

Article

ESG as a Booster for Logistics Stock Returns—Evidence from the US Stock Market

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Abstract: This article investigates the connection between US logistics companies' commitment to environmental, social and fair governance (ESG) strategy and their performance on the US stock market during the 2007–2022 period. The research considers historical data analysis, CAPM and a comparison of optimised portfolios. According to the results of the analyses, 'green' logistics stocks are less volatile, and hence less risky, and more profitable compared to 'non-green' logistics stocks. The Great Recession (2007–2009) and the COVID-19 pandemic (2020) had the greatest impact on stock volatility, in terms of the US stock market. Optimised during the time of the Ukrainian crisis, green logistics portfolios were shown to have higher returns, but also risks and Sharpe ratios, than 'non-green' ones. The results confirm there to be a connection between companies' commitment to ESG strategy and enhanced stock performance, which contributes to the importance of the ESG agenda.

Keywords: ESG risk; green logistics stocks; investment portfolio; CAPM; Sharpe ratio



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1. Introduction

Current global challenges have been affecting businesses and their global operations significantly. In terms of business valuation, companies' owners and investors can no longer rely solely on financial value. Considering that a greater emphasis is being placed on sustainability issues by numerous communities around the world, the value of a business is now seen as a combination of its financial value and its societal and environmental impact. In this way, it seems reasonable to assume that the extent to which a company is engaged in green operations is closely linked to its reputation. It is thus likely to be true that 'green' companies are seen as more attractive to investors that value the environment and take long-term positions. Hence, it should also be observed that sustainability factors can cause stock price differences between green and non-green logistics companies, and commitment to one of these approaches is shown by the environmental, social and fair governance (ESG) performance of the company.

As the global economy is integrating countries globally, and the paradigm is shifting from manufacturing to assembling, the importance of logistics is under the spotlight. As documented by the IEA in 2019, a quarter of the total CO₂ emissions come from road transport, and the rate of emissions is predicted to increase. According to the International Transport Forum (2019), the demand for freight transport will have tripled by 2050. Thus, the 'greening' of logistics systems is required, and making transport operations more environmentally friendly is becoming a crucial goal of the transport industry in its attempt to prevent climate change and reduce air pollution.

In this study, we take a closer look at green and non-green logistics companies operating in the US that are listed on the US stock market. The paper considers logistics and transportation companies, since sustainability issues are significant to these industries.

2. Literature Review

This paper addresses the sustainable transformation of companies and patterns of their performance in the market, and particularly on the stock market. A combination of environmental, societal and financial value generated by green companies has been mentioned in numerous previous studies (Serafeim and Amel-Zadeh, 2018) [1].

During operational activities, companies have a social obligation towards the surrounding environment, in what is now better known as ESG. Greater investor appetite and long-term perspectives for green companies have been addressed by Dimeson et al. (2012) [2] and Escrig-Olmedo et al. (2019) [3]. Moreover, in support of the mentioned studies, Flammer (2019) [4] and Guenster et al. (2011) [5] indicated that greater investor appetite for such companies' stocks might lead to boosting their overall value and higher regard from the viewpoint of stock markets. Another document in support of sustainable investing was presented by BlackRock in 2018 [6]. It delivered results derived from a globally representative set of three sustainable indices whose performance was analysed against non-sustainable benchmarks back to 2015. According to the document, companies with ESG profiles are less prone to decreasing future stock prices. This implication is valid across sectors. Another implication suggests that the implementation of ESG practices is conducive to operational performance. Thus, firm value is higher for sustainable companies, as is the efficiency of equity and asset management. Based on an 18-year analysis of numerous US companies, Eccles et al. (2014) [7] concluded that highly sustainable firms outperform on the stock market their competitors with lower ESG ratings. The abnormal returns were 4.8% higher for the former, which was a statistically significant result. Accounting performance was also shown to be higher for sustainable companies. However, the inverse relation was found by Landi and Sciarelli (2018) [8]. Based on the fixed effect model developed by the authors, ambiguous results were derived, although the model indicated investors and managers' growing interest in corporate responsibility in Italy. Studies such as those by Buchanan et al. (2018), Cao et al. (2019), Gillan et al. (2018) and Hu et al. (2021) confirmed that, due to the spread of the concept among different market participants, the quality of CSR assessment has increased [8–12]. In the meantime, the results of Landi and Sciarelli (2018) also suggest that by applying ESG criteria to their stocks, companies will not enjoy abnormal returns, which indicates a negative relationship between ESG implementation and market premium on the stock market [8].

Moreover, Zhou and Zhou (2022) highlighted that a company's good ESG performance can serve as a hedge during a crisis (they observed this during the COVID-19 pandemic) [13]. The study considered the MSCI index in the Bloomberg database to measure environmental and social performance based on the corporate governance of A-share listed companies. The results indicated excellent ESG performance of single listed companies reduced stock price volatility during the COVID-19 crisis and stabilised their stock price. In contrast to companies with poor ESG performance, different methods have shown that those with excellent performance have had lower volatility and more stable stock prices during the economic recession caused by the COVID-19 pandemic. However, the study of Engelhardt et al. (2021) [14] concluded from a sample of publicly listed firms from 16 European countries that their ESG score showed a negative but insignificant effect on stock return volatility during the COVID-19 crisis. Xiong (2021) [15] and La Torre et al. (2020) [16] found green stocks with low ESG risk to have higher returns and less volatility during the COVID-19 crisis than those with high ESG risk ratings. Additionally, the study of Albuquerque et al. (2020) used the differential difference method to measure the mitigation effect of ESG input on corporate downside risk during the COVID-19 crisis and concluded that the downside risk for companies with excellent ESG performance is significantly lower than that for companies with poor ESG performance [17]. Ouchen (2021) confirmed the MSCI USA ESG Select portfolio to be less turbulent during a crisis than the S&P 500 benchmark index [18].

As for studying ESG portfolio performance in terms of increasing the return, Chelawat and Trivedi (2015) examined the performance of ESG investment in an emerging economy

(India). They found, using the capital asset pricing model and Brown–Forsythe and Levene’s tests, that the ESG India Index outperformed the conventional index, even in the short time since its inception, and hence ESG investing enhances investment returns without any significant difference in risk [19]. However, Zehir and Aybars’s (2020) observation of the European and Turkish markets concluded, from results obtained from CAPM regression, that the ESG-based scores for two portfolios underperformed the market indices. This means that there was no relationship between ESG score and portfolio performance [20]. At the same time, the research of Kumar et al. (2016) compared an ESG portfolio (Dow Jones Sustainability Index) with a non-ESG one on the US stock market and found that companies that have incorporated ESG factors show lower volatility in their stock performances than their peers in the same industry, that each industry is affected differently by ESG factors and that ESG companies generate higher returns [21]. Table 1 depicts the main contributions of empirical studies on the topic alongside the data they contain and their dependent variable (y), ESG factor and the results of research.

Table 1. Literature review.

Authors	Sample	y	ESG Factor	Results
Zhou and Zhou (2022) [13]	MSCI index disclosed in the Bloomberg database from 1 December 2019 to 31 March 2020.	Stock prices	ESG by MSCI ESG rating	A company’s good ESG performance can serve as a hedge during crisis.
Engelhardt et al. (2021) [14]	1452 publicly listed firms from 16 European countries from 3 February 2020 to 23 March 2020	Cumulative abnormal stock return	ESG by Refinitiv’s ESG rating	Negative but insignificant effect of ESG score on stock return volatility during the COVID-19 crisis.
Xiong (2021) [15]	US stocks from September 2009 to November 2020	Log stock returns	Sustainalytics’s ESG risk	Greenstocks with low ESG risk had higher returns and less volatility during the COVID-19 crisis than stocks with high ESG risk rating. Green funds and ETFs that hold green stocks have attracted significantly more fund flows than their counterparts.
La Torre et al. (2020) [16]	46 companies of the Eurostoxx50 index from May 2010 to December 2018	Stock returns	ESG Overall index data by CSRHub	Greenstocks are less volatile during crises.
Ouchen (2022) [18]	MSCI USA ESG Select portfolio from 1 June 2005 to 31 December 2020	Log stock returns	ESG by MSCI ESG rating	An ESG portfolio is relatively less turbulent compared with the market.
Chelawat and Trivedi (2015) [19]	ESG India Index	Stock returns	ESG by India Index rating	ESG investing enhances investment returns without any significant difference in risk.
Zehir and Aybars (2020) [20]	Stocks located in Europe and Turkey from 2004 to 2018	Excess return of portfolio	ESG by Refinitiv’s ESG rating	No relationship between ESG score and portfolio stock performance.
Kumar et al. (2016) [21]	157 companies listed in the Dow Jones Sustainability Index and 809 that were not over a 2-year period	Log stock returns	ESG by Dow Jones’s ESG rating	ESG companies generate higher returns.
Broadstock et al. (2021) [22]	China’s CSI300 constituents from 1 July 2015 to 31 March 2020	Stock returns	ESG by SynTao Green Finance	High-ESG portfolios generally outperform low-ESG ones. ESG performance mitigates financial risk during a financial crisis.

Table 1. Cont.

