	***44.2883***	1.6018
	II	**–1.7423**	II and III	**–2.1316**	**7.9205**	1.4446
	III	**2.4633**	I and III	–0.5504	***5.5916***	1.3711
	whole	1.5304	Annual rate of return in 2020			0.4478
Israel TA35	I	1.4866	I and II	**2.2780**	***17.0466***	2.1258
	II	**–2.1428**	II and III	**–2.3180**	**3.5399**	1.7159
	III	1.3487	I and III	–0.3056	***4.8156***	1.3240
	whole	–0.1147	Annual rate of return in 2020			–0.1106
Italy FTSEMIB	I	1.5494	I and II	**3.6884**	***25.2856***	1.7891
	II	**–3.5425**	II and III	**–3.7393**	**6.2678**	1.5641
	III	1.6098	I and III	–0.3817	***4.0342***	1.3399
	whole	–0.1730	Annual rate of return in 2020			–0.0642
Germany DAX	I	1.2740	I and II	**3.1592**	***16.3405***	1.9435
	II	**–3.0354**	II and III	**–3.3230**	**3.4077**	1.6393
	III	**1.9583**	I and III	–0.9364	***4.7951***	1.3269
	whole	0.4629	Annual rate of return in 2020			3.55
France CAC40	I	0.9724	I and II	**2.9009**	***21.8579***	1.9415
	II	**–2.8208**	II and III	**–3.0445**	**4.1753**	1.6388
	III	**1.6825**	I and III	–0.9142	***5.2351***	1.3228
	whole	0.1259	Annual rate of return in 2020			–0.0633
UK FTSE100	I	0.5174	I and II	**2.6856**	***10.8146***	1.5789
	II	**–2.6373**	II and III	**–2.9230**	**1.9877**	1.4349
	III	1.3187	I and III	–0.7942	***5.4408***	1.3566
	whole	–0.2750	Annual rate of return in 2020			–0.1324
Developed markets MSCI Europe	I	1.5689	I and II	**2.6497**	***15.6878***	1.5750
	II	**–2.3962**	II and III	**–2.9177**	**2.7425**	1.4327
	III	**2.2220**	I and III	–0.9752	***5.7203***	1.3491
	whole	0.5534	Annual rate of return in 2020:			0.0401

Note: Bold numbers denote the value of the test statistics which let us reject the null hypothesis at the significance level of 0.05. Numbers in italics denote events when the standard deviation in the first period is smaller than the one in the second and third periods.

Source: own calculations based on Tables 4, 5.

Looking at the relationships between the behavior of the capital markets in 2020 and GDP and inflation in the years 2020 and 2021, we evaluated the Pearson linear correlation coefficients for pairs of series concerning both macroeconomic parameters and annual returns for all of the analyzed European countries. The Pearson correlation coefficients evaluated for GDP growth rate in 2020 are significantly positive (0.544) whereas for 2021 significantly negative (–0.764). The correlation coefficients between returns and inflation are insignificantly positive for the years 2020 and 2021. Therefore, we can state that the situation on the European stock markets in 2020 and GDP in 2020 and 2021 had a mutual impact although the direction for both years is the opposite.

It is noticeable that although all of the analyzed indexes show positive expected rates of returns in the pandemic stabilization period[2] (Tables 4 and 5), only stock indexes in the USA, Germany, and China together with the aggregated index MSCI Europe generated positive annual rate of return in 2020 (Tables 6 and 7). It means that these 4 markets offset declines which appeared during the covid crises in the same year whereas other considered markets require more time to recover after a crisis.

Conclusions

Our study shows that the COVID-19 pandemic had a similar impact on all of the analyzed economies. Although, the GDP growth rate and inflation differ among countries. GDP growth rates were all negative in 2020 and increases in 2021 did not offset the declines from the previous year in the Czech Republic, Germany, France, Italy and the UK. This is confirmed by the correlation analysis, indicating that the decrease in GDP in 2020 was associated with decreases in annual rates of return which are negatively correlated with the increase of GDP in 2021. On the other hand, the instability and volatility experience in 2020 from the COVID-19 pandemic did not influence inflation in 2020 and 2021. Comparing the GDP growth and inflation rates, observed in 2021 in comparison to 2019, they are bigger in the European post-communist countries than in the developed countries. The biggest world economies, i.e., the USA and China in 2021 were able to offset GDP declines caused by the pandemic.

