sustainability

MDPI

Article

Sustainable Finance and COVID-19: The Reaction of ESG Funds to the 2020 Crisis

Fabio Pisani * and Giorgia Russo

Department of Economics and Finance, University of Rome Tor Vergata, 00133 Roma, RM, Italy; giorgiarusso069@gmail.com

* Correspondence: fabio.pisani@uniroma2.it

Abstract: We investigated the financial performance of a sample of sustainable investment funds in terms of returns, volatility, and contagion risk during the financial crisis caused by the COVID-19 pandemic. In order to conduct a more reliable analysis, we considered a homogenous sample composed of 30 funds declaring the same benchmark (the MSCI Europe index). The Morningstar Sustainability ESG rating was used to determine the level of sustainability of each fund. Both the GARCH models and the event study suggest that funds with a higher ESG rating were able to outperform other funds during the COVID-19 period. These funds had a greater level of resilience and exhibited a lower level of risk contagion during the pandemic. These instruments appear to assume the role of risk protection and should be considered a means of both promoting sustainable growth and minimizing portfolio risk.

Keywords: ESG funds; volatility analysis; financial performance; sustainable finance

JEL Classification: C58; G01; G11

Citation: Pisani, F.; Russo, G. Sustainable Finance and COVID-19: The Reaction of ESG Funds to the 2020 Crisis. *Sustainability* **2021**, *13*, 13253. https://doi.org/10.3390/su132313253

Academic Editor: Luigi Aldieri

Received: 4 October 2021
Accepted: 23 November 2021
Published: 30 November 2021

1. Introduction

Since the end of 2019, humanity has faced problems caused by the SARS-CoV-2 virus. The health emergency caused by the COVID-19 pandemic very quickly turned into a global economic and financial crisis. In fact, to counteract the coronavirus outbreak, in many countries, people were required to stay in their homes and national governments imposed a state of alarm, which brought economic activity to a standstill. This led to the deepest economic recession of the modern era. As a result of this, the beginning of 2020 saw a severe financial market crash.

According to recent research, the spread of the virus and its consequences on people's health could be the result of unsustainable development, which is a major cause of climate change and ecosystem alteration (e.g., [1–3]).

The coronavirus outbreak is creating both serious health problems and economic problems. These two problems are linked by the general and extended lockdown [4]. One of the first studies in this field (Coibion et al. [5] found that a large proportion of people reported a reduction in their income and level of consumption and a reduction in the employment rate. Research from the IMF [6] confirmed the same negative trend with regard to work hours and forecast a downturn in GDP in the main developed countries (G20). Aside from these results, Guerrieri et al. [7] demonstrated that the negative supply shock caused by the COVID-19 pandemic could lead to an even more severe negative demand shock. From another point of view, Bonaccorsi et al. [8] demonstrated a relationship between the lockdown and an increase in socio-economic inequality. Given that finance is closely related to the real economy, the rapid and extreme drop in market indexes and the dramatic increase in the VIX between 24 February and 27 March are no surprise. Looking at the returns of many stock market indexes, it is very easy to see the impact of this shock. For example, using an event study-based methodology, a previous study by Liu et al. [9]

showed that the unexpected virus outbreak had a profound impact on many stock markets. Moreover, in terms of volatility, there were many negative consequences. In this regard, Meher et al. [10] reported higher volatility in all the markets that they considered in their analysis and this volatility increased as the number of cases of COVID-19 increased.

It is evident that there is the need to face two problems simultaneously: On one hand, it is necessary to revive the economy as quickly as possible, and, on the other, economic growth must be managed in a more sustainable way. One of the possible tools with which to approach this trade-off is responsible finance. Ethical and green finance could be used to achieve this aim because it considers financial returns alongside environmental, social, and governance (ESG) issues. More generally, sustainable finance could help to overcome the economic and environmental crisis because of its capacity to gather resources to promote investment and to foster economic growth with a low socio-environmental impact. To support this hypothesis, we recall the research of McWilliams and Siegel [11] who found that it is possible to maximize the value for the shareholder while adopting a corporate social responsibility policy.

For this reason, we would like to investigate the financial performance of ESG funds during the last economic downturn in greater depth. They could overcome the trade-offs but, as is well known, the results concerning their financial performance are mixed. On one hand, sustainable financial products have been shown to outperform the market during a crisis (e.g., [12,13], and more recently Broadstock et al. [14] and Engelhardt et al. [15]); by contrast, some results are negative or do not show any outperformance during a bear market (e.g., [16,17], and, with a specific focus on the last crisis, Folger-Laronde et al. [18], Demers et al. [19], and Chiappini et al. [20]) or without considering any financial crisis period (e.g., [21,22]).

Given this scenario, our research attempted to provide new insights concerning the conditional heteroskedasticity of ESG funds and their resilience during the COVID-19 pandemic with the aim of improving our knowledge of the performance (both in terms of returns and risk) of these tools and selecting more efficient portfolios.

We based our analysis on a sample of European ESG funds. This was because Europe was one of the areas most affected by the pandemic and because the financial markets in these countries had been less investigated than those in other areas, despite representing a large share of global GDP. We are aware that our sample is small, but this was the price that we had to pay in order to create a portfolio with homogenous funds. In fact, every item considered holds the MSCI Europe index as the benchmark. Given that the funds have the same benchmark, our results our more reliable. Moreover, we chose the MSCI Europe index because it adequately represents the financial markets of the main European countries and firms.

We conducted our research with univariate and multivariate GARCH models and an event study-based methodology. Our analysis confirmed previous results in a new scenario. When we considered the impact of the exogenous shock caused by the COVID-19 pandemic, we found that high ESG rating funds show (1) a particular ability to protect against the risk of financial contagion; and (2) a higher level of resilience. Both results should be considered for an optimal portfolio choice given that sustainable funds represent the possibility of improving risk diversification without a decrease in returns during a period of crisis. Considering this, we were able to confirm that sustainable finance is not only a matter of social preferences; it is also a reliable insurance instrument or refugee instrument, as was already suggested by Becchetti et al. [23], Gangi and Trotta [24], and Yingxu [25].

The paper is organized as follows. Section 2 is a synthetic review of the literature on sustainable finance. Section 3 presents the data, while Section 4 presents the empirical models and reports our findings. Section 5 concludes.

2. Related Literature

Given the aim of our research, it is useful to introduce a review of the literature regarding the performance of responsible financial instruments during the COVID-19 pandemic in greater depth. The study of Albuquerque et al. [26] was published shortly after the virus outbreak. They found that firms with high environmental and social ratings performed better during the crisis, both in terms of higher returns and lower volatility of stock prices. A similar result was reported by Broadstock et al. [14] for a Chines sample in which the governance component was also taken into account. With respect to the US, Xiong [27] found that green stocks provided higher returns and better tail-risk protection. His findings were also confirmed for the pandemic period. While Rubbaniy et al. [28] showed the safe-haven characteristics of ESG investments. Moreover, using an event study-based empirical analysis and GARCH models, Mirza et al. [29] found that during the COVID-19 pandemic, social funds were able to time volatility and outperform other types of investment funds. From another point of view, Ferriani and Natoli [30] demonstrated that the demand for low-ESG-risk funds increased from February 2020, and this was especially true for low governance and environmental risk funds. Considering the aforementioned studies, it is possible to affirm that during the COVID-19 pandemic, high-ESG-rated portfolios performed well and presented a lower financial risk.

Outside this period, the results are less evident. When considering ETFs, Folger-Laronde et al. [18] showed that eco-funds perform well but do not protect investments during a market downturn. In this case, the problem could be explained by an unfair rating method. Nofsinger and Varma [12] and Nakai et al. [31] analyzed the impact of past financial crises. More specifically, the former study showed that responsible mutual funds outperformed during periods of financial crises and underperformed during non-crisis periods. The latter study, which assessed a sample of funds investing in Japanese firms, indicated that socially responsible funds performed better than conventional funds, both in terms of returns and conditional heteroskedasticity, during the bankruptcy of Lehman Brothers. With a specific focus on the financial crises of 2008 and 2011, socially responsible funds appear to play the role of "refugee funds" or "safe harbor" [24,25] and of "insurance" [23].

Anyway, other positive results associated with responsible financial products were found even without considering financial crisis periods. For example, Biasin et al. [32]—one of the last studies before the pandemic—highlight the benefits of social impact investment-based portfolios. Abate et al. [33], using a sample of European funds, and Das et al. [34] showed that socially responsible mutual funds outperformed conventional funds and Ouchen [35] demonstrated that the ESG portfolio MSCI USA ESG Select was "less turbulent". Meanwhile, Becchetti and Ciciretti [36], analyzing the volatility issue in greater depth, found that individual socially responsible stocks are significantly less risky when controlling for conditional heteroskedasticity. Sabbaghi [37], using a TGARCH (1,1) model and a sample of green ETFs, demonstrated that, for a green ETF, the volatility was persistent throughout time.

Sustainable finance is also considered a useful tool against the risk of contagion. As is well known, the financial markets are strongly correlated and during periods of crisis, there is increased co-movement of prices and stock returns, so the risk of financial contagion is extremely severe (e.g., [38–42]).

In conclusion, it appears that sustainable investments can provide better performance than traditional financial instruments, especially (but not only) during crisis periods. Therefore, they are a good candidate with which to face the negative effects of economic and financial crises more resiliently.