Authors	Sample	y	ESG Factor	Results
Shakil (2020) [23]	44 textile and apparel firms from Refinitiv between 2010 and 2018	Stock price volatility	ESG by Refinitiv's ESG rating	Higher ESG performance significantly reduces stock price volatility for textile and apparel firms. Firm size portrays a non-significant moderating effect on the ESG stock price volatility nexus.
Sabbaghi (2020) [24]	The MSCI USA ESG Leaders Index over a 1-year period	Log stock returns	ESG by MSCI ESG rating	The impact of news on the volatility of ESG firms is larger for bad news compared with good news. Green stocks with a lower ESG risk rating significantly outperform brown stocks with a higher ESG risk rating.
James (2021) [15]	US stocks from September 2009 to November 2020.	Stock returns	Sustainalytics's ESG risk	Higher ESG scores did not lead to superior returns or smaller losses during the pandemic. ESG scores were negatively associated with returns during the COVID-19 recovery period in Q2 of 2020.
Demers et al. (2020) [25]	1652 firms during the COVID-19 crisis (January to June 2020)	Abnormal stock returns	ESG by MSCI ESG rating	A one standard deviation decrease in ESG scores is associated with an increase of 13 basis points in monthly expected returns.
Ciciretti et al. (2019) [26]	From 1359 firms in 2004 to 5219 in 2017, covering North America, Europe, Japan, Asia Pacific ex. Japan, South America and Africa.	Average monthly excess return of portfolio	ESG by Refinitiv's ESG rating; ESG scores from the VIGEO-EIRIS dataset	Lack of a significant relationship between ESG rating and stock return.
Evans and Peiris (2010) [27]	The Domini 400 Social Index (DSI) over the period 2005–2010	Excess monthly stock return	ESG by DSI	

From the results of the previous empirical studies, we can suppose the following hypothesis:

A green logistics portfolio will have better performance on the stock market than a non-green one.

In other words, a green portfolio is more effective, in terms of obtained return by a green group of stocks allocated with the optimised weights in the portfolio, than a non-green portfolio.

3. Materials and Methods

3.1. Initial Data Collection

The current article investigates stock returns and fluctuations among logistics companies using data from Wharton Research Data Services [28] and Yahoo! Finance [29]. It considers the daily historical stock data for 32 logistics companies operating in the US and listed on the US stock market. The US stock market was chosen as the most appropriate market for statistical analysis as it provides the greatest number of green logistics companies to compare with non-green ones on the same market. The data cover the period from 1 January 2007 to 4 April 2022. The companies are divided into two groups by their overall ESG risk score for February 2022. The first group comprises companies with ESG scores lower than 25 and exposure level is 'low'; these are called the green companies. ESG risk was obtained by Wharton Research Data Services from the Sustainalytics database. The overall ESG risk is a news-based factor that is calculated as the sum of environmental, social and corporate governance risks by Sustainalytics. Environmental risk calculates the risk arising from factors primarily attributable to environmental issues. Social risk calculates the risk arising from factors primarily attributable to a company's relations with its employees, for example in terms of salaries, education, workplace diversity policy and

inclusion, as well as its relations with customers. Governance risk calculates the risk arising from factors primarily attributed to a company's management policy, such as its laws, rules and regulations.

The second group consists of companies with an overall ESG risk score higher than 25 points, which are referred to as non-green companies. The companies are presented in Table 2.

Table 2. Logistics companies.

Nº	Company Name	Ticker	ESG Risk	Exposure
Green companies				
1	J.B. Hunt Transport	JBHT	14.3	Low
2	Expeditors International	EXPD	16.3	Low
3	Ryder System	R	16.4	Low
4	ArcBest	ARCB	17.8	Low
5	Werner Enterprises Inc.	WERN	18.3	Low
6	Saia Inc.	SAIA	18.5	Low
7	Avis Budget Group Inc.	CAR	18.6	Low
8	Marten Transport Ltd.	MRTN	19.3	Low
9	Knight-Swift Transportation Holdings Inc.	KNX	19.3	Low
10	United Parcel Service	UPS	19.5	Low
11	Old Dominion Freight Line	ODFL	19.5	Low
12	XPO Logistics	XPO	19.6	Low
13	Heartland Express Inc.	HTLD	19.7	Low
14	C.H. Robinson Worldwide	CHRW	19.8	Low
15	Landstar System Inc.	LSTR	19.9	Low
16	FedEx	FDX	20.5	Low
Non-green companies				
1	Hub Group	HUBG	25.1	Medium
2	Union Pacific	UNP	25.2	Medium
3	Universal Logistics Holdings	ULH	25.8	Medium
4	Radiant Logistics Inc.	RLGT	25.9	Medium
5	Atlas Air Worldwide Holdings	AAWW	25.9	Medium
6	Golden Ocean Group Ltd.	GOGL	26.9	Medium
7	Eagle Bulk Shipping Inc.	EGLE	27.8	High
8	American Airlines	AAL	29.2	High
9	JetBlue Airways Corp.	JBLU	29.3	Medium
10	United Airlines Holdings Inc.	UAL	30.2	Medium
11	Hawaiian Holdings Inc.	HA	31.7	Medium
12	Southwest Airlines Company	LUV	32.4	Medium
13	Skywest Inc.	SKYW	36.9	Medium
14	Allegiant travel company	ALGT	37.3	Medium
15	AAR Corp	AIR	40.2	High
16	USA Truck	USAK	42.5	High

The research considers 16 green companies and 16 non-green companies to study the impact of the ESG strategy on their stock market performance. Such performance was evaluated using adjusted close price data from Yahoo! Finance and following calculations for the optimisation of the two investment portfolios.

3.2. Algorithm and Methodology

Based on the data and literature review, a research algorithm was developed (Figure 1).



Figure 1. Research algorithm.

The first stage of the research involves the data preparation. We first parsed the adjusted closing stock prices from Yahoo! Finance and divided them into two groups (green and non-green) based on the ESG data from Wharton Research Data Services. For further analysis, we calculated the annual returns (annual percentage rate and annual percentage yield) and the standard deviation of them. There were two annual returns calculated:

1. Effective rate, or annual percentage yield (APY);
2. Nominal rate, or annual percentage rate (APR).

APR does not consider inflation and compounding, whereas APY does, and it gives a higher value for the rate. The effective rate takes into consideration the compounding of the respective years and stands as a more accurate measure for the returns of investment instruments (Equation (1)).

$$R_{\text{effective}} = \left(1 + \frac{R_{\text{nominal}}}{N}\right)^N - 1, \quad (1)$$

where N is the number of trading days of the corresponding year.

The nominal rate is computed as in Equation (2):

$$R_{\text{nominal}} = \ln\left(\frac{P_N}{P_0}\right), \quad (2)$$

where P_0 is the stock price at the previous period and P_N is the current stock price.

Simple return shows correlations among investment instruments while only the stock price cannot indicate it. Log return, if compared with simple return, allows us to differentiate more clearly between how instruments are modelled in continuous time. The sum of the log differences can be interpreted as the total change (as a percentage) over the period summed (which is not a property of the other formulations, as they will overestimate growth).

The volatility or risk is evaluated as the annualised standard deviation of return, as in Equation (3):

$$\sigma = \sqrt{\sigma^2} = \sqrt{\frac{\sum_{i=1}^N (R_i - \bar{R}_I)^2}{N}} \sqrt{N}, \quad (3)$$

where R_i is the return of instrument i .

The second stage was to perform a comparison of green and non-green logistics stock returns and volatility. Here, we analysed historical data of log stock returns (APR), providing graphs with returns and their standard deviations over the research period and risk–return plots.

The third stage used CAPM modelling to compare the performance of the groups of stocks. The central insight of the CAPM is that in equilibrium, the riskiness of an asset is not measured by the standard deviation (σ) of its return but by its beta (β). In particular, the CAPM model (a linear model) supposes the existence of a linear relationship between the expected return of any instrument (or portfolio) and the expected return of the market portfolio.

Equation (4) shows the CAPM-based return-generating model (expanded CAPM or single index model).

$$E(r_p) - r_f = \alpha_p + \beta_p [E(r_m) - r_f] + \varepsilon, \quad (4)$$

where α_p is performance, the abnormal return for portfolio; β_p is the independent variable, representing the systematic risk of the portfolio, and ε is the unsystematic risk.

The adjusted close price on 4 April 2022 of 13-week treasury bills (‘IRX ticker’) is used as the risk-free instrument for the CAPM and equals to 0.5 dollars. The interpretations of alpha (α) and beta (β) are presented in Table 3.

Table 3. Interpretations of CAPM parameters.

Parameter	Explanation
α	$\alpha < 0$: investment in an asset is too risky for the return.
	$\alpha = 0$: investment in an asset earns adequate return for the risk taken.
	$\alpha > 0$: investment in an asset earns excess return for the risk taken.
	α should be greater 0 in order to ‘beat’ the market and earn excess return.
β	$\beta > 1$: investment in an asset is more volatile than the market.
	$0 < \beta < 1$: investment in an asset is less volatile than the market.
	$\beta = 0$: uncorrelated to the market.
	$\beta < 0$: negatively uncorrelated to the market;
	$\beta < 0$: instruments included in the portfolio are less volatile than the market.

We are not only interested in the expected return and risk of a collection of individual instruments, we also need to obtain some insights and information on the portfolio of stocks as a whole. We thus implemented the fourth stage of the research algorithm, which consists of a comparison of green and non-green logistics portfolios. For the portfolio optimisation, we used the Monte Carlo method (or simulation) to model the probability of different outcomes in a process that could not easily be predicted due to the intervention of random variables. It is a technique used to understand the impact of risk and uncertainty in prediction and forecasting models. For this study, it was used to conduct repeat random sampling of the input space to generate 10,000 probable portfolios, based on calculated risks and returns, for the two groups: green and non-green. The sum of assets’ shares was equal to 1. Expected return and risk of the portfolios are presented in the earlier formulas. For this article, a comparison of the two kinds of portfolio was provided in terms of minimum risk (standard deviation) and maximum efficiency (the Sharpe ratio). The Sharpe ratio (Equation (5)) is the ratio of the expected excess return of a portfolio to the portfolio’s volatility. Therefore, an optimal portfolio should maximise the Sharpe ratio.