All markets apart from the NASDAQ100, SSE, DAX and MSCI Europe reported negative annual rates of return in 2020. Among 9 stock indexes describing the European capital markets behavior only 3 of them (DAX – 0.01%, FTSEMIB – 12.27% and MSCI Europe –

[2] What is more, for all of the analyzed indexes but the FTSE100 and TA35 evaluated t-statistics (2) let us reject the null hypothesis (1) thus these returns are significantly positive (Tables 6 and 7).

3.08%) showed a full recovery in 2020 whereas the rest of the markets achieved maximal values after the lockdown smaller than maximums in the pre-pandemic period from 8.6% for WIG20 to 14.07% for CROBEX. However, the biggest loss was observed for TA35 (14.38%). The NASDAQ100 and SSE quotations were higher after the lockdowns with maximal values equal to 32.16% and 11.46%, respectively, than before a lockdown.

The highest risk (measured by standard deviation of daily returns) was observed in the pandemic shock period. In that subperiod, expected returns from all stock indexes were significantly smaller than zero (except SSE) whereas in the pre-covid period rates of return did not significantly differ from zero, except for the NASDAQ100, BUX and PX. It is noticeable that in the pandemic stabilization period expected returns from all stock indexes (except the FTSE100 and TA35) were significantly positive. This consistency was confirmed by comparing the asymmetry in the last two analyzed periods for all markets, whereas in the pre-pandemic period we observed a different asymmetry in the post-communist countries (except PX) and countries that have been members of the European Union for a much longer time. The latter is characterized by negative asymmetry which means that the rate of returns bigger than the average appears more often, whereas for the new European Union transitional member countries the rate of returns smaller than average appears more often.

Our investigation of the covid crisis provided for selected countries in 3 distinguished subperiods (of pre-covid, pandemic shock and pandemic stabilization periods) is our preliminary analysis which is to be continued for other markets and countries. It is also necessary to consider longer time spans although the COVID-19 crisis impact on the European stock markets was further complicated by the start of the Russian-Ukraine war in February 2021 followed by the European fuel crisis making it difficult to separate both events' impact on the stock markets. Our study results indicate that an unexpected external shock such as from the COVID-19 pandemic that is not an internal economic or financial shock must now be considered as one of the possible variables in analyzing and determining contagious global financial crisis events.

References

Ahmad, W., Kutan, A.M., Gupta, S. (2021). Black swan events and COVID-19 outbreak: Sector level evidence from the US, UK, and European stock markets. *International Review of Economics and Finance*, *75*, 546–557.

Ashraf, B.N. (2020). Stock Markets' Reaction to COVD-19: Cases or Fatalities? *Research in International Business and Finance*, *54*, 101249.

Bogdan, S., Sustar, N., Drazenovic, B.O. (2022). Herding behavior in developed, emerging, and frontier European stock markets during COVID-19. *Journal of Risk and Financial Management*, *15*(9), 400.

Chowdhury, E.M., Khan, I.I., Dhar, B.K. (2020). Catastrophic Impact of COVID-19 on the Global Stock Markets and Economic Activities. *Business and Society Review*, *127*(2), 437–460.

Contessi, S., De Pace, P. (2021). The International Spread of Covid-19 Stock Market Collapses. *Finance Research Letters*, *42*.

Dębski, W. (2014). *Financial market and its mechanisms. Theory and practice"* [in Polish Rynek finansowy i jego mechanizmy, Podstawy teorii i praktyki]. Warszawa: Wydawnictwo Naukowe PWN.

Deng, T., Xu, T., Lee, Y.J. (2022). Policy responses to COVID-19 and stock market reactions – An international evidence. *Journal of Economics and Business*, *119*, 106043.

Espinosa-Mendez, C., Arias, J. (2021). COVID-19 effect on herding behavior in European capital markets. *Finance Research Letters*, *38*, 101787.