3. Data Description

We used daily closing prices of 30 ESG-rated funds that invested in European equities. This study utilized data from 2 January 2015 to 30 September 2020. To make the analysis more reliable, we selected a sample of homogeneous items; in fact, all of the funds declared

the MSCI Europe index as the benchmark (MSCI Europe index includes more than 400 firms with large and middle capitalization of 15 European countries). As a measure of the sustainability of every fund, we adopted the Morningstar sustainability rating, which uses the ESG methodology and is based on the ESG risk rating provided by *Sustainalytics*. The funds were ranked according to five categories depending on their rating. The rating score was expressed with "globes": One globe denotes a high ESG risk, and five globes indicate the lowest level of ESG risk and consequently the most sustainable funds. The list of funds (our sample includes 2 funds with 1 globe; 8 funds with 2 globes; 7 funds with 3 globes; 7 funds with 4 globes, and 6 funds with 5 globes) is shown in Table S1 of the online Supplementary Materials.

The daily logarithmic returns of the funds and the MSCI Europe index were calculated with the following formula: $R_{j,t} = log(P_{j,t}) - log(P_{j,t-1})$, where $log(P_{j,t})$ is the log of the closing price of the j fund on day t; as a measure of volatility, we used the square of the returns.

The main descriptive statistics are shown in Table 1 with the Jarque–Bera normality test, the augmented Dickey–Fuller unit-root test, and Durbin's alternative test for autocorrelation. The daily returns were not normally distributed while the returns series was stationary (the LM test for ARCH effects shows that a GARCH model is required (LM tests are not provided but are available upon request)). Figure 1 represents the time series of the MSCI Europe index's values, its daily returns, and volatility over the entire period. It vividly shows (1) that the market crash occurred on 20 February 2020, as the COVID-19 pandemic started to be considered a serious and global problem; and (2) the presence of volatility clustering (similar trends are observed for the interments funds). In Figure 2, two funds with different ESG ratings are compared, i.e., BNP Europe Value—1 globe vs. BlackRock Europe Focus—5 globes. The funds exhibit similar trends and volatility clusters, even though volatility appears to be more emphasized for the BNP Europe Value fund. The volatility clusters show the first elements of conditional heteroscedasticity, while the partial difference in the volatility trends between ETFs with different ESG ratings shows that a multivariate GARCH analysis is required.

In Table 2, we reported the descriptive statistics for returns when the entire time series is divided into two periods, i.e., pre-virus and during the pandemic period. The date 20 February 2020 is considered a breaking point as the financial markets crashed following the early effects of the COVID-19 pandemic.

Looking at the returns in Table 1, it is possible to see that the funds with the lowest sustainability ratings performed more poorly than those in other categories, while the standard deviation is relatively similar among the items considered, a similar result to that of Meher et al. [10]. Table 2 shows, during the COVID-19 pandemic, the returns were negative, and the volatility was higher than in the previous period. Before the exogenous shock, the returns of the funds were very similar; however, during the second period, the investment funds with a higher level of sustainability outperformed MSCI Europe and the other funds. The results of the preliminary and basic analysis of investment funds are in accordance with previous research that highlights the capacity of sustainable finance to better deal with periods of crisis.

Table 1. Descriptive statistics (returns—all sample).

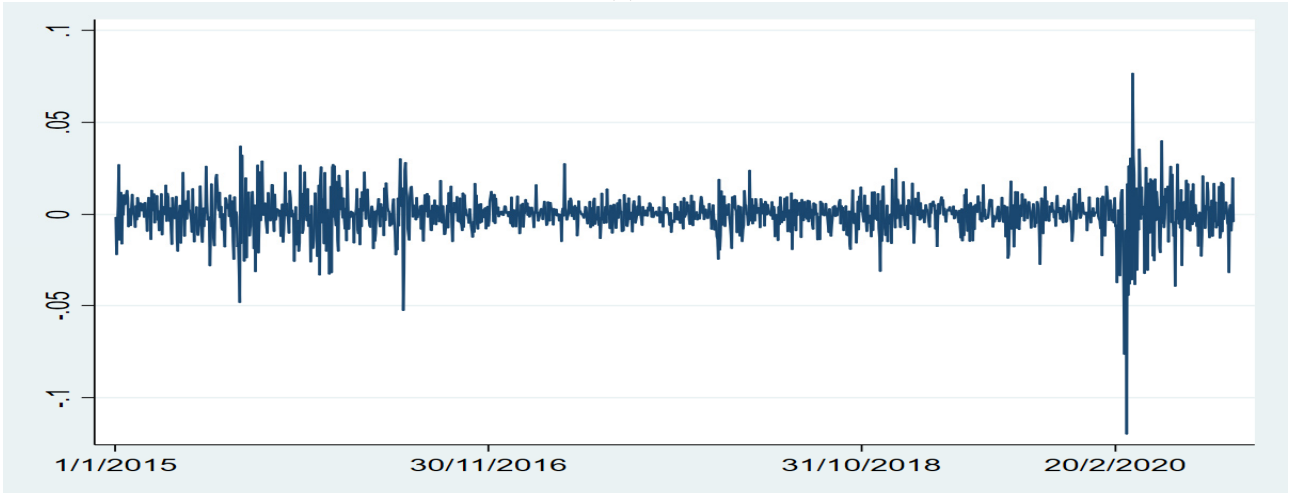
Funds	ESG Rating [1]	Obs.	Mean	SD	Min.	Max.	Skewness	Kurtosis	*p*-Value [2]	JB [3] Test	ADF [4]	Durbin Test [5]
BNP Europe Value	1	1499	−0.0001	0.013	−0.13	0.089	−1.32	17.66	0.000	1.4×10^4	−37.568 ***	0.26 ***
Odey Pan EUR	1	1499	−0.0002	0.009	−0.075	0.053	−1.11	13.04	0.000	6608	−35.05 ***	0.001 ***
Capital Group	2	1499	0.00008	0.011	−0.119	0.08	−1.54	20.86	0.000	2.1×10^4	−38.408 ***	0.786 ***
Candriam Equities	2	1499	0.00005	0.012	−0.138	0.087	−1.435	21.828	0.000	2.3×10^4	−38.27 ***	0.684 ***
Anima	2	1499	0.00008	0.011	−0.113	0.028	−1.216	15.96	0.000	1.1×10^4	−38.119 ***	0.573 ***
Amundi Index MSCI EUR	2	1499	0.0001	0.011	−0.125	0.082	−1.28	18.29	0.000	1.5×10^4	−38.536 ***	0.887 ***
Amundi Funds Top EUR	2	1499	0.00006	0.012	−0.126	0.081	−1.28	17.699	0.000	1.4×10^4	−37.63 ***	0.289 ***
Allianz	2	1499	0.0001	0.011	−0.103	0.067	−1.33	16.4	0.000	1.2×10^4	−38.463 ***	0.829 ***
Amundi AZ	2	1499	0.00004	0.012	−0.129	0.075	−1.53	19.36	0.000	1.7×10^4	−38.74 ***	0.958 ***
Amundi SF	2	1499	0.0001	0.012	−0.127	0.075	−1.46	18.51	0.000	1.6×10^4	−37.948 ***	0.460 ***
BNP Europe Equity	3	1499	0.0001	0.011	−0.117	0.068	−0.117	0.029	0.000	8757	−38.988 ***	0.756 ***
GAM Star	3	1499	0.0002	0.011	−0.107	0.083	−0.9511	14.062	0.000	7870	−38.047 ***	0.524 ***
Candriam L. C	3	1499	0.0004	0.010	−0.096	0.055	−0.8235	10.605	0.000	3782	−39.19 ***	0.608 ***
Candriam L. N	3	1499	0.0004	0.010	−0.097	0.055	−0.8252	10.62	0.000	3799	−39.185 ***	0.618 ***
CPR Silver age	3	1298	0.00003	0.010	−0.115	0.071	−1.55	20.68	0.000	1.7×10^4	−35.214 ***	0.435 ***
Azimut	3	1499	−0.0001	0.011	−0.138	0.085	−1.696	24.28	0.000	2.9×10^4	−39.528 ***	0.402 ***
DPAM	3	1499	0.0003	0.011	−0.114	0.075	−1.068	15.151	0.000	9506	−38.634 ***	0.964 ***
BNP Action Croissance	4	1499	0.0003	0.01	−0.087	0.066	−1.176	14.109	0.000	8054	−39.407 ***	0.468 ***
Candriam optimum	4	1499	0.0003	0.01	−0.114	0.065	−1.426	20.819	0.000	2×10^4	−39.349 ***	0.509 ***
BL Equities	4	1499	0.0003	0.01	−0.088	0.059	−0.788	10.182	0.000	3377	−39.311 ***	0.533 ***
BMO	4	1499	0.0001	0.011	−0.104	0.059	−1.134	12.603	0.000	6081	−38.054 ***	0.528 ***
Janus	4	1094	0.0002	0.012	−0.126	0.083	−2.335	34.553	0.000	4.6×10^4	−40.023 ***	0.002 ***
New Capital	4	795	0.0001	0.010	−0.109	0.065	−1.865	23.748	0.000	1.5×10^4	−28.253 ***	0.911 ***
GAM Equity	4	1499	0.0002	0.011	−0.108	0.085	−1.065	14.794	0.000	8970	−38.194 ***	0.625 ***
Comgest Growth	5	1499	0.0003	0.01	−0.085	0.065	−0.685	10.257	0.000	3407	−37.62 ***	0.284 ***
Echiquier Major	5	1499	0.0003	0.010	−0.106	0.079	−1.01	14.617	0.000	8684	−30.079 ***	0.689 ***
Fidelity Active Strategy	5	1499	0.0003	0.011	−0.09	0.067	−0.828	10.975	0.000	4144	−38.511 ***	0.863 ***
Sailern Int. Eur	5	1499	0.0003	0.009	−0.072	0.063	−0.546	9.055	0.000	2365	−38.361 ***	0.75 ***
Black Rock Eur focus	5	1499	0.0001	0.011	−0.091	0.067	−0.855	12.715	0.000	6078	−39.009 ***	0.741 ***
Pictec	5	1499	0.0002	0.01	−0.094	0.049	−1.153	13.599	0.000	7349	−38.19 ***	0.622 ***
MSCI Europe		1499	0.0002	0.011	−0.119	0.077	−1.34	18.92	0.000	1.6×10^4	−38.8 ***	0.912 ***

[1] ESG risk rating provided by *Sustainalytics*; [2] Normality test based on skewness and kurtosis values; [3] Jarque–Bera test; [4] Augmented Dickey–Fuller test; [5] Durbin's alternative test for autocorrelation; *** $p < 0.01$.