A large Sharpe ratio indicates that an instrument's returns (APR) are large relative to its volatility (standard deviation).

$$SR = \frac{E(R_p) - R_f}{\sigma_p} \quad (5)$$

4. Results

4.1. Analysis of Historical Stock Data

First, we provided the descriptive statistics of the dataset, which consists of 32 logistics companies and the S&P 500 index's adjusted close prices from 1 January 2007 to 4 April 2022 (Table 4).

Table 4. Descriptive statistics.

Variable	Obs.	Mean	SD	Min.	Median	Max.
JBHT	3849	74.613	44.243	16.3	70.5	218
EXPD	3849	51.785	24.470	20.3	42.1	136
R	3849	48.692	16.739	13.3	46.8	89.9
ARCB	3849	30.313	17.227	6.02	26.9	122
WERN	3849	23.173	10.476	7.91	20.5	48.4
SAIA	3849	55.292	68.125	4.68	31.4	364
CAR	3849	35.864	40.044	0.36	28.7	357
MRTN	3849	7.925	4.338	2.35	6.45	19.8
KNX	3849	25.439	12.233	10.1	22.9	61.5
UPS	3849	83.324	43.042	26.1	79.2	230
ODFL	3849	66.814	79.052	5.53	40.1	364
XPO	3849	24.426	23.502	1.56	15.9	90.4
HTLD	3849	16.031	3.738	9.53	16.5	26.1
CHRW	3849	60.081	18.423	28.4	57	111
LSTR	3849	69.566	38.184	23.6	56.2	183
FDX	3849	137.291	64.463	30.6	128	312
HUBG	3849	40.243	12.303	15.8	38.3	86.8
UNP	3849	88.200	63.317	12.8	74.4	277
ULH	3849	16.791	5.020	7.68	15.7	34.3
RLGT	3849	3.127	2.216	0.06	3.07	8.64
AAWW	3849	48.025	14.437	9.05	48.1	95.8
GOGL	3849	23.386	19.206	1.89	18.8	71.3
EGLE	3849	34.116	66.178	8.91	27	310
AAL	3849	23.685	15.240	1.66	20.8	58.4
JBLU	3849	12.233	6.441	2.84	11.1	27
UAL	3849	42.912	23.764	3.13	41.6	96.7
HA	3849	17.978	14.090	2.17	13.2	58.1
LUV	3849	29.373	18.863	4.64	27.4	64.4
SKYW	3849	25.671	16.608	5.83	17.2	65.9
ALGT	3849	99.507	58.932	14.4	104	269
AIR	3849	26.828	9.660	9.37	25.2	51.8
USAK	3849	13.708	5.685	2.8	13.8	31.8
GSPC	3849	2096.341	956.135	677	1935	4797

In a preliminary analysis of the dataset, the historical data of companies' adjusted close prices was obtained to observe the collapses in stock prices, and log returns were calculated on the basis of the adjusted close prices. The graph of green companies' adjusted close prices is presented in Figure 2.

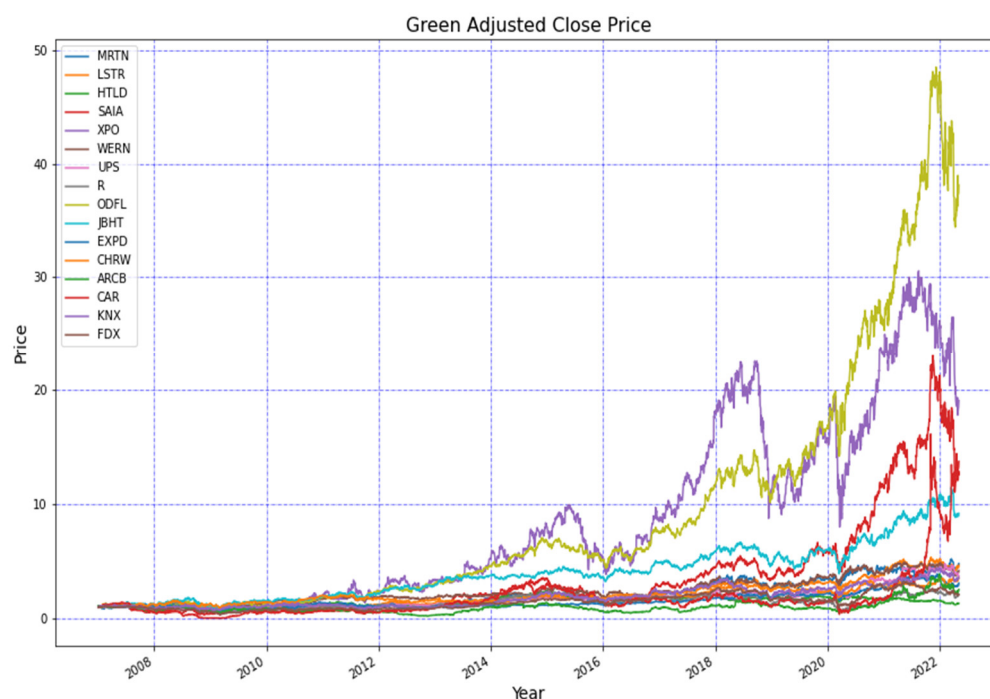


Figure 2. Adjusted close prices for green stocks.

From Figure 2, it can be seen that the stock prices of the green companies group show a general upward trend, although there are certain periods of stock price declines. In particular, the following shocks to the stock market can be highlighted:

1. 2009: The Great Recession, including the US recession that lasted from December 2007 to June 2009, and the ensuing global recession in 2009.
2. 2011: Black Monday, which refers to 8 August 2011, when US and global stock markets crashed because of a weakening US economy and a widening debt crisis in Europe.
3. 2015–2016: A global decline in the value of stock prices between June 2015 and June 2016 due to different negative signals across the world. These included the effects of the end of quantitative easing in the US in October 2014, slowing GDP growth in China, a fall in petroleum prices, the Greek debt default in June 2015, a sharp rise in bond yields in early 2016 and the UK–European Union membership referendum (Brexit) of the same year.
4. 2018: The shock to the stock market refers to some negative factors, such as President Donald Trump’s trade war with China, a slowdown in global economic growth and concern over missteps made by the Federal Reserve. Nevertheless, the general economy was doing well (with record low unemployment, strong GDP growth and relatively low inflation).
5. 2020: Stock market crash due to the COVID-19 pandemic.
6. 2022: Geopolitical shocks, including the Ukrainian crisis.

When the log return plot of green group is observed, it can be seen that the most volatile periods were the Great Recession and COVID-19 pandemic (Figure 3).

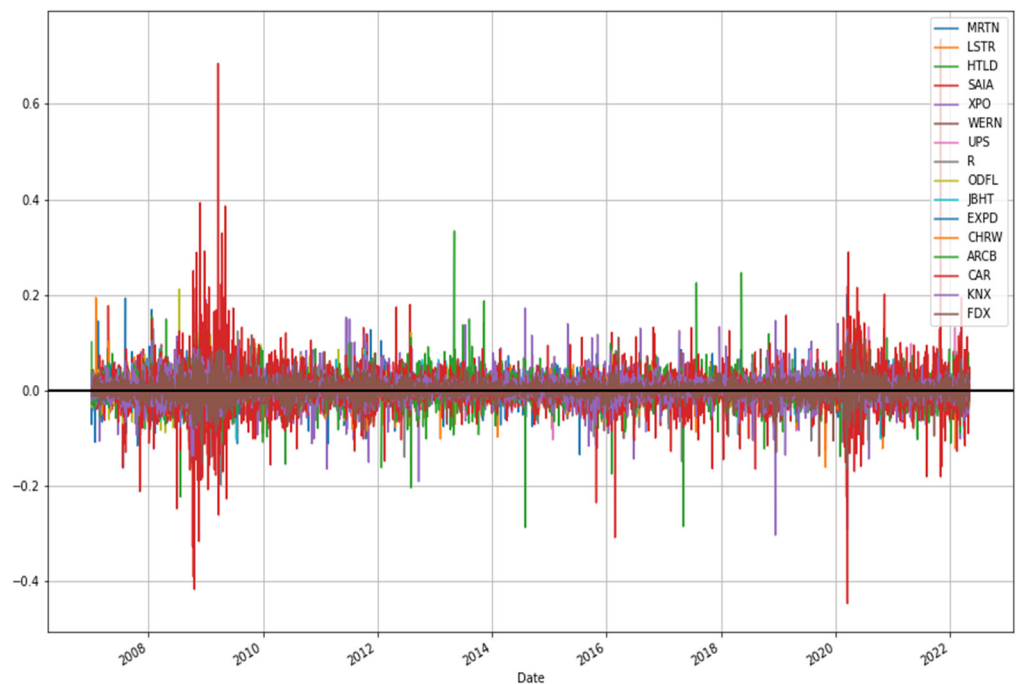


Figure 3. Log return plot for green stocks.