Estrada, M., Koutronas, E., Lee, M. (2020). Stagpression: The economic and financial impact of COVID-19 pandemic. *SSRN Electronic Journal, January*. Retrieved from https://www.researchgate.net/publication/341189419_Stagpression_The_Economic_and_Financial_Impact_of_COVID-19_Pandemic (12.06.2023).

Fang, H., Chung, C-P., Lee, Y-H., Yang, X. (2021). The effect of COVID-19 on herding behavior in Eastern European Stock markets. *Frontiers in Public Health*, *9*, 695931.

Global Times (2021). China's GDP makes up over 17% of the world economy in 2020: NBS. Retrieved from https://www.globaltimes.cn/page/202102/1216746.shtm (l7.06.2023).

Guo, H., Zhao, X., Yu, H., Zhang, X. (2021). Analysis of global stock markets' connections with emphasis on the impact of COVID-19. *Physica A*, *569*, 125775.

Kotishwar, A. (2020). Impact of COVID-19 pandemic on stock market with reference to select countries – A Study. *Academy of Accounting and Financial Studies Journal*, *24*(4), 72–78.

Li, Y., Lian, Chao., Ma, F., Wang, J. (2020). The role of the IDEMV in predicting European stock market volatility during the COVID-19 pandemic. *Finance Research Letters*, *36*, 101749.

Liu, H., Manzoor, A., Wang C.Y., Zhang, L., Manzoor, Z. (2020a). The COVID-19 outbreak and affected countries stock markets response. *International Journal of Environmental Research and Public Health*, *17*, 2800.

Liu, Y., Wei, Y., Wang, Q., Liu, Y. (2022b). International stock market risk contagion during the COVID-19 pandemic. *Finance Research Letters*, *45*, 102145.

Matos, P., Costa, A., da Silva, C. (2021). COVID-19, stock market and sectoral contagion in US: A time-frequency analysis. *Research in International Business and Finance*, *57*, 101400.

Salisu, A.A., Sikiru, A.A., Vo, X.V. (2020). Pandemics and the emerging stock markets. *Borsa Istanbul Review*, *20*(S1), S40–S48.

Seven, U., Yılmaz, F. (2021). World equity markets and COVID-19: Immediate response and recovery prospects. *Research in International Business and Finance*, *56*, 101349.

Siriopoulos, C., Svingou, A., Dandu, J. (2021). Lessons for Euro markets from the first wave of COVID-19. *Investment Management and Financial Innovations*, *18*(1), 285–298.

Klose, J., Tillmann, P. (2021). COVID-19 and financial markets: A panel Analysis for European countries. *Journal of Economics and Statistics*, *241*(3), 297–347.

USA Today (2022). COVID-19 Restrictions. Retrieved from https://www.usatoday.com/storytelling/coronavirus-reopening-america-map (12.06.2023).

World Bank (2022): *Global economic prospects: Slowing Growth and the risk of stagflation-World Bank Expert Answers*. Retrieved from https://www.worldbank.org/en/news/video/2022/06/06/global-economic-prospects-slowing-growth-risk-stagflation-expert-answers (7.06.2023).

World Bank Data. Retrieved from https://databank.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/1ff4a498/Popular-Indicators# (15.01.2023).

Zaremba, A., Kizys, R., Aharon, D.Y., Demir, E. (2020). Infected markets: Novel coronavirus, Government interventions and stock return volatility around the globe. *Finance Research Letters*, *35*, 101597.

Żebrowska-Suchodolska, D., Karpio, A., Kompa, K. (2021). COVID-19 pandemic: Stock markets situation in European ex-communist countries. *European Research Studies Journal*, *24*(3), 1106–1128.

Zhang, D., Hu, M., Ji, Q. (2020). Financial markets under global pandemic of COVID-19. *Finance Research Letters*, *36*, 101528.

Citation

Foo, J., Witkowska, D. (2024). The 2020 COVID-19 Financial Crisis Impact on the European Stock Markets and Economies. A Preliminary Analysis. *Folia Oeconomica Stetinensia*, *24*(1), 22–40. DOI: 10.2478/foli-2024-0002.