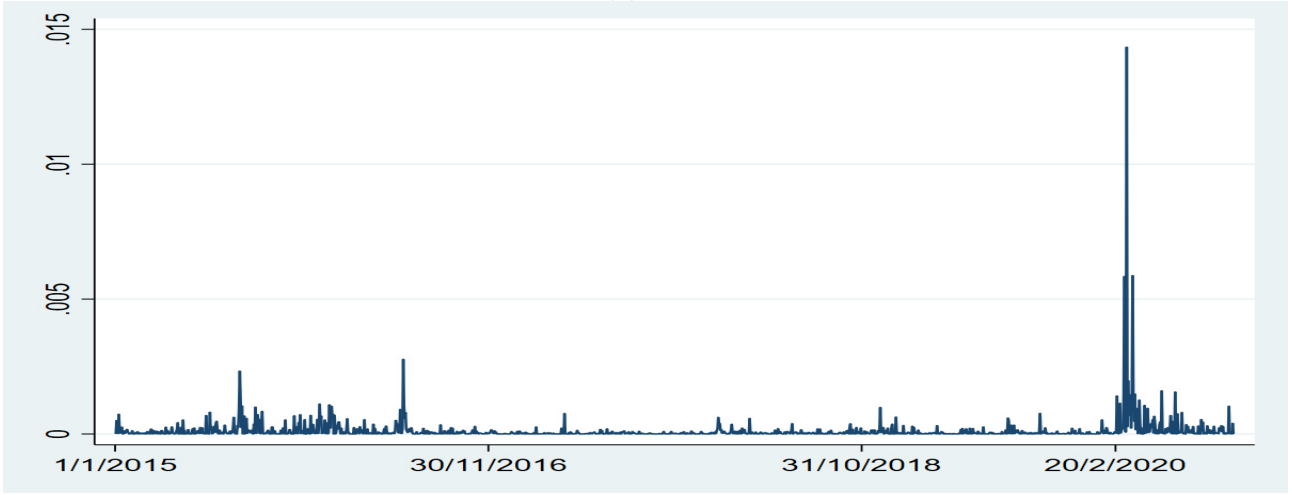
Table 2. Descriptive statistics (returns—split sample before and post COVID-19).

Funds	Obs.		ESG Rating	Mean		SD		Min.		Max.		Skewness		Kurtosis	
	Before	Post		Before	Post	Before	Post	Before	Post	Before	Post	Before	Post	Before	Post
BNP Europe Value	1340	159	1	0.0001	−0.002	0.011	0.024	−0.079	−0.137	0.047	0.09	−0.552	−1.305	7.72	10.6
Odey Pan EUR	1340	159	1	0.0000	−0.001	0.008	0.011	−0.051	−0.076	0.038	0.053	−0.424	−1.187	6.684	8.055
Capital Group	1340	159	2	0.0003	−0.001	0.009	0.021	−0.078	−0.12	0.048	0.081	−0.799	−1.29	11.202	10.31
Candriam Equities	1340	159	2	0.0002	−0.001	0.009	0.024	−0.057	−0.138	0.039	0.087	−0.287	−1.39	6.837	11.06
Anima	1340	159	2	0.0002	−0.0008	0.009	0.019	−0.076	−0.113	0.043	0.072	−0.59	−1.43	8.28	11.66
Amundi Index MSCI EUR	1340	159	2	0.0003	−0.001	0.009	0.022	−0.056	−0.125	0.041	0.082	−0.433	−1.308	6.849	10.63
Amundi Funds Top EUR	1340	159	2	0.0002	−0.001	0.009	0.022	−0.061	−0.126	0.043	0.081	−0.442	−1.328	6.703	10.47
Allianz	1340	159	2	0.0003	−0.0011	0.009	0.021	−0.057	−0.103	0.044	0.067	−0.633	−1.213	7.686	8.882
Amundi AZ	1340	159	2	0.0002	−0.0012	0.009	0.022	−0.081	−0.129	0.039	0.076	−0.706	−1.444	9.09	10.57
Amundi SF	1340	159	2	0.0002	−0.0012	0.009	0.022	−0.064	−0.127	0.041	0.075	−0.54	−1.45	7.102	10.52
BNP Europe Equity	1340	159	3	0.0002	−0.0005	0.009	0.021	−0.055	−0.117	0.039	0.068	−0.347	−1.42	5.924	9.804
GAM Star	1340	159	3	0.0003	−0.0002	0.009	0.02	−0.075	−0.107	0.038	0.083	−0.665	−0.91	7.644	9.746
Candriam L. C	1340	159	3	0.0004	0.0004	0.009	0.017	−0.046	−0.097	0.043	0.055	−0.261	−1.377	5.565	9.49
Candriam L. N	1340	159	3	0.0004	0.0003	0.009	0.017	−0.046	−0.097	0.043	0.055	−0.261	−1.37	5.566	9.49
CPR Silver age	1139	159	3	0.0002	−0.001	0.008	0.019	−0.052	−0.115	0.032	0.071	−0.55	−1.495	6.75	11.8
Azimut	1340	159	3	0.0002	−0.0013	0.009	0.023	−0.078	−0.138	0.035	0.085	−0.733	−1.477	9.469	12.11
DPAM	1340	159	3	0.0004	−0.0002	0.009	0.019	−0.062	−0.115	0.043	0.075	−0.455	−1.24	6.684	10.48
BNP Action Croissance	1340	159	4	0.0004	−0.0003	0.009	0.017	−0.087	−0.078	0.049	0.066	−1.21	−0.77	14.455	7.145
Candriam optimum	1340	159	4	0.0003	−0.0004	0.008	0.018	−0.047	−0.114	0.038	0.065	−0.281	−1.816	7.067	13.96
BL Equities	1340	159	4	0.0003	−0.0002	0.008	0.016	−0.045	−0.088	0.039	0.059	−0.335	−1.125	5.27	8.87
BMO	1340	159	4	0.0002	−0.0004	0.009	0.018	−0.06	−0.104	0.040	0.058	−0.617	−1.355	7.077	9.52
Janus	935	159	4	0.0004	−0.001	0.007	0.026	−0.041	−0.126	0.030	0.083	−0.59	−1.362	5.333	10.13
New Capital	636	159	4	0.0003	−0.0007	0.006	0.019	−0.03	−0.109	0.024	0.065	−0.418	−1.37	5.157	10.34
GAM Equity	1340	159	4	0.0003	−0.0002	0.009	0.02	−0.086	−0.108	0.042	0.085	−0.818	−0.942	9.59	9.29
Comgest Growth	1340	159	5	0.0004	−0.0004	0.008	0.016	−0.043	−0.085	0.036	0.065	−0.345	−0.831	5.258	8.42
Echiquier Major	1340	159	5	0.0004	−0.0004	0.009	0.019	−0.047	−0.106	0.033	0.078	−0.493	−1.033	5.742	9.64
Fidelity Active Strategy	1340	159	5	0.0004	−0.0004	0.009	0.018	−0.079	−0.09	0.034	0.067	−0.64	−0.724	8.58	6.718
Sailern Int. Eur	1340	159	5	0.0004	−0.0001	0.008	0.015	−0.048	−0.072	0.038	0.063	−0.332	−0.714	6.27	7.63
Black Rock Eur focus	1340	159	5	0.0002	−0.0001	0.009	0.021	−0.084	−0.091	0.056	0.068	−0.629	−0.763	10.742	6.51
Pictec	1340	159	5	0.0003	−0.0009	0.008	0.018	−0.062	−0.094	0.036	0.05	−0.52	−1.19	7.99	7.945
MSCI Europe	1340	159		0.0003	−0.0009	0.009	0.021	−0.053	−0.119	0.037	0.077	−0.42	−1.35	6.407	10.74

(**a**)

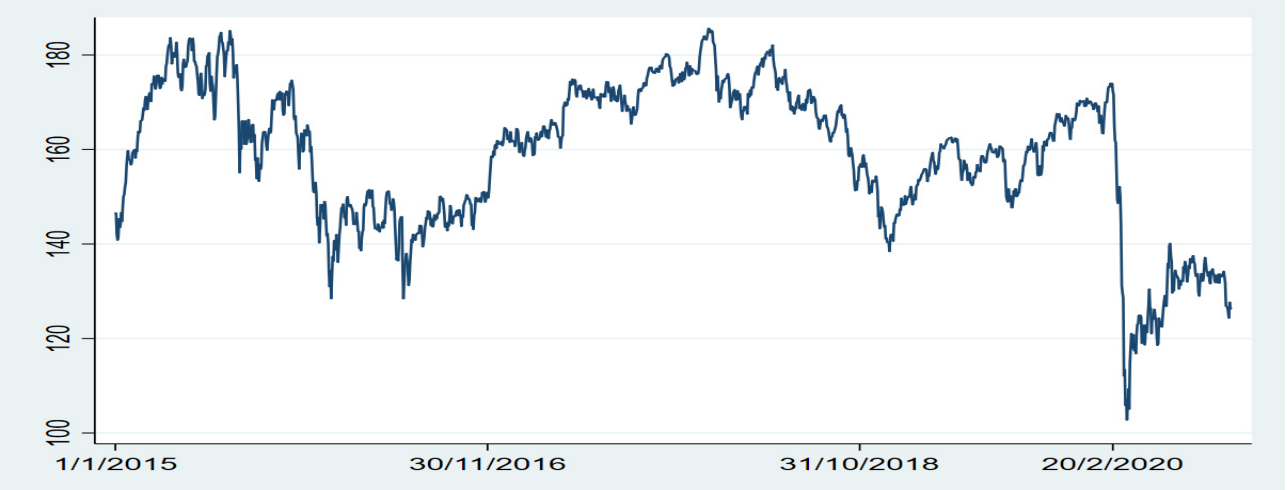


(**b**)