From Figure 4, which shows the adjusted close prices for the non-green group, it is clear that there is no general trend, and the companies' values are more heterogeneous than those of the green group. It is also notable that the maximal prices of the green group are higher than those of the non-green one.

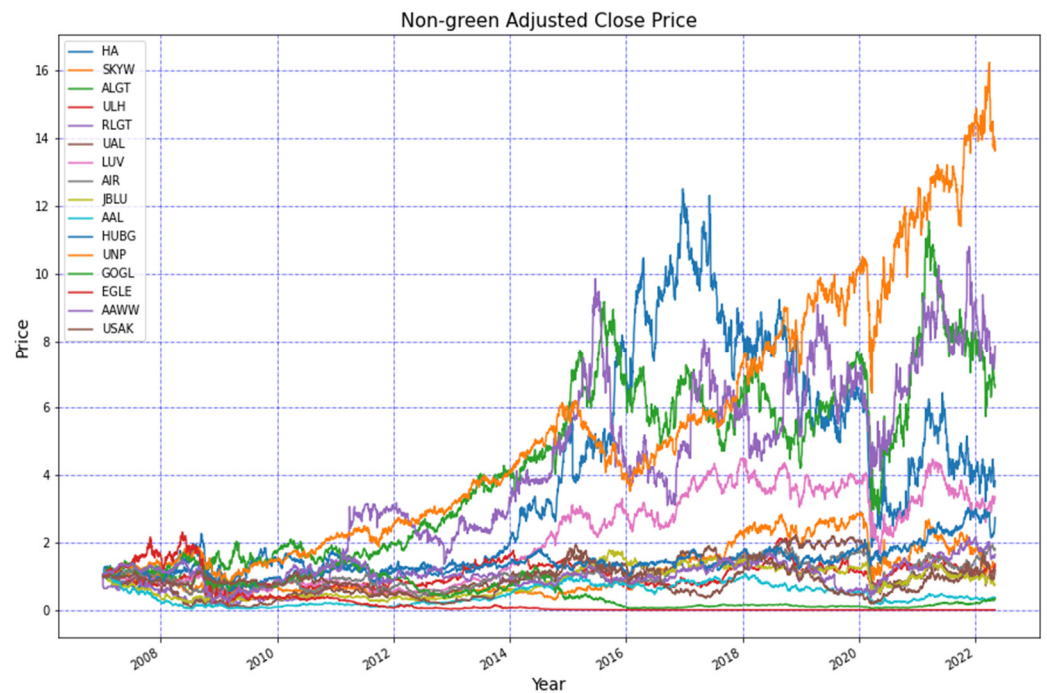


Figure 4. Adjusted close prices for non-green stocks.

As Figure 4 does not define a general time trend pattern, periods of stock price falls can hardly be seen, except for during the Great Recession and the period of the lockdowns due

to the COVID-19 pandemic. Therefore, a plot of log returns should be more representative (Figure 5).

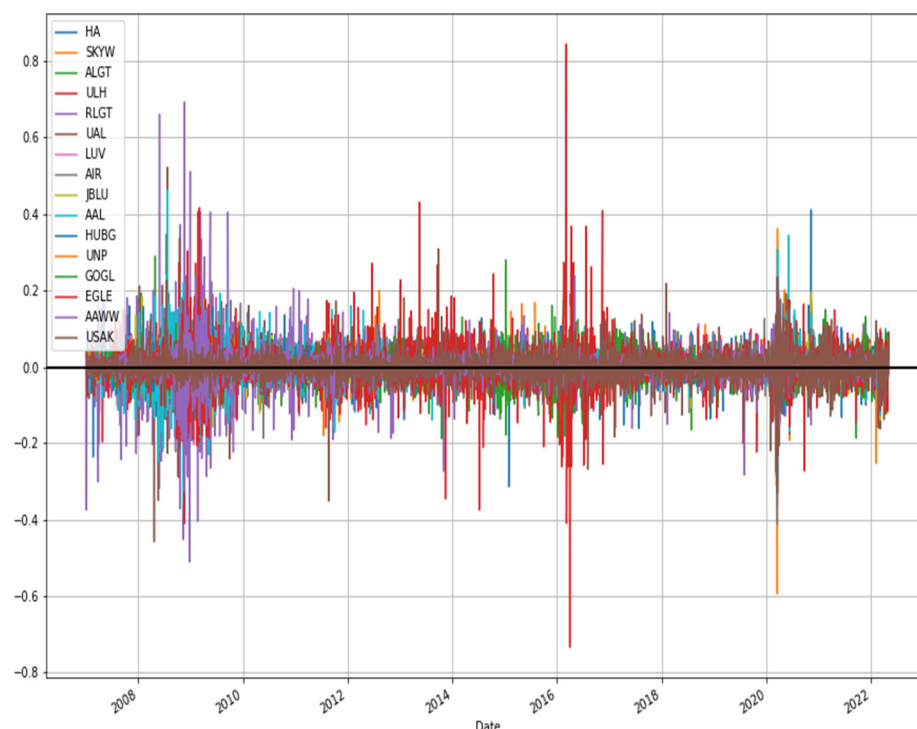


Figure 5. Log return plot for non-green stocks.

In general, it can be highlighted that values of non-green companies' log returns are more volatile, as can be seen from the graph of their stock prices (Figure 4). However, the peaks of log return volatility can be distinguished in Figure 5. These include:

1. 2008–2009: The Great Recession.
2. 2016: Global decline in the value of stock prices, as it affected green companies; the period when consequences of quantitative easing in the US appeared; the fall in petroleum prices; the Brexit referendum; etc.
3. 2020: Global recession due to the COVID-19 pandemic.

As a benchmark for the market, historical data from S&P 500 were analysed. Adjusted close stock prices of the S&P 500 are presented in Figure 6.

The S&P 500 can be seen to show an increasing trend generally from 2009, except for some falls that are the same as for the green companies' performance listed above.

The greatest volatility of the S&P 500 log returns is during the period of the Great Recession and at the beginning of COVID-19 pandemic (Figure 7).

Risk in finance is commonly described by computing standard deviation as a measure of dispersion. This basic mathematical concept that measures volatility in the stock market is calculated on the basis of log return values. It determines the level of risk associated with investment, so that the higher the standard deviation of the stock price, the higher the risk that the stock bears. In fact, after examining the graphs with stock prices and log return plots, the riskiest situations for the observed companies and their stock performance can be seen. However, computing the standard deviation values allows us to identify when the risk was the highest during the risky periods.

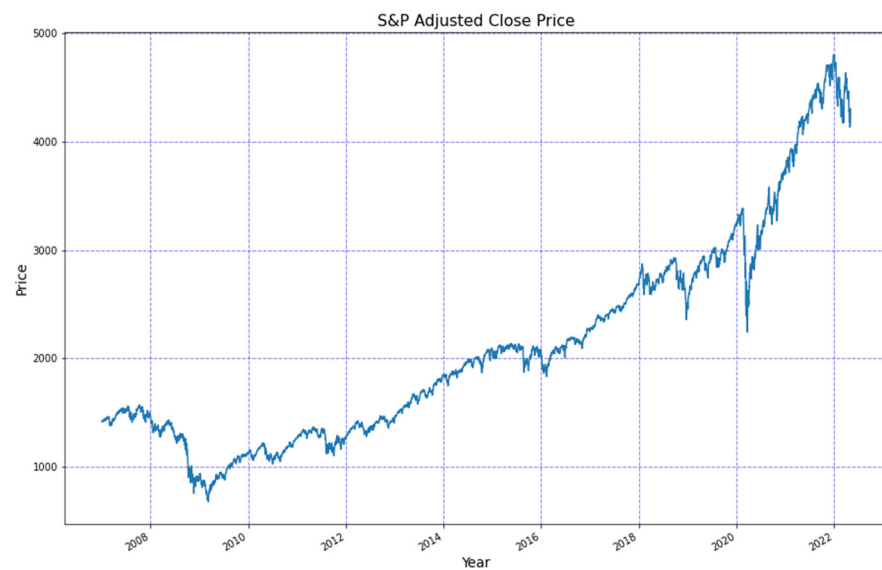


Figure 6. Adjusted close price of the S&P 500.

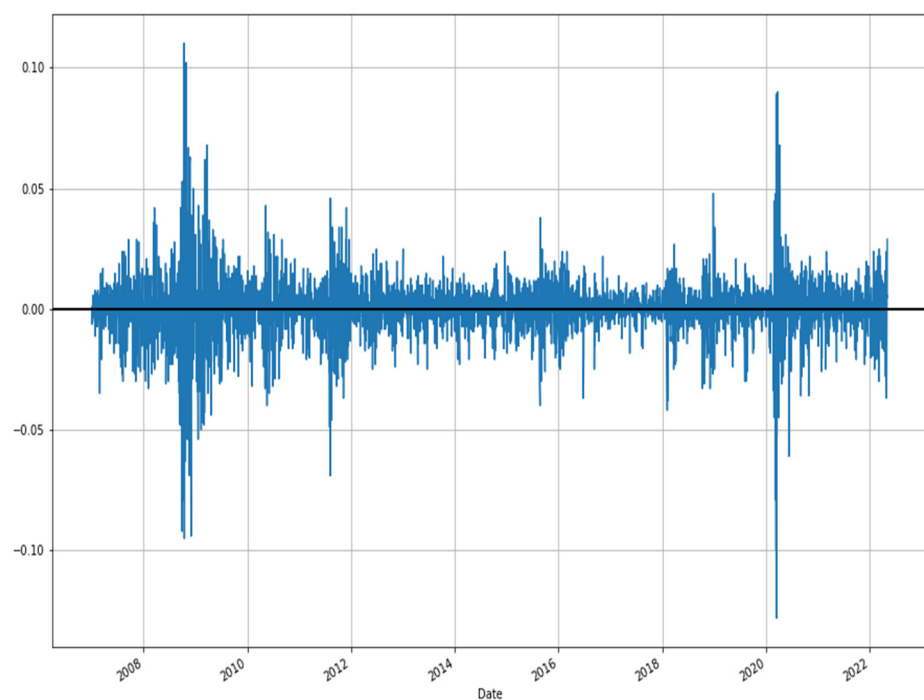


Figure 7. Log return plot of the S&P 500.