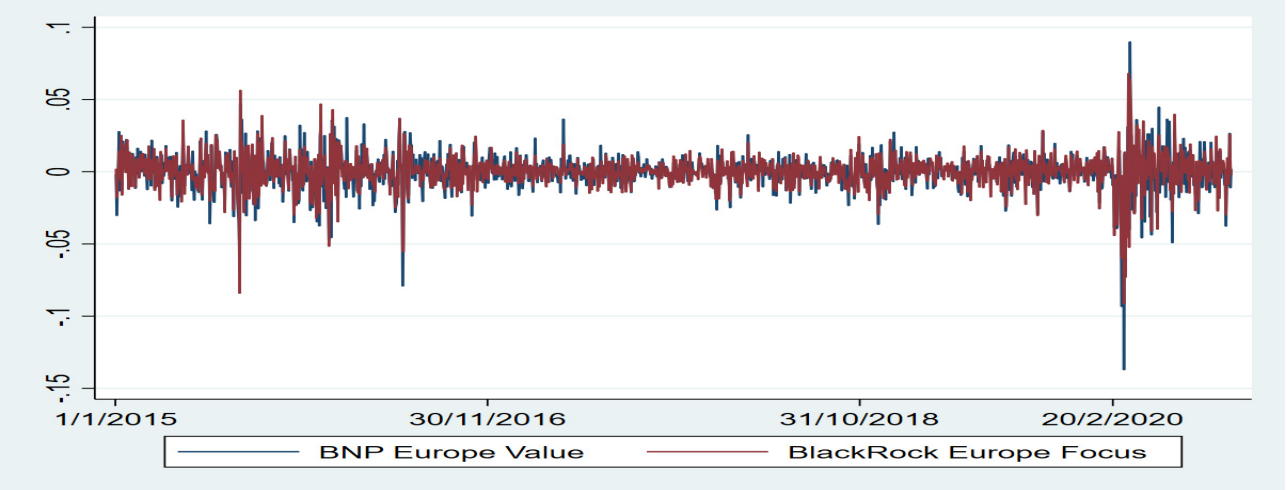
(**c**)

Figure 1. MSCI Europe—overview (daily observations). (**a**) Panel 1A. MSCI Europe index. (**b**) Panel 1B. Returns series (natural logarithm). (**c**) Panel 1C. Volatility. Note: From 1 January 2015 to 30 September 2020, consisting of 1499 observations.



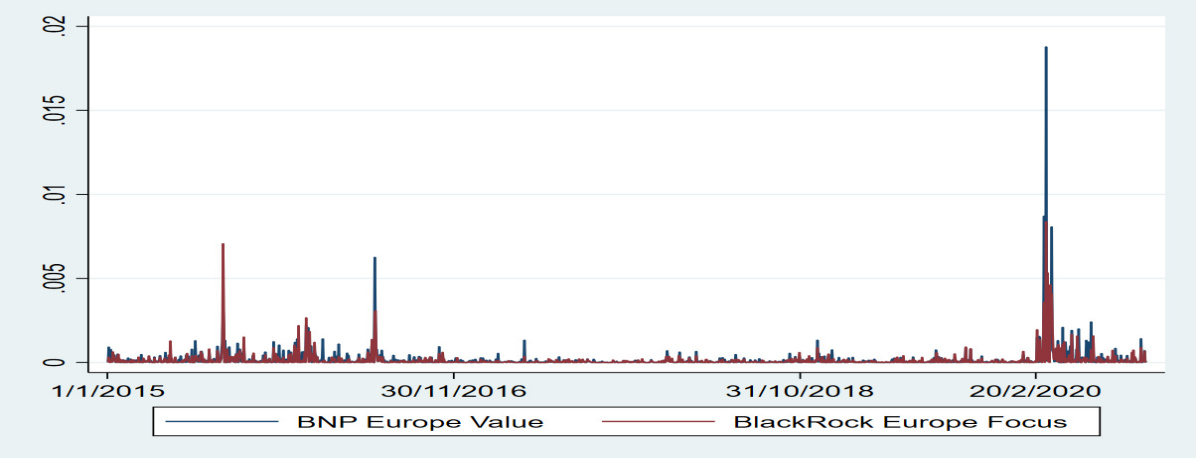
(**a**)

(**b**)



(**c**)

Figure 2. *Cont*.



(**d**)

Figure 2. BNP Europe Value vs. BlackRock Europe Focus—overview (daily observations). (**a**) Panel 2A1. BNP Europe Value. (**b**) Panel 2A2. BlackRock Europe Focus. (**c**) Panel 2B. Returns series. (**d**) Panel 2C. Volatility. Note: From 1 January 2015 to 30 September 2020, consisting of 1499 observations.

4. Empirical Strategy

4.1. GARCH

The previous descriptive statistics highlight the returns of the funds over the time span analyzed are not normally distributed, while the ARCH-LM test (the LM test for ARCH effects shows that a GARCH model is required (LM tests are not provided but are available upon request)) of Engle [43] shows the presence of ARCH effects. This was already noted in the literature by Hoti et al. [44] and Rehan et al. [45] who suggest the use of a specific model, namely a GARCH model, to better fit the data and discover and compare the dynamics of the volatility series.

We began our empirical analysis with a simple ARCH model [43], and after that the AIC model selection criteria (Akaike information criterion (AIC)) showed the GARCH model [46] was preferable. This model allows the number of parameters to be saved and the data to be better fitted.

A generic GARCH(m, n) could be represented by the following mean equation and conditional variance:

$$y_t = x_t\beta + \varepsilon_t \quad (1)$$

$$h_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \alpha_2\varepsilon_{t-2}^2 + \cdots + \alpha_m\varepsilon_{t-m}^2 + \delta_1 h_{t-1}^2 + \delta_2 h_{t-2}^2 + \cdots + \delta_n h_{t-n}^2 \quad (2)$$

where ε_t^2 represents the innovations, and α_i and δ_i represent the ARCH and GARCH parameters, respectively; with $\alpha_0 > 0; \alpha_i, \delta_j \geq 0$ and $\sum_i a_i + \sum_j \delta_i < 1$ to ensure a positive and stationary conditional variance.

To overcome the problem caused by the leptokurtic distribution of the returns, we removed the $\varepsilon_t \sim N(0, h_t^2)$ assumption and we tested different model specifications (GARCH with a generalized error distribution and GARCH with Student's t distribution). Among the various specifications, the AIC model selection criteria indicated that a GARCH(1,1) with a Student's t distribution and three degrees of freedom (we also ran models with a second order ARCH and GARCH components, but the results were not satisfying) was the preferred model. Using the same model, we also ran two separate estimates for the two sub-periods: Before and during the pandemic (see Table 3). The estimates for the entire period show that there was persistence volatility (the sum of α and δ approaches 1, as was suggested by Bollerslev [46]), while the autocorrelation of conditional volatility prevailed with respect to that of the squared errors. When we observed the two subsamples, we did not find any significant differences in the first period with the respect to the whole sample. However, for the second period, it was possible to see that the component related to the α coefficient was not statistically significant, and the

autocorrelation of conditional volatility was higher for the investment funds with a lower sustainability rating. We can confirm that all investment funds were characterized by low ARCH effects and high GARCH effects, so the heteroskedastic volatility persisted over a long-term period (a result similar to that of Sabbaghi [37]). Therefore, these effects are long term, and this is especially true for investment funds with lower sustainability ratings during the pandemic period.

Table 3. GARCH(1,1)-t(3).

Funds	ESG Rating	All Sample		Before COVID-19		Post COVID-19	
		α_1	δ_1	α_1	δ_1	α_1	δ_1
BNP Europe Value	1	0.158 ***	0.884 ***	0.165 ***	0.874 ***	0.072	0.931 ***
Odey Pan EUR	1	0.161 ***	0.875 ***	0.175 ***	0.859 ***	0.068 *	0.932 ***
Capital Group	2	0.237 ***	0.828 ***	0.25 ***	0.808 ***	0.129	0.885 ***
Candriam Equities	2	0.174 ***	0.879 ***	0.192 ***	0.863 ***	0.067	0.93 ***
Anima	2	0.2 ***	0.849 ***	0.223 ***	0.825 ***	0.089	0.892 ***
Amundi Index MSCI EUR	2	0.205 ***	0.852 ***	0.227 ***	0.828 ***	0.09	0.912 ***
Amundi Funds Top EUR	2	0.192 ***	0.857 ***	0.208 ***	0.833 ***	0.1	0.904 ***
Allianz	2	0.141 ***	0.886 ***	0.119 ***	0.903 ***	0.182 *	0.815 ***
Amundi AZ	2	0.223 ***	0.844 ***	0.252 ***	0.816 ***	0.083	0.915 ***
Amundi SF	2	0.215 ***	0.853 ***	0.238 ***	0.831 ***	0.088	0.912 ***
BNP Europe Equity	3	0.236 ***	0.822 ***	0.259 ***	0.791 ***	0.128	0.879 **
GAM Star	3	0.182 ***	0.865 ***	0.203 ***	0.844 ***	0.108	0.885 ***
Candriam L. C	3	0.178 ***	0.876 ***	0.184 ***	0.871 ***	0.123	0.877 ***
Candriam L. N	3	0.178 ***	0.876 ***	0.185 ***	0.871 ***	0.123	0.877 ***
CPR Silver Age	3	0.207 ***	0.835 ***	0.246 ***	0.779 ***	0.094	0.904 ***
Azimut	3	0.229 ***	0.839 ***	0.254 ***	0.814 ***	0.091	0.907 ***
DPAM	3	0.209 ***	0.849 ***	0.248 ***	0.816 ***	0.093	0.909 ***
BNP Action Croissance	4	0.118 ***	0.882 ***	0.898 ***	0.884 ***	0.177	0.861 ***
Candriam optimum	4	0.187 ***	0.871 ***	0.186 ***	0.872 ***	0.106	0.89 ***
BL Equities	4	0.18 ***	0.873 ***	0.186 ***	0.865 ***	0.129	0.874 ***
BMO	4	0.198 ***	0.848 ***	0.221 ***	0.817 ***	0.114	0.888 ***
Janus	4	0.182 ***	0.852 ***	0.153 ***	0.845 ***	0.222 *	0.827 ***
New Capital	4	0.268 ***	0.783 ***	0.292 ***	0.678 ***	0.146	0.862 ***
GAM Equity	4	0.193 ***	0.856 ***	0.209 ***	0.838 ***	0.131	0.866 ***
Comgest Growth	5	0.157 ***	0.886 ***	0.152 ***	0.889 ***	0.139	0.867 ***
Echiquier Major	5	0.225 ***	0.839 ***	0.242 ***	0.819 ***	0.149	0.871 ***
Fidelity Active Strategy	5	0.218 ***	0.848 ***	0.24 ***	0.818 ***	0.125	0.892 ***
Sailern International Eur	5	0.139 ***	0.891 ***	0.134 ***	0.892 ***	0.119	0.88 ***
Black Rock Eur focus	5	0.229 ***	0.825 ***	0.251 ***	0.796 ***	0.167 *	0.856 ***
Pictec	5	0.187 ***	0.86 ***	0.203 ***	0.842 ***	0.128 *	0.878 ***
MSCI Europe		0.245 ***	0.826 ***	0.284 ***	0.789 ***	0.99	0.918 ***

Note: Estimates are run with a GARCH(1,1) model with a Student's t distribution and 3 d.o.f. The coefficient α_1 is related to the ARCH effect, δ_1 is related to the GARCH effect. The other coefficients are available upon request. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As for some funds the hypothesis of stationary covariance was rejected, it is reasonable to assume some form of asymmetry. To take into account possible leverage effects, we adopted more advanced GARCH models that utilize asymmetric effects to capture the different impacts of negative and positive shocks on volatility. We tested different asymmetric models, assuming a non-normal distribution for the error term, i.e., Exponential GARCH [47], Glosten–Jagannathan–Runkle GARCH [48], and the Threshold Model [49]. The Threshold GARCH(1,1) model with a Student's t distribution and three degrees of freedom demonstrated a better capacity to fit the data, so this was our final choice. The Threshold Garch(1,1) is represented by the following formula:

$$h_t = \alpha_0 + \alpha_1|\varepsilon_{t-1}| + \gamma_1|\varepsilon_{t-1}|I_{|\varepsilon_{t-1}<0|} + \delta_1 h_{t-1} \quad (3)$$

where $I_{|\varepsilon_{t-1}<0|}$ is a dummy variable equal to 1 if $|\varepsilon_{t-1}| < 0$ and 0 otherwise, and γ_1 denotes the leverage effect.

We also utilized the model to investigate any differences among the funds during the crisis period. These results are shown in Table 4 in which the leverage effect is captured by the coefficient γ. When we considered the whole sample, the coefficient was negative, statistically significant, and relatively similar among funds, thus indicating an asymmetry issue. More specifically, the negative shocks appeared to have a greater impact on volatility than the positive shocks. Moreover, the second period was more interesting again. In this case, the sustainable funds appeared to present a γ coefficient with a larger magnitude in absolute value. This category of funds exhibited a volatility process that reacted more to negative shocks than the others. One possible explanation for this could be the lower attitude towards speculation. Generally, investors who choose these types of financial instruments do not have a particular preference towards risk. Interpreting the output in another way, it is reasonable to assume that they could overreact to negative exogenous shocks and require a higher risk premium. Ultimately, one of the most appealing aspects of ESG funds is the lower level of risk, so it is reasonable to assume that those who buy these types of financial instruments have a lower willingness to take risks.

Table 4. Threshold GARCH(1,1)-t(3).

Fuds	ESG Rating	All Sample			Post 20 February 2020		
		α_1	β_1	γ_1	α_1	β_1	γ_1
BNP Europe Value	1	0.229 ***	0.903 ***	−0.228 ***	−0.401 ***	0.044	−0.092 *
Odey Pan EUR	1	0.167 ***	0.908 ***	−0.108 ***	−0.080	0.099	0.442 *
Capital Group	2	0.255 ***	0.882 ***	−0.238 ***	−0.511 ***	0.395 ***	−0.233 ***
Candriam Equities	2	0.219 ***	0.906 ***	−0.203 ***	−0.525 ***	−0.065	0.015
Anima	2	0.247 ***	0.888 ***	−0.235 ***	−0.322 ***	0.369 *	0.432 **
Amundi Index MSCI Eur	2	0.24 ***	0.897 ***	−0.236 ***	−0.431 ***	0.045	−0.080
Amundi Funds Top Eur	2	0.238 ***	0.894 ***	−0.234 ***	−0.424 ***	0.038	−0.095 *
Allianz	2	0.189 ***	0.920 ***	−0.201 ***			
Amundi AZ	2	0.251 ***	0.889 ***	−0.237 ***	−0.334 ***	0.253	−0.431 **
Amundi SF	2	0.24 ***	0.897 ***	−0.225 ***	−0.433 ***	−0.029	−0.118 **
BNP Europe Equity	3	0.268 ***	0.872 ***	−0.264 ***	−0.466 ***	−0.020	−0.148 ***
GAM Star	3	−0.223 ***	0.891 ***	−0.196 ***	−0.504 ***	0.182	0.042
Candriam L. C	3	0.219 ***	0.895 ***	−0.202 ***	−0.520 ***	0.260 ***	−0.328 ***
Candriam L. N	3	0.22 ***	0.895 ***	−0.212 ***	−0.520 ***	0.232 ***	−0.329 ***
CPR Silver Age	3	0.259 ***	0.880 ***	−0.283 ***	−0.407 ***	0.128	−0.073
Azimut	3	0.245 ***	0.902 ***	−0.248 ***	−0.429 ***	0.005	−0.074
DPAM	3	0.244 ***	0.897 ***	−0.249 ***	−0.630 ***	0.030	0.023
BNP Action Croissance	4	0.207 ***	0.903 ***	−0.232 ***	0.226	−0.330 *	−0.553 ***
Candriam optimum	4	0.239 ***	0.892 ***	−0.211 ***	−0.603 ***	0.334 ***	−0.299 ***
BL Equities	4	0.220 ***	0.894 ***	−0.214 ***	0.102	−0.150	−0.538 ***
BMO	4	0.233 ***	0.891 ***	−0.228 ***	0.471 ***	0.114	−0.196 ***
Janus	4	0.208 ***	0.897 ***	−0.188 ***	0.218 ***	0.459 ***	−0.805 ***
New Capital	4	0.29 ***	0.851 ***	−0.238 ***			
GAM Equity	4	0.235 ***	0.884 ***	−0.202 ***			
Comgest Growth	5	0.211 ***	0.896 ***	−0.189 ***	−0.679 ***	0.002	0.157 ***
Echiquier Major	5	0.252 ***	0.877 ***	−0.237 ***	0.258	0.036	−0.639 ***
Fidelity Active Strategy	5	0.259 ***	0.871 ***	−0.224 ***	−0.741 ***	0.418 ***	−0.231 ***
Sailern International Eur	5	0.204 ***	0.896 ***	−0.186 ***	−0.351 ***	−0.119	−0.229 *
Black Rock Eur focus	5	0.251 ***	0.878 ***	−0.224 ***			
Pictec	5	0.222 ***	0.9 ***	−0.216 ***			
MSCI Europe		0.265 ***	0.898 ***	−0.293 ***	−0.444 ***	−0.034	−0.102 *

Note: Estimates are run with a Threshold GARCH(1,1) model with a Student's t distribution and 3 d.o.f. The coefficient α_1 is related to the ARCH effect, δ_1 is related to the GARCH effect and γ_1 represents the asymmetric effect. The other coefficients are available upon request. Missing values occur where numerical optimization fails. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. Multivariate GARCH

In order to complete the volatility analysis, a generalized multivariate GARCH was used to verify the relationship between the volatility process of each fund and the benchmark (the MSCI Europe index). More specifically, we wanted to investigate how the volatility of the MSCI Europe index affected that of the funds and vice versa. In this way, it was also possible to determine the presence of contagion risk during the pandemic period. As suggested by Forbes and Rigobon [50], the latter phenomenon is determined by an increase in the connection between or within the financial markets after an exogenous shock. Therefore, an increase in the co-movements of the financial instruments could indicate the presence of contagion risk. Firstly, we used a dynamic conditional correlational bivariate GARCH model [51,52] to conduct the empirical analysis, because the assumption of a time invariant conditional correlation was too restrictive (we used a Student's t distribution for the error term). A DCC GARCH model has two main positive attributes: It is more flexible than a constant conditional correlation model [53], so it allows for a time-varying conditional correlation; and it is more parsimonious than other models, so the estimation of the parameters is more feasible.