The historical data on the stocks' standard deviations are presented in Figures A1–A3. It can be seen that the highest peaks of standard deviation were in 2008 and 2020 (the Great Recession and the pandemic), but it can also be seen that all the considered companies were exposed to a general trend, as was explained in the return analysis above, and the highs of the standard deviations repeat information about the stock price falls and the volatility of the stock returns.

4.2. Analysis of Risk–Return Plots

We provide a risk–return plot that depicts stock risk on the x-axis and returns on the y-axis. Such scatterplots are used to explain portfolio selection from modern portfolio

theory by analysing the past performance of stocks. In our case, standard deviation was used as a measure of stock risk and APY (effective rate).

The first risk-versus-return plot is that for stocks in the green group (Figure 8).

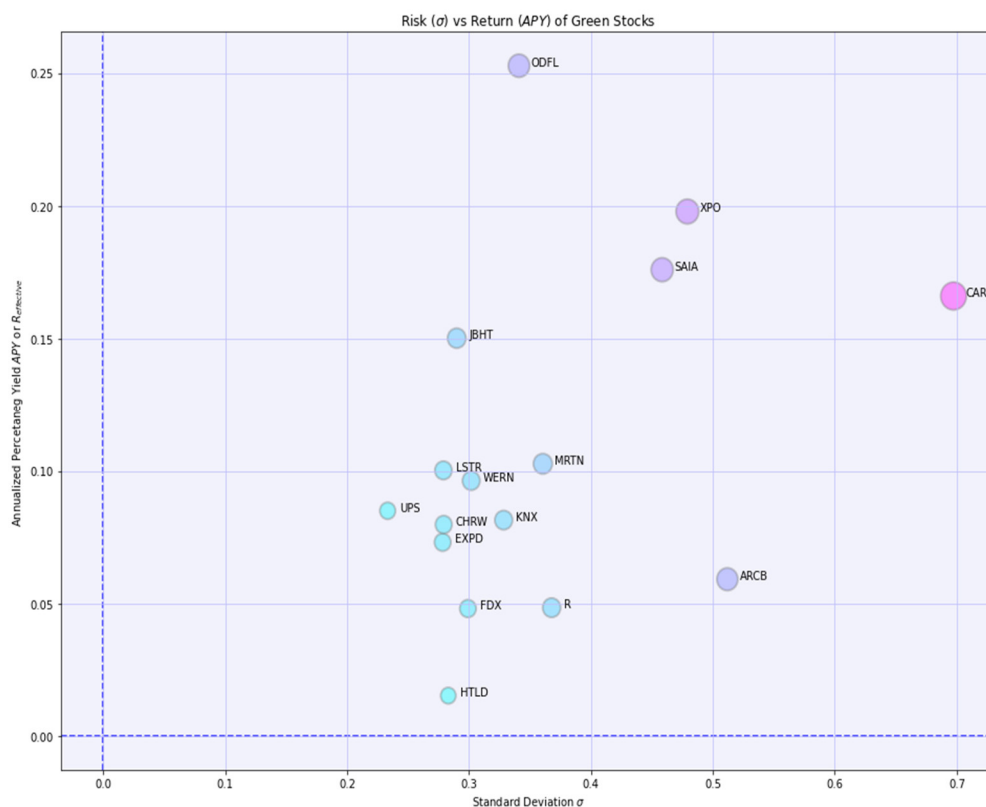


Figure 8. Risk vs. return of green stocks.

The green group stocks are shown mostly to have standard deviation equal to about 0.3 and APY of about 10%. Nevertheless, some stocks are riskier; for example, Avis Budget Group Inc. (CAR) has a standard deviation of 0.7 and an APY of 17%. Some stocks are more profitable and less risky, such as Old Dominion Freight Line (ODFL), with an APY of 25% and a standard deviation of 0.34.

On the other hand, Figure 9 shows the risk versus return plot of stocks in the non-green group. If the two scatterplots are compared with each other, it should be noted that the general performance of companies in the non-green group is worse. Although all the observed green group stocks have positive APY, four out of the 16 non-green group companies have negative APY; moreover, although most of the companies have positive values of APY, these are close to zero and with higher standard deviation (about 0.5), in comparison with green stocks (0.3).

As can be seen, the riskiest stock (average standard deviation 0.8) is Eagle Bulk Shipping Inc (EGLE), which also has the lowest stock APY (−38%). The second riskiest stock is Allegiant (ALGT), with standard deviation of 0.4 and an APY of −12%. Union Pacific company (UNP) shows both the least risky (average standard deviation 0.2) and the most profitable (APY 18%) performance in the stock market. Therefore, it can be reiterated that non-green companies do not create a general trend for the group.

A comparison with the USA stock market (results of S&P 500) shows the average standard deviation to be equal to 0.2 and the APY to be −7%. This confirms that the S&P 500 is not as risky as the groups of logistics companies, and hence not as profitable. Nevertheless, companies with a lower APY value have higher standard deviation, on average.

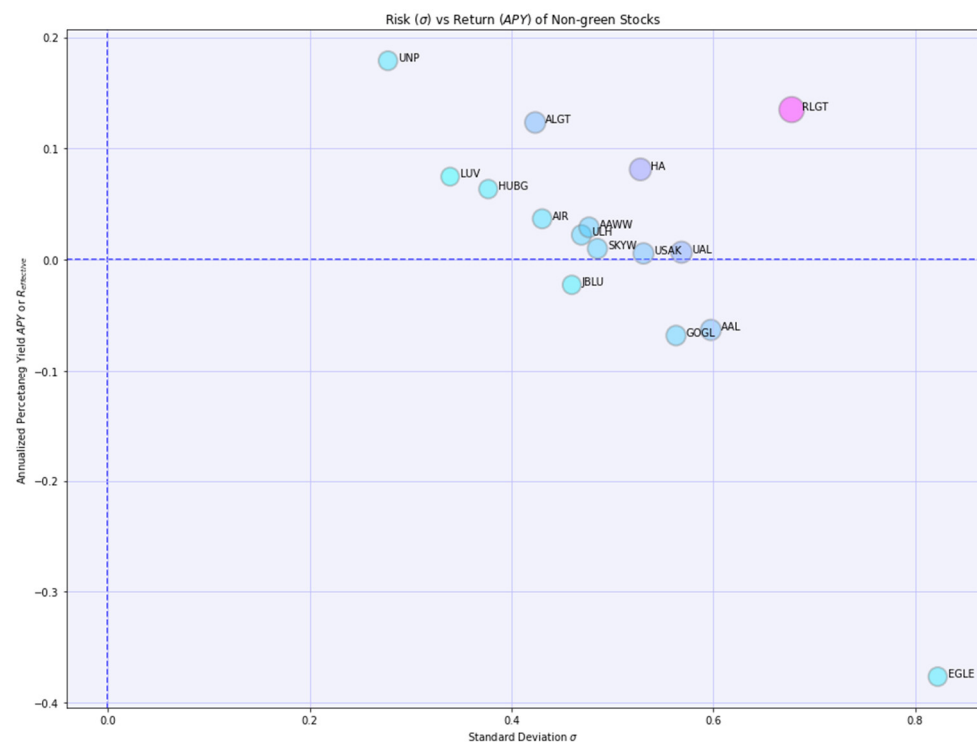


Figure 9. Risk vs. return for non-green stocks.

Therefore, from the risk–return analysis, the following findings can be drawn:

1. Periods with the highest volatility of green logistics stocks are similar to the whole US market (S&P 500 performance) and also for the non-green group of stocks. This means that we described the main US stock market shocks.
2. The green stocks are less volatile, and hence less risky, and more profitable when compared with the non-green stocks.
3. The green stocks showed exposure to general trends in the frame of the selected green logistics companies, in contrast with non-green stocks that are more disconnected within the group.
4. The logistics company groups are on average more profitable yet riskier than the S&P 500.
5. The Great Recession (2007–2009) and COVID-19 pandemic (2020) had the greatest impact, in terms of the US stock market, on stock volatility.

4.3. CAPM Analysis

CAPM, as has already been mentioned, is a set of metrics necessary for the financial analysis of stock performance. It considers the nexus between the expected return and the systematic risk of investing in an asset. The main idea of the model is that the higher the risk of investing in an asset, the higher the returns from it.

CAPM calculation begins by computing the pairwise correlation of stock log returns and S&P 500 log returns. This is required for the subsequent calculation of beta coefficients. The results of the coefficient of determination, or R-squared (the square of correlation), for stocks are presented in Table A1. The coefficient of determination shows the proportion of the variation in the S&P 500 log return that can be predicted from the stocks log returns.