A multivariate GARCH model is represented by the following mean equation and conditional variance:

$$y_t = Cx_t + \varepsilon_t \tag{4}$$

where y_t and x_t are the vectors of the dependent and independent variable, respectively; and C is the matrix of parameters.

$$\varepsilon_t = H_t^{1/2}\omega_t \text{ with } H_t = D_t^{1/2}R_tD_t^{1/2} \tag{5}$$

where $H_t^{1/2}$ is the Cholesky factor of the time-varying conditional covariance matrix H_t and ω_t is the vector of the innovations—independent and identically distributed—with zero mean and unit variance; R_t is the matrix of conditional correlations (the conditional correlations follow GARCH (1,1)) and D_t is the diagonal matrix of the conditional variances. In a dynamic conditional correlation model, R_t changes over time, while in a constant conditional correlation model, it becomes a static matrix R and the correlation between the assets becomes time invariant. In this analysis, we have

$$h_{ij,t} = \rho_{ij,t}\sigma_{i,t}\sigma_{j,t} \tag{6}$$

where i represents the i fund considered and j is the MSCI index; the diagonal elements of $\sigma_{i,t}$ and $\sigma_{j,t}$ follow a GARCH process, and $\rho_{ij,t}$ is the time-varying conditional correlation between the volatilities of the i fund and the MSCI Europe index. To discover any difference between the pre-COVID-19 phase and the later period, we divided the sample into two parts using the date 20 February 2020 as the dividing point. The main results are reported in Table 5, where ρ_1 represents the conditional correlation between the volatilities of each fund and the MSCI Europe index, and the two parameters (λ_1, $\lambda_2 \geq 0$ and $0 \leq \lambda_1 + \lambda_2 < 1$). λ_1 and λ_2 show the evolution of the conditional correlation over time. Firstly, we found that λ_1 and λ_2 were statistically significant in the first period, while in the second period, these were quite often not statistically significant (it is difficult to say if this occurred because the conditional correlation was not dynamic or because there were too few observations). Secondly, we found that the conditional correlation was always positive and often statistically significant. The third and more interesting result resulted from the comparison of the two periods. In fact, it is possible to see an increase in the conditional correlation from the first to the second period. This trend was also found in the studies of Salvador and De Paula Franca [39], and in the most recent studies of Rehan et al. [45] and Zhang et al. [54]. This finding could be a signal of financial contagion due to the exogenous shock. The conditional correlation increased for all funds for which the numerical optimization was met. Another relevant finding is related to the size of this correlation. Both in the first and second periods, the funds with a lower sustainability rating exhibited a higher

conditional correlation value than the other categories. Furthermore, during the COVID-19 pandemic, this correlation increased much more for the low-ESG funds. These results are in accordance with those of Roy and Roy [41] and Cerqueti et al. [42]. The most sustainable investment funds represented instruments that protected against the negative effects of exogenous shocks. Finally, given that many of the λ_1 and λ_2 coefficients in the DCC model related to the second period estimates were not statistically significant, and for 11 out 30 funds, numerical optimization failed (the second period was very short and consisted of only 160 observations), we decided to also run a constant conditional correlation GARCH model. A constant conditional correlation model could be fitted for the purpose, given that the period was short and during this phase the correlation was possibly time invariant. We are aware that this hypothesis is not valid (in future research, more observations could be utilized to elucidate this issue). Looking at the results of the CCC GARCH model, it is possible to see that the negative relationship between the conditional correlation and the ESG rating was confirmed. Therefore, a high level of volatility in the MSCI Europe index was associated with a high level of volatility in the investment funds, and this was especially true for the funds with low ESG ratings. This result has certain important consequences in terms of portfolio diversification and volatility minimization. One possible explanation for our findings can be found in the investment fund strategy, i.e., funds with a low ESG rating could follow a full replication of the benchmark, while funds with a high ESG rating could adopt different approaches.

Table 5. Multivariate GARCH(1,1)-t(3).

Funds	ESG Rating	Before			Post COVID-19			
		Dynamic Conditional Correlational			Dynamic Conditional Correlational			Constant Conditional Correlation
		ρ_1	λ_1	λ_2	ρ_1	λ_1	λ_2	ρ_1
BNP Europe Value	1	0.918 ***	0.050 ***	0.937 ***				0.956 ***
Odey Pan EUR	1	0.628 ***	0.047 ***	0.941 ***	0.786 ***	0.210	0.035	0.758 ***
Capital Group	2	0.902 ***	0.044 ***	0.948 ***				0.967 ***
Candriam Equities	2	0.934 ***	0.070 ***	0.901 ***	0.964 ***	0.151 ***	0.798 ***	0.962 ***
Anima	2	0.956 ***	0.117 ***	0.806 ***	0.977 ***	0.266 ***	0.009	0.976 ***
Amundi Index MSCI Eur	2	0.971 ***	0.151 ***	0.745 ***	0.989 ***	0.404 ***	0.393 **	0.986 ***
Amundi Funds Top Eur	2	0.945 ***	0.050 ***	0.926 ***				0.977 ***
Allianz	2	0.555 ***	0.041 ***	0.858 ***				0.593 ***
Amundi AZ	2	0.959 ***	0.097 ***	0.841 ***	0.986 ***	0.113	0.067	0.985 ***
Amundi SF	2	0.957 ***	0.088 ***	0.851 ***	0.984 ***	0.131	0.371	0.984 ***
BNP Europe Equity	3	0.863 ***	0.111 ***	0.819 ***	0.943 ***	0.261	0.591 *	0.946 ***
GAM Star	3	0.923 ***	0.083 ***	0.840 ***	0.953 ***	0.083	0.761 ***	0.949 ***
Candriam L. C	3	0.886 ***	0.063 ***	0.935 ***	0.917 ***	0.159	0.481*	0.912 ***
Candriam L. N	3	0.885 ***	0.053 ***	0.927 ***	0.918 ***	0.160	0.480 *	0.922 ***
CPR Silver Age	3	0.896 ***	0.063 ***	0.878 ***				0.958 ***
Azimut	3	0.964 ***	0.113 ***	0.818 ***				0.987 ***
DPAM	3	0.948 ***	0.092 ***	0.873 ***				0.963 ***
BNP Action Croissance	4	0.748 ***	0.078 ***	0.789 ***	0.888 ***	0.244 *	0.157	0.877 ***
Candriam optimum	4	0.866 ***	0.062 ***	0.922 ***				0.952 ***
BL Equities	4	0.884 ***	0.067 ***	0.914 ***	0.911 ***	0.085 **	0.890 ***	0.922 ***
BMO	4	0.925 ***	0.0419 ***	0.941 ***	0.937 ***	0.043	0.899 ***	0.949 ***
Janus	4	0.858 ***	0.092 *	0.073				0.844 ***
New Capital	4	0.899 ***	0.284 ***	0.057	0.960 ***	0.183 **	0.425 *	0.955 ***
GAM Equity	4	0.919 ***	0.085 **	0.786 ***	0.934 ***	0.126	0.082	0.934 ***
Comgest Growth	5	0.851 ***	0.082 ***	0.876 ***	0.916 ***	0.248 **	0.024	0.915 ***
Echiquier Major	5	0.883 ***	0.052 ***	0.931 ***	0.935 ***	0.045	0.895 ***	0.945 ***
Fidelity Active Strategy	5	0.892 ***	0.054 ***	0.931 ***				0.927 ***
Sailern International Eur	5	0.828 ***	0.051 ***	0.929 ***				0.866 ***

Table 5. *Cont.*

Funds	ESG Rating	Before			Post COVID-19			
		Dynamic Conditional Correlational			Dynamic Conditional Correlational			Constant Conditional Correlation
		ρ_1	λ_1	λ_2	ρ_1	λ_1	λ_2	ρ_1
Black Rock Eur focus	5	0.793 ***	0.039	0.862 ***				0.788 ***
Pictec	5	0.483	0.041 ***	0.958 ***	0.816 ***	0.021	0.435	0.816 ***

Note: Estimates are run with a multivariate GARCH(1,1) model with a Student's t distribution and 3 d.o.f. The coefficient ρ_1 represents the conditional correlation between the volatilities of each fund and the MSCI Europe index; λ_1 and λ_2 show the evolution over time of the conditional correlation. The other coefficients are available upon request. Missing values occur where numerical optimization fails. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3. Event Study

Finally, we investigated the resilience of the funds. More precisely, we wanted to explore whether funds with a high ESG rating better responded to the financial crisis caused by the global pandemic. In this regard, one result was already obtained in the basic preliminary basic analysis at the beginning of this work, when the returns of the funds were compared between the two periods. As highlighted in Table 1, the funds with high ESG ratings appeared to perform better during the pandemic phase given that these reported higher average returns. To investigate the specific issue of resilience, we applied the event study-based methodology. This type of analysis is useful to find a relationship between stock or bond returns and an exogenous shock, because it allows the ways in which unexpected events affect changes in the prices of the funds to be identified. The event study-based methodology is not new in this field; in fact, it was already applied to verify the effect of various diseases on stock returns. For example, Bash [55] and AlAli [56] focused on the impact of COVID-19, Chen et al. [57] investigated the consequences of the SARS, and Ichev and Marinč [58] analyzed Ebola. These studies analyzed specific sectors or countries, while we analyzed the impact on different categories of ESG funds. In our study, the main aim was to test the hypothesis that funds with a greater focus on the ESG criteria are more resilient than funds with a lower sustainability rating, and consequently, they report a lower impact in terms of negative abnormal returns.