For a comparison of the two groups of stocks in terms of obtaining abnormal returns (alpha's output), Figure 10 provides bar plots for non-green (top) and green (bottom) stocks, where each colour depicts a company's stock. When analysing the alpha values, attention should be paid to Table 3 for an interpretation of alpha and beta values.

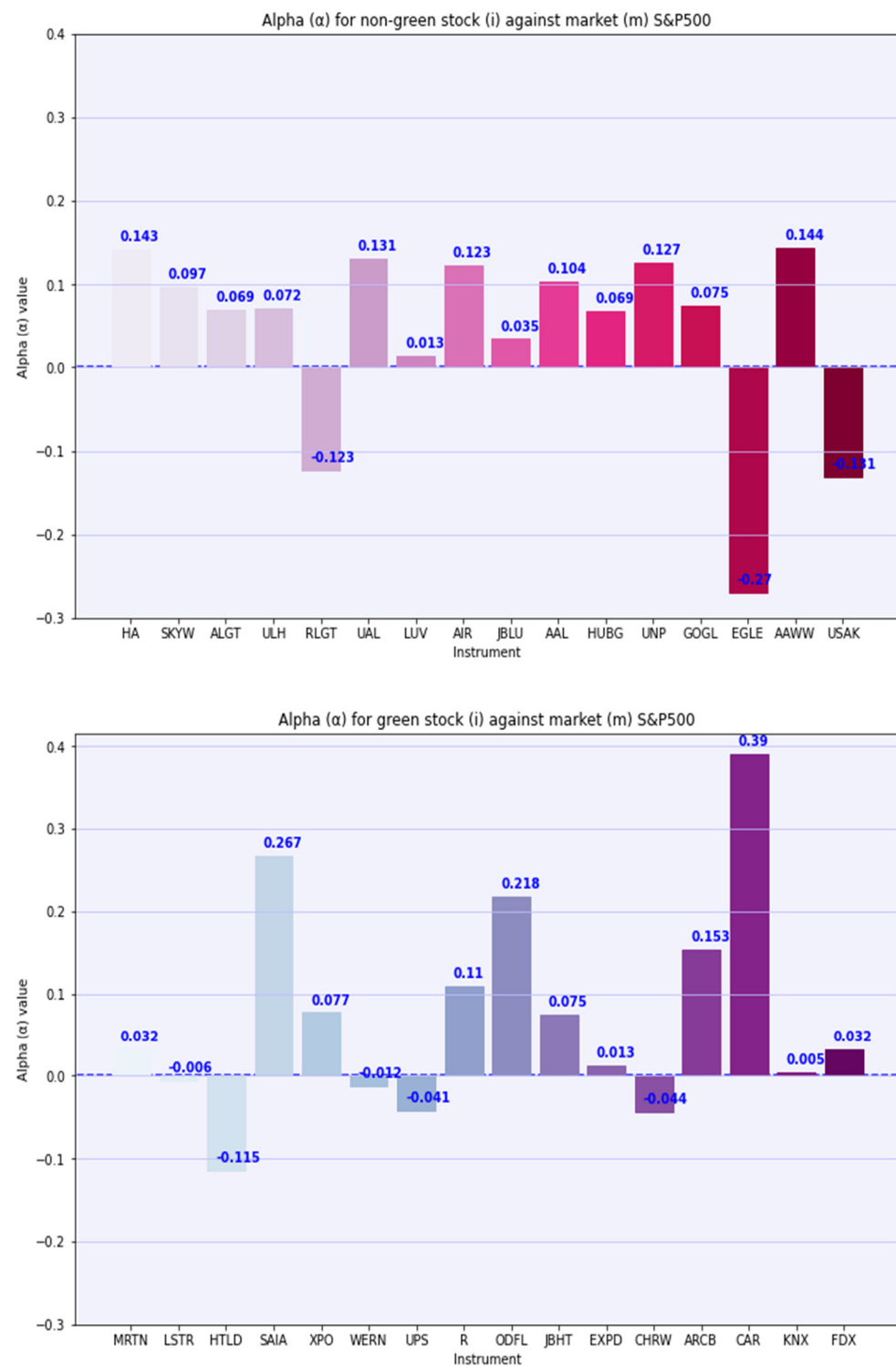


Figure 10. Alpha values of stocks.

As can be seen in Figure 10, there are stocks with negative and close to zero alpha in both groups. Three non-green stocks have negative alpha, with the lowest value equal to -0.27 ; EGLE shows the highest average risk and lowest average loss in return. Five green stocks have negative alpha, with Heartland Express Inc. (HTLD) having the lowest value (-0.115). It can also be highlighted that the negative alpha values of green stocks, with the exception of HTLD, do not exceed 0.1; rather, they are close to zero, in the range of -0.1 to 0.4 , which means that investment in such stocks will earn adequate return for the risk

taken. All non-green stocks with negative alpha exceed -0.1 , which is why investment in such non-green stocks is riskier for returns in comparison with green ones.

At the same time, non-green stocks with positive alpha have values that are around 0.1, with Atlas Air Worldwide Holdings (AAWW) and Hawaiian Holdings Inc. (HA) having the highest values (0.144 and 0.143, respectively). The green stocks with the highest values are CAR (0.39) and Saia Inc. (SAIA; 0.267). It should be noted that CAR also shows the greatest risk after EGLE, according to a comparison of the graphs with the risk versus return plots (Figures 7 and 8); however, CAR has one of the highest stock returns, while EGLE has the lowest one. The situation is understandable because a positive alpha indicates that stock investments earn excess returns for the risk taken, which is why CAR stock, with the second highest risk and the highest alpha, has one of the highest annual percentage yields, while EGLE, with the highest risk and the lowest alpha, has the lowest annual percentage yield.

Therefore, green stocks, on average, earn adequate return for the risk taken, while non-green stocks earn abnormal return for the risk taken, although there are also non-green stocks that are riskier than other logistics stocks. In comparison, there are green stocks that give the highest return for the risk taken, which may increase the attractiveness of investment in the group of green stocks.

Figure 11 shows a comparison of beta coefficients between the two groups, representing the systematic risk of the stocks. The top graph shows the non-green stocks, and the bottom shows the green stocks, with each colour depicting a company's stock.

From the top of the Figure 11, it can be seen that most of the stocks (14 out of 16 companies) have beta higher than 1, which means that these stocks are more volatile than the US stock market. The highest beta value is obtained by EGLE, and it is worth mentioning that this stock also has the highest alpha, making it the most volatile of the non-green stocks and the second highest out of all the observed logistics stocks.

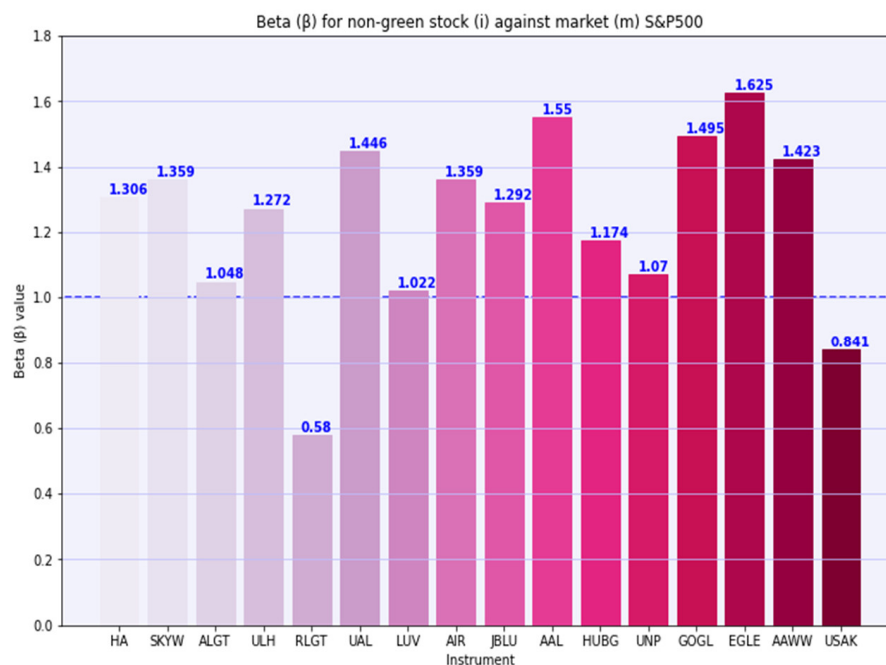


Figure 11. Cont.

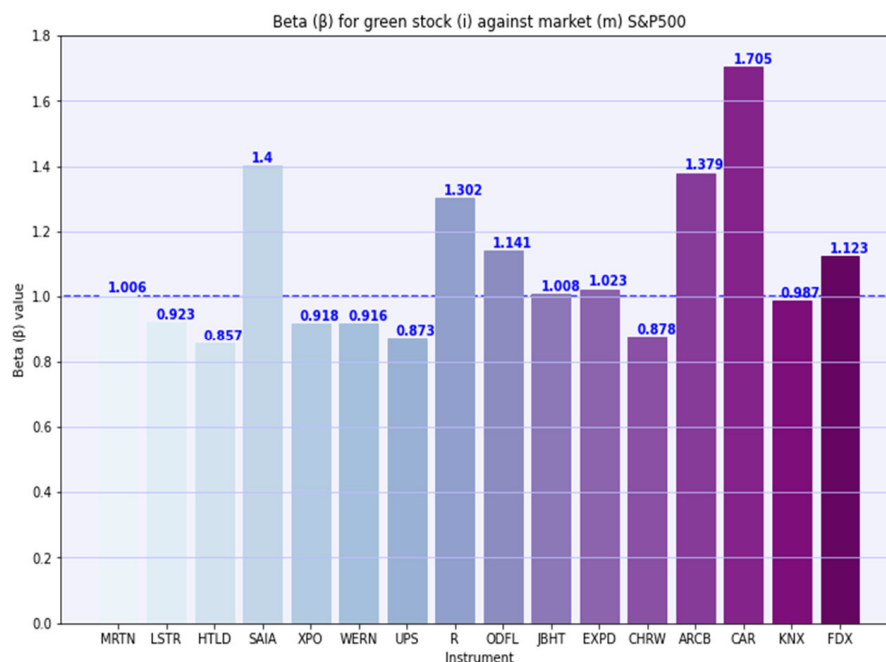


Figure 11. Beta values of stocks.

When considering the EGLE stock conditions, it should be explained that the stock is very volatile, according to beta value, and very risky, according to alpha value, which is why it has the lowest APY. In contrast, the two other non-green stocks here with negative alpha, Radiant Logistics Inc (RLGT) and USA Truck (USAK), have beta lower than 1 (0.58 and 0.841, respectively), which means that these stocks are less volatile than the stock market. However, the most volatile stock is the green stock CAR, with beta equal to 1.705. Nevertheless, it is one of the most profitable stocks, and it confirms the highest positive value of alpha (0.39). SAIA presents the second highest beta value (1.4) and alpha value (0.267) of the green group of stocks. It is also one of the most profitable stocks in the whole sample.

On the other hand, it can be mentioned that most green stocks have values of around 1, which is close to the overall stock market performance, and seven stocks do not exceed it.

To conclude the alpha and beta comparisons, it can be highlighted that the alpha and beta values mostly repeated each other's performances in terms of stock and performance on the stock market. In addition, graphic information about CAPM can be found for non-green stocks in Figure A4 and for green stocks in Figure A5 as plots of stock log returns versus S&P 500 log returns. These illustrate the beta of stocks as a slope of the regression line.

4.4. Portfolio Comparison

The last stage of the research is to compare the US logistics companies as two portfolios, the first consisting of only non-green stocks and the second comprising only green stocks.

So far, the research has not been concerned with the expected return and risk of a collection of individual stocks, but rather it has preferred insights and information on the portfolio of stocks as whole.

Therefore, 10,000 simulated portfolios were created consisting of non-green stocks with data points (portfolios) based on their Sharpe ratio performance (the higher they are, the denser the pink). The result of simulation for the non-green group is presented in Figure 12.

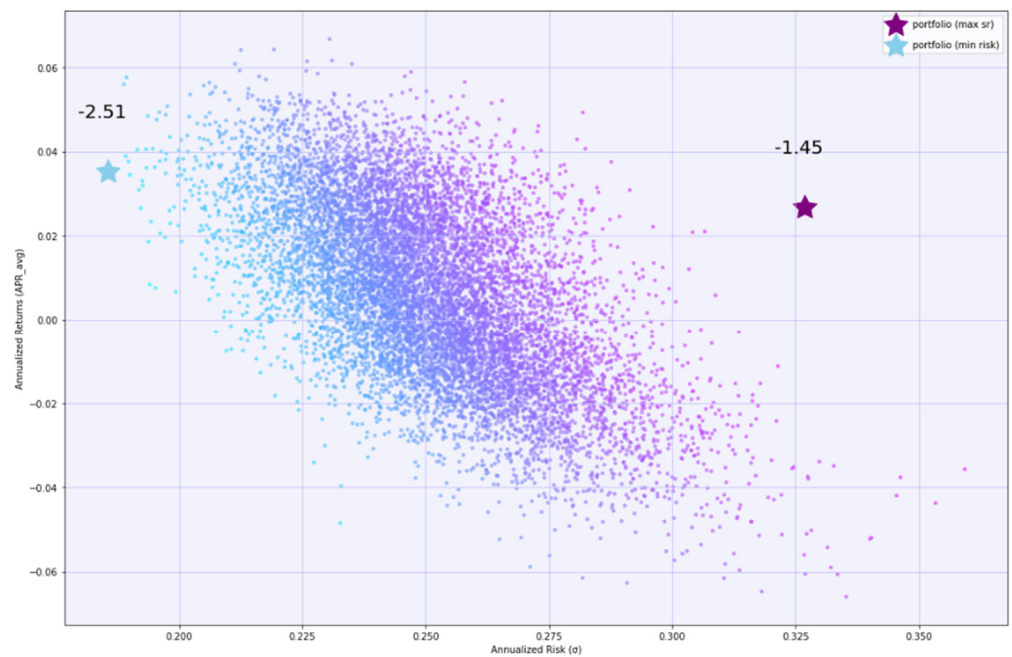


Figure 12. 10,000 simulated non-green portfolios.

It can be seen that in the portfolio with the least risk, the annualised return is 0.035, the annualised risk is 0.186 and the Sharpe ratio is -2.505 . In the portfolio with the maximum Sharpe ratio, the annualised return is 0.027, the annualised risk is 0.327 and the Sharpe ratio is -1.447 . Both portfolios have negative Sharpe ratios, meaning that the risk-free rate is greater than the portfolio's return. This is explained by the fact that the stock market is under pressure from crises and geopolitical shocks at the moment.

The same algorithm is applied to green stocks in Figure 13.

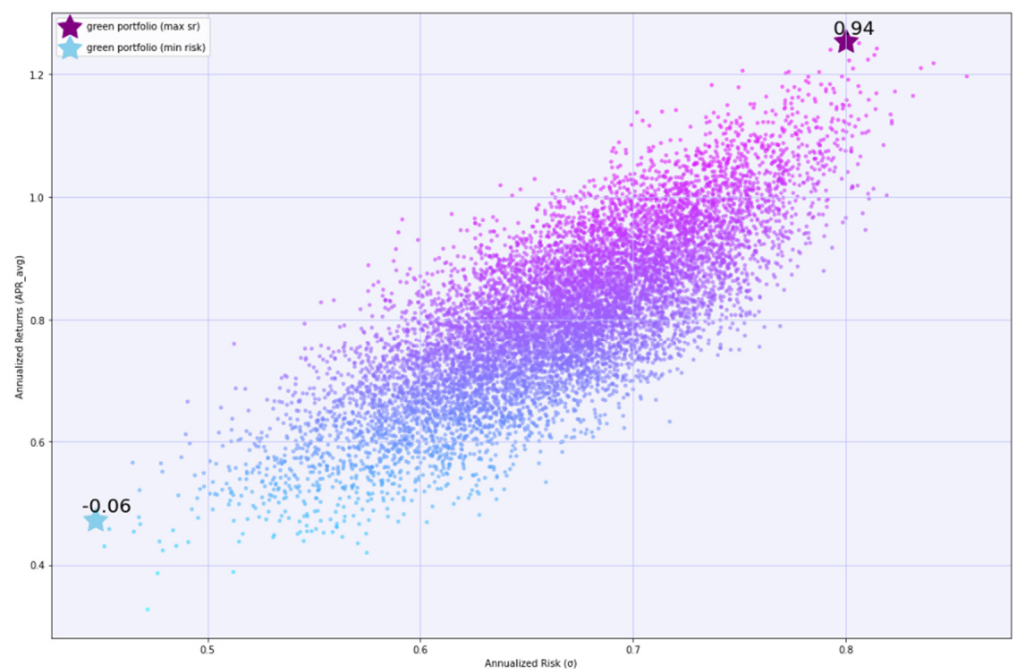


Figure 13. 10,000 simulated green portfolios.

It can be seen that in the portfolio with least risk, the annualised return is 0.473, the annualised risk is 0.447 and the Sharpe ratio is -0.061 . In the portfolio with the maximum Sharpe ratio, the annualised return is 1.253, the annualised risk is 0.800 and the Sharpe ratio is 0.941. In this case, a positive Sharpe ratio is obtained by the portfolio with maximum Sharpe ratio, while the portfolio with minimum risk has a negative Sharpe ratio value; however, it is close to zero, which is much smaller than for the non-green stocks.

Figure 14 provides a comparison of the non-green and green portfolios, revealing that the performance of the green portfolio is better overall. The weights of the stocks in the portfolios are depicted in Tables A2 and A3. Therefore, times of crisis give a negative Sharpe ratio of the markets and risk-free assets increase their value; in contrast, the Sharpe ratio becomes negative for risky assets.