In this context, the exogenous and unexpected shock was the COVID-19 pandemic. For this, we used the date 20 February 2020 as the dividing point between periods, as was previously explained (observing the daily trend of the MSCI Europe index in Figure 1, it is easy to identify the structural break). To overcome any problems related to accuracy that may have occurred due to the long event window, we considered two short time frames: 3 and 5 days from the event date. If the event was unexpected and had a significant economic or financial relevance, it was assumed to cause abnormal returns. In order to apply the event study-based methodology, it was necessary to calculate the abnormal returns (AR) and the cumulative average abnormal returns (CAAR).

The time series of ARs of a specific fund i in the period t was calculated as the difference between the observed return R_{it} and the expected return $E(R_{it}|X_t)$.

$$AR_{it} = R_{it} - E(R_{it}|X_t) \tag{7}$$

On the other hand, the cumulative average abnormal returns are represented by the following formula:

$$CAAR\ (t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t \text{ with } t_1 < t_2 \text{ and } t_1, t_2 \in \text{ event window}, \tag{8}$$

where AAR_t represents the average abnormal returns.

We opted for a historical mean model (HMM) [59], and we considered event windows of 3 and 5 days. Table 6 shows the results of these estimates. The investment funds with a

higher level of sustainability exhibited smaller CAARs (in absolute value) than the other funds. The magnitude of the CAARs calculated with a 5-day window was larger, but the negative correlation between the CARRs and the number of ESG globes remained; therefore, the higher the sustainability of the funds, the smaller the negative CAARs. This allowed us to confirm the most sustainable funds were more resilient to the crisis, which is in accordance with the results of Nakai et al. [31] and Gangi and Trotta [24], who analyzed other types of sustainable financial assets and types of shocks.

Table 6. Event study (HMM model—event date 20 February 2020).

Funds	ESG Rating	CAAR [−3, 3]	CAAR [−5, 5]
BNP Europe Value	1	−6.91% **	−10.99% ***
Odey Pan EUR	1	−2.93%	−3.74%
Capital Group	2	−6.58% ***	−10.23% ***
Candriam Equities	2	−5.88% **	−10.11% ***
Anima	2	−6.33% **	−10.56% ***
Amundi Index MSCI EUR	2	−6.61% ***	−10.62% ***
Amundi Funds Top EUR	2	−6.19% **	−10.65% ***
Allianz	2	−5.27% **	−7.93% ***
Amundi AZ	2	−6.45% **	−10.84% ***
Amundi SF	2	−6.65% ***	−11.09% ***
BNP Europe Equity	3	−5.41% **	−9.00% ***
GAM Star	3	−6.67% ***	−10.47% ***
Candriam L. C	3	−4.29% *	−8.44% ***
Candriam L. N	3	−4.29% *	−8.45% ***
CPR Silver Age	3	−5.38% **	−9.53% ***
Azimut	3	−6.41% ***	−9.93% ***
DPAM	3	−4.50% *	−8.52% ***
BNP Action Croissance	4	−3.98% *	−7.71% **
Candriam optimum	4	−3.62% *	−7.07% ***
BL Equities	4	−5.27% **	−8.59% ***
BMO	4	−5.41% **	−8.99% ***
Janus	4	−7.30% ***	−11.32% ***
New Capital	4	−5.53% ***	−9.01% ***
GAM Equity	4	−5.88% **	−10.29% ***
Comgest Growth	5	−5.96% ***	−9.01% ***
Echiquier Major	5	−4.96% **	−8.43% ***
Fidelity Active Strategy	5	−4.15% *	−7.07% **
Sailern International Eur	5	−5.24% **	−8.03% ***
Black Rock Eur focus	5	−4.50% *	−8.84% ***
Pictec	5	−4.08% *	−8.48% ***

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Conclusions

We compared ETFs with different ESG ratings with each other and with the MSCI Europe index. The comparison between ETFs allowed us to verify if the ESG policy of the funds affected the financial performance, while the MSCI Europe index allowed us to compare the ETFs with a neutral benchmark. We suppose our findings were mainly determined by the sample, composed by homogenous funds. In this way, we were able to mitigate possible spurious effects due to sample composed by not very similar items.

Our research shows that sustainable funds outperform funds with a low ESG rating during a period of financial crisis determined by an exogenous shock. This result is in accordance with those of Nofsinger and Varma [12], Lins et al. [13], Albuquerque et al. [26], Mirza et al. [29], and Xiong [27]. By contrast, these findings do not support the conclusions of Broadstock et al. [14], Folger-Laronde et al. [18], Hartzmark and Sussman [22], Demers et al. [19], and Chiappini et al. [20].

Our results derive from the comparison of the financial performance of the funds before the COVID-19 pandemic and during the pandemic period. The more sustainable

funds appeared to react better to the unexpected event of the pandemic both in terms of returns and risk. The basic preliminary analysis of the descriptive statistics indicates that, after the structural break (20 February 2020), the high ESG funds were able to recover more rapidly and that, with the event study-based methodology, it was possible to show their superior level of resilience. With regard to risk, the univariate GARCH model exhibits a leverage effect: The negative shocks affected volatility to a greater degree than the positive shocks (which this is true for all the funds analyzed). Instead, the multivariate GARCH models highlight the lower conditional correlation level of the volatility processes between the benchmark (represented by the MSCI Europe index) and the sustainable funds. This finding is even clearer for the estimates related to the pandemic period. The volatility analysis shows that the COVID-19 pandemic increased the contagion risk, but the sustainable funds had a superior ability to face this type of risk, as was already reported by Ouchen [35] for an ESG portfolio.

In summary, we can confirm that sustainable investment funds can be also seen as an insurance instrument against unexpected risks. These financial instruments should be considered not only by investors with pro-social preferences but also by investors aiming to build an optimal portfolio. Investors have to consider that sustainable funds exhibit a higher level of resilience and the ability to reduce the risk of financial contagion, especially during periods of crisis. As already highlighted by Yingxu [25], the ESG rating should be considered as an indicator of resilience in times of crisis.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/su132313253/s1, Table S1: List of funds, Table S2: Akaike information criterion.

Author Contributions: Conceptualization, F.P. and G.R.; methodology, F.P. and G.R.; validation, F.P. and G.R.; formal analysis, F.P. and G.R.; investigation, F.P. and G.R.; resources, F.P. and G.R.; data curation, F.P. and G.R.; writing—original draft preparation, F.P. and G.R.; writing—review and editing, F.P. and G.R.; visualization, F.P. and G.R.; supervision, F.P. and G.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Contini, D.; Costabile, F. Does Air pollution Influence COVID-19 Outbreak? *Atmosphere* **2020**, *11*, 377. [CrossRef]
2. Setti, L.; Passarini, F.; De Gennaro, G.; Di Giulio, A.; Palmisani, J.; Buono, P.; Fornari, G.; Perrone, M.G.; Piazzalunga, A.; Barbieri, P.; et al. Evaluation of the Potential Relationship Between Particulate Matter (PM) Pollution and COVID-19 Infection Spread in Italy. *BMJ* **2020**, *10*. [CrossRef]
3. Conticini, E.; Frediani, B.; Caro, D. Can atmospheric pollution be considered a co-factor in extremely high level of SARS-CoV-2 lethality in Northern Italy? *Environ. Pollut.* **2020**, *261*, 114465. [CrossRef] [PubMed]
4. ECB. *Economic Bulletin*; European Central Bank: Frankfurt, Germany, 2020.
5. Coibion, O.; Gorodnichenko, Y.; Weber, M. *The Cost of the COVID-19 Crisis: Lockdowns, Macroeconomic Expectations, and Consumer Spending*; NBER Work. Pap. No. w27141; National Bureau of Economic Research: Cambridge, MA, USA, 2020. [CrossRef]
6. IMF. *World Economic Outlook Update: A Crisis Like No Other, an Uncertain Recovery*; The International Monetary Fund: Washington, DC, USA, 2020.
7. Guerrieri, V.; Guido, L.; Straub, L.; Werning, I. *Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages?* NBER Work. Pap. No. w26918; National Bureau of Economic Research: Cambridge, MA, USA, 2020; pp. 1–36. [CrossRef]
8. Bonaccorsi, G.; Pierri, F.; Cinelli, M.; Porcelli, F.; Galeazzi, A.; Flori, A.; Schmidth, A.L.; Valensise, C.M.; Scala, A.; Quattrociocchi, W.; et al. Economic and Social Consequences of Human Mobility Restrictions Under COVID-19. *Proc. Natl. Acad. Sci. USA* **2020**, *117*, 15530–15535. [CrossRef]
9. Liu, H.; Manzoor, A.; Manzoon, Z.; Wang, C.; Zhang, L. The COVID-19 outbreak and affected countries stock markets response. *Int. J. Environ. Res. Public Health* **2020**, *17*, 2800. [CrossRef]

10. Meher, B.K.; Hawaldar, I.T.; Mohapatra, L.; Spulbar, C.; Birau, R. The effects of ESG scores on investment returns and stock volatility. *Int. J. Energy Econ. Policy* **2020**, *10*, 4. [CrossRef]
11. McWilliams, A.; Siegel, D. Corporate social responsibility: A theory of the firm perspective. *Acad. Manag. Rev.* **2001**, *26*, 117–127. [CrossRef]
12. Nofsinger, J.; Varma, A. Socially responsible funds and market crises. *J. Bank. Financ.* **2014**, *48*, 180–193. [CrossRef]
13. Lins, K.V.; Servaes, H.; Tamayo, A. Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *J. Financ.* **2017**, *72*, 4. [CrossRef]
14. Broadstock, D.C.; Chan, K.; Cheng, L.; Wang, X. The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Financ. Res. Lett.* **2021**, *38*, 101716. [CrossRef] [PubMed]
15. Engelhardt, N.; Ekkenga, J.; Posch, P. ESG Ratings and Stock Performance during the COVID-19 Crisis. *Sustainability* **2021**, *13*, 7133. [CrossRef]
16. Leite, P.; Cortez, M.C. Performance of European socially responsible funds during market crises: Evidence from France. *Int. Rev. Financ. Anal.* **2015**, *40*, 132–141. [CrossRef]
17. Matallín-Sáez, J.C.; Soler-Domínguez, A.; de Mingo-López, D.V.; Tortosa-Ausina, E. Does socially responsible mutual fund performance vary over the business cycle? New insights on the effect of idiosyncratic SR features. *Bus. Ethics* **2019**, *28*, 71–98. [CrossRef]
18. Folger-Laronde, Z.; Pashang, A.; Feor, L.; ElAlfy, A. ESG Ratings and Financial Performance of Exchange-Traded Funds During the COVID-19 pandemic. *J. Sustain. Financ. Invest.* **2020**, 1–7. [CrossRef]
19. Demers, E.; Hendrikse, J.; Joos, P.; Lev, B. ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. *J. Bus. Finance Account.* **2021**, *48*, 3–4. [CrossRef]
20. Chiappini, H.; Vento, G.; De Palma, L. The Impact of COVID-19 Lockdowns on Sustainable Indexes. *Sustainability* **2021**, *13*, 1846. [CrossRef]
21. Revelli, C.; Viviani, J.L. Financial performance of socially responsible investing (SRI): What have we learned? A meta-analysis. *Bus. Ethics Eur. Rev.* **2015**, *24*, 158–185. [CrossRef]
22. Hartzmark, S.M.; Sussman, A.B. Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows. *J. Financ.* **2019**, *74*, 6. [CrossRef]
23. Becchetti, L.; Ciciretti, R.; Dalò, A.; Herzel, S. Socially responsible and conventional investment funds: Performance comparison and the global financial crisis. *Appl. Econ.* **2015**, *47*, 2541–2562. [CrossRef]
24. Gangi, F.; Trotta, C. The ethical finance as a response to the financial crises: An empirical survey of European SRFs performance. *J. Manag. Gov.* **2015**, *19*, 371–394. [CrossRef]
25. Yingxu, Y. The impact of ESG performance during times of crisis. *Perspectives* **2020**, *53*. Available online: http://unipub.lib.uni-corvinus.hu/6734/1/Green_Financial_Perspectives.pdf#page=55 (accessed on 22 November 2021).
26. Albuquerque, R.; Koskinen, Y.; Yang, S.; Zhang, C. Resiliency of Environmental and Social Stocks: An Analysis of the Exogenous COVID-19 Market Crash. *Rev. Corp. Financ. Stud.* **2020**, *9*, 593–621. [CrossRef]
27. Xiong, J.X. The Impact of ESG Risk on Stocks. *J. Impact ESG Investig.* **2021**, *2*, 7–18. [CrossRef]
28. Rubbaniy, G.; Khalid, A.A.; Ali, S.; Naveed, M. *Are ESG Stocks Safe-Haven during COVID-19?* SSRN Pap.; 2021; pp. 1–24. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3779430 (accessed on 22 November 2021).
29. Mirza, N.; Naqvi, B.; Rahat, B.; Rizvi, S.K.A. Price reaction, volatility timing and funds' performance during Covid-19. *Financ. Res. Lett.* **2020**, *36*, 101657. [CrossRef] [PubMed]
30. Ferriani, F.; Natoli, F. ESG risks in times of Covid-19. *Appl. Econ. Lett.* **2020**, *28*, 1537–1541. [CrossRef]
31. Nakai, M.; Yamaguchi, K.; Takeuchi, K. Can SRI Better Resist Global Financial Crisis? Evidence from Japan. *Int. Rev. Financ. Anal.* **2016**, *48*, 12–20. [CrossRef]
32. Biasin, M.; Cerqueti, R.; Giacomini, E.; Marinelli, N.; Quaranta, A.G.; Riccetti, L. Macro Asset Allocation with Social Impact Investments. *Sustainability* **2019**, *11*, 3140. [CrossRef]
33. Abate, G.; Basile, I.; Ferrari, P. The level of sustainability and mutual fund performance in Europe: An empirical analysis using ESG ratings. *Corp. Soc. Responsib. Environ. Manag.* **2021**, *28*, 5. [CrossRef]
34. Das, N.; Chatterje, S.; Ruf, B.; Sunder, A. Fund Characteristics and Performances of Socially Responsible Mutual Funds: Do ESG Ratings Play a Role? *J. Account. Financ.* **2018**, *18*, 7.
35. Ouchen, A. Is the ESG portfolio less turbulent than a market benchmark portfolio? *Risk Manag.* **2021**, 1–33. [CrossRef]
36. Becchetti, L.; Ciciretti, R. Corporate Social Responsibility and Stock Market Performance. *CEIS Res. Pap.* **2009**, *19*, 1283–1293. [CrossRef]
37. Sabbaghi, O. The behavior of green exchange-traded funds. *Manag. Financ.* **2011**, *37*, 5. [CrossRef]
38. Caporale, G.M.; Cipollini, A.; Spagnolo, N. Testing for contagion: A conditional correlation analysis. *J. Empir. Financ.* **2005**, *12*, 476–489. [CrossRef]
39. Salvador, L.; De Paula Franca, I. Correlation of financial markets in times of crisis. *Stat. Mech. Its Appl.* **2011**, *391*, 187–208.
40. Morales, L.; Andreosso-O'Callaghan, B. The Global Financial Crisis: World Market or Regional Contagion Effects? *Int. Rev. Econ. Financ.* **2014**, *29*, 108–131. [CrossRef]
41. Roy, R.P.; Roy, S.S. Financial Contagion and Volatility Spillover: An Exploration into Indian Commodity Derivative Market. *Econ. Model.* **2017**, *67*, 368–380. [CrossRef]

42. Cerqueti, R.; Ciciretti, R.; Dalò, A.; Nicolosi, M. ESG Investing: A Chance to Reduce Systematic Risk. *J. Financ. Stab.* **2021**, *54*, 100887. [CrossRef]
43. Engle, R.F. Autoregressive Conditional Heteroschedasticity with estimates of the variance of UK inflation. *Econometrica* **1982**, *50*, 987–1007. [CrossRef]
44. Hoti, S.; McAleer, M.; Pauwels, L. Measuring risk in environmental finance. *J. Econ. Surv.* **2007**, *21*, 970–998. [CrossRef]
45. Rehan, M.; Alvi, J.; Karaca, S. *Short Term Stress of COVID-19 on World Major Stock Indices*; SSRN Pap.; 2020; pp. 1–34. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=287751 (accessed on 22 November 2021).
46. Bollerslev, T. Generalized autoregressive conditional heteroskedasticity. *J. Econom.* **1986**, *31*, 307–327. [CrossRef]
47. Nelson, D.B. Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica* **1991**, *59*, 347–370. [CrossRef]
48. Glosten, L.R.; Jagannathan, R.; Runkle, D.E. On the relation between the expected value and the volatility of the nominal excess return on stocks. *J. Financ.* **1993**, *48*, 1779–1801. [CrossRef]
49. Zakoian, J. Threshold heteroskedastic models. *J. Econ. Dyn. Contro* **1994**, *18*, 931–955. [CrossRef]
50. Forbes, K.J.; Rigobon, R. No contagion, only interdependence: Measuring stock market co-movement. *J. Financ.* **2002**, *57*, 2223–2261. [CrossRef]
51. Engle, R.F.; Sheppard, K. *Theoretical and Empirical Properties of Dynamic Conditional Correlation Multivariate GARCH*; NBER Work. Pap.; 2001; p. 8554. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3663900 (accessed on 22 November 2021).
52. Engle, R.F. Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models. *J. Bus. Econ. Stat.* **2002**, *20*, 339–350. [CrossRef]
53. Bollerslev, T. Modelling the Coherence in Short-Run Nominal Exchange Rates: A Multivariate Generalized ARCH Model. *Rev. Econ. Stat.* **1990**, *72*, 498–505. [CrossRef]
54. Zhang, D.; Hu, M.; Ji, Q. Financial markets under the global pandemic of COVID-19. *Financ. Res. Lett.* **2020**, *36*, 101528. [CrossRef]
55. Bash, A. International Evidence of COVID-19 and Stock Market Returns: An Event Study Analysis. *Int. J. Econ. Financ. Issues* **2020**, *10*, 34–38. [CrossRef]
56. AlAli, M.S. The Effect of WHO COVID-19 Announcement on Asian Stock Markets Returns: An Event Study Analysis. *J. Econ. Bus.* **2020**, *3*, 3. [CrossRef]
57. Chen, M.H.; Jang, S.S.; Kim, W.G. The impact of the SARS outbreak on Taiwanese hotel stock performance: An event-study approach. *Int. J. Hosp. Manag.* **2007**, *26*, 200–212. [CrossRef] [PubMed]
58. Ichev, R.; Marinč, M. Stock prices and geographic proximity of information: Evidence from the Ebola outbreak. *Int. Rev. Financ. Anal.* **2018**, *56*, 153–166. [CrossRef]
59. Brown, S.J.; Warner, J.B. Using daily stock returns: The case of event studies. *J. Financ. Econ.* **1985**, *14*, 3–31. [CrossRef]