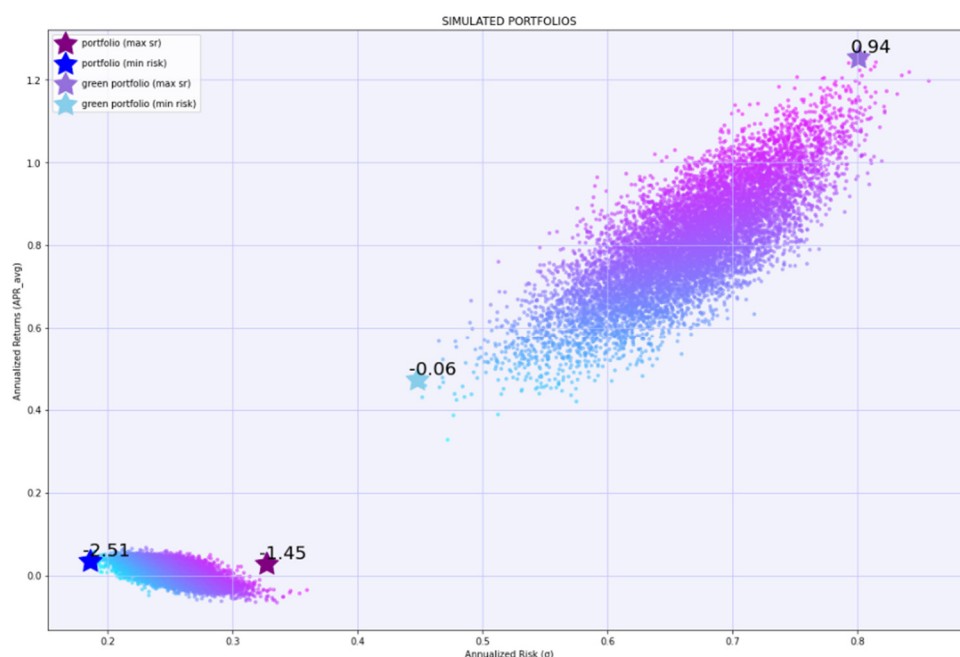


Figure 14. Simulated green and non-green portfolios.

It can be seen that the optimised green portfolio containing stocks of US logistics companies at the point of the maximum Sharpe ratio gives a positive ratio value (0.94), whereas the corresponding non-green portfolio returns a negative value (-1.45). In addition, the returns and risks for the green portfolio are higher than for the non-green one.

Such results are obtained even during crisis, with high volatility on the global markets, geopolitical shocks and various sanctions, such as the embargo on energy from Russia that directly exerts pressure on the logistics and transport industry. Consequently, it can be concluded that green companies are more resistant to market volatility during the crisis.

To test the statistical significance of the results obtained in the portfolio comparison, we conducted a two-sample t test with equal variances, a two-sample t test with unequal variances with using Welch's formula and a median test based on the returns, risks and Sharpe ratios of our 20,000 randomly generated portfolios (Table 5).

Table 5. Tests of the results.

Variable	Obs0.	Mean	Std0. Err0.	Std0. Dev0.	95% Conf0. Interval		Median
				Two-sample t test			Median test
return	10,000	0.006	0.000	0.021	0.005	0.006	0.006
green return	10,000	0.809	0.001	0.133	0.806	0.811	0.808
combined	20,000	00.407	0.003	0.412	0.402	0.413	
diff		−0.803	0.001		−0.805	−0.800	
Ha: diff != 0		Pr(T > t) = 0.0000					Pr = 0.000
risk	10,000	0.251	0.000	0.020	0.251	0.252	0.250
green risk	10,000	0.678	0.001	0.058	0.677	0.679	0.680
combined	20,000	0.465	0.002	0.218	0.462	0.468	
diff		−0.426	0.001		−0.428	−0.425	
Ha: diff != 0		Pr(T > t) = 0.0000					Pr = 0.000
Sharpe ratio	10,000	−10.974	0.001	0.129	−10.976	−10.971	−10.970
green Sharpe ratio	10,000	0.445	0.002	0.169	0.442	0.448	0.455
combined	20,000	−0.764	0.009	10.219	−0.781	−0.748	
diff		−20.419	0.002		−20.423	−20.415	
Ha: diff != 0		Pr(T > t) = 0.0000					Pr = 0.000

These tests help us to conclude that there is a difference between green and non-green indicators, and it is statistically significant. The two-sample t test confirmed the significant difference between green and non-green portfolios in terms of the mean values of their indicators, whereas the median test proved it in terms of median values. Therefore, we can conclude that the results of the portfolio comparison are valid, due to the significant difference between the green and non-green portfolios.

5. Discussion

As a result of the study, it can be concluded that the proposed hypothesis, based on a literature review of previous studies, is confirmed.

As suggested by the previous research of Chelawat and Trivedi (2015), ESG investing enhances investment returns without any significant difference in risk [19]. However, Zehir and Aybars (2020) provided a different point of view on the issue, finding there to be no relationship between ESG score and portfolio performance [20], while the research of Kumar et al. (2016) showed ESG portfolios to be less volatile in their stock performance and to generate higher returns than non-ESG ones [21].

In the current article, individual green logistics stocks were less volatile than non-green ones but more volatile than the market (S&P 500), according to the results of standard deviation values and an analysis of stock log returns, especially during periods of high volatility on the US stock market (crises, news shocks). Additionally, CAPM analysis indicated better performance of green logistics stocks in comparison with the US market (S&P 500) than non-green stocks. Analysis of alpha values showed that some non-green alphas had the lowest value, equal to −0.27 (EGLE, which had the highest average risk and lowest average loss in returns), −0.13 (USAK) and −0.12 (RLGT). Five green stocks had negative alphas, with HTLD having the lowest value (−0.115); nevertheless, with the exception of HTLD, green stocks did not exceed 0.1 and were close to zero, in the range of −0.1 to 0.4, meaning that investment in such stocks would earn adequate returns for the risk taken, leading to more investor confidence. All non-green stocks with negative alpha exceeded 0.1, which is why, in comparison with green stocks, investment in these is riskier for the returns.

With regard to other EGLE stock conditions, it should be explained that the stock is also very volatile, according to beta value, and very risky, according to alpha value, which is why it has the lowest APY, as is seen from the risk–return plot. In contrast, two other non-green stocks with negative alpha, RLGT and USAK, had beta lower than 1 (0.58 and 0.84, respectively), which means that the stocks are less volatile than the stock market. However,

the most volatile stock was CAR, a green stock with beta equal to 1.705. Nevertheless, it is one of the most profitable stocks, and it also had the highest positive alpha value (0.39). SAIA had the second highest beta value (1.4) out of the green group of stocks, as well as alpha (0.267). It is also one of the most profitable stocks out of the whole observed sample. On the other hand, most of the green stocks had beta values of around 1, which put them close to the overall stock market performance, and seven stocks did not exceed it, meaning that green logistics stocks are mostly less volatile than the market.

Hence, the overall performance of the green logistics portfolio was better. The optimised green portfolio with stocks of US logistics companies at the point of the maximum Sharpe ratio give a positive ratio value (0.94), whereas the corresponding non-green portfolio gave a negative Sharpe ratio (−1.45). The green portfolio with the minimum risk also gave a higher Sharpe ratio, which was negative but close to zero (−0.06), in contrast with the non-green portfolio, for which the ratio was equal to −2.51. In addition, the analysis showed that the returns and risks of the green portfolio were higher than those of the non-green portfolio. Therefore, it can be highlighted that, even in the current period of US economic recession, the green logistics portfolio showed a positive Sharpe ratio in contrast to the non-green one. However, moments of crisis usually give a negative Sharpe ratio for the markets, and in particular the US stock market (Nieto and Rubio, 2022), as risk-free assets increase in value, while for risky assets the ratio becomes negative [30].

6. Conclusions

In the current research, we have analysed the stock performance of several large logistics companies in the US and estimated their performance relative to the US stock market (using the S&P 500 as a benchmark) from an investor's point of view. Due to restricted access to the full database of logistics companies operating in the US, we have considered only the 32 largest companies listed on the US stock market. This means that the dataset does not capture the patterns of all companies in the logistics industry. However, given that the companies with the largest market shares have been considered, it is likely that the current paper mirrors the general picture of how logistics companies' commitment to ESG strategy can improve their stock performance on the market and increase their stock return.

We obtained CAPM and 20,000 simulated portfolios, which confirmed the hypothesis stated in the paper: that a green logistics portfolio will have a better performance on the stock market than non-green one, in terms of portfolio investment effectiveness.

We can also conclude the following. First, periods of the highest volatility, which were described for green group, are similar to the whole US market (S&P 500 performance) and non-green group of stocks. This means that we described the main US stock market shocks in the research period. Second, green logistics stocks are less volatile, and hence less risky, and more profitable when compared with non-green logistics stocks. Third, the logistics companies, divided into green and non-green groups, were on average more profitable and riskier than the S&P 500. Fourth, the Great Recession (2007–2009) and the COVID-19 pandemic (2020) had the greatest impact in terms of the US stock market on stock volatility. Fifth, the optimised green logistics portfolio, as of April of 2022, had higher returns, risks and Sharpe ratios than non-green one.

Our article supports previous studies and outlines that being labelled as a green company may be conducive to enhanced performance, from an investor's point of view.

Overall, the obtained results support several earlier articles concerning the relationship between a company's commitment to ESG policy and its stock performance. The novelty of our research lies in its confirmation of the hypothesis concerning better green logistics companies' stock performance on the US stock market. We also established additional result in terms of green companies' higher resilience to crisis (e.g., investment portfolio during the Ukrainian crisis).

The research has some limitations. We have only considered companies in the US transport and logistics sector, which reduces the heterogeneity of the data and eliminates

institutional differentiation. Additionally, we investigated companies with different firm sizes, since we were examining the general trend of green and non-green groups of logistics stocks. Future research may consider other indicators that can influence companies' stock performance (e.g., market value, net income, Tobin's Q, financial leverage) using panel data analysis. In addition, the resilience of green stocks to crises may be investigated by event study analysis.

Author Contributions: Conceptualisation, M.R. and A.S.; data curation, M.R.; formal analysis, M.R.; funding acquisition, T.K.; investigation, M.R.; methodology, A.S.; project administration, T.K.; software, M.R. and A.S.; supervision, T.K. and A.S.; validation, A.S.; writing—original draft, M.R.; writing—review & editing, A.S. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: Available upon request.

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

Appendix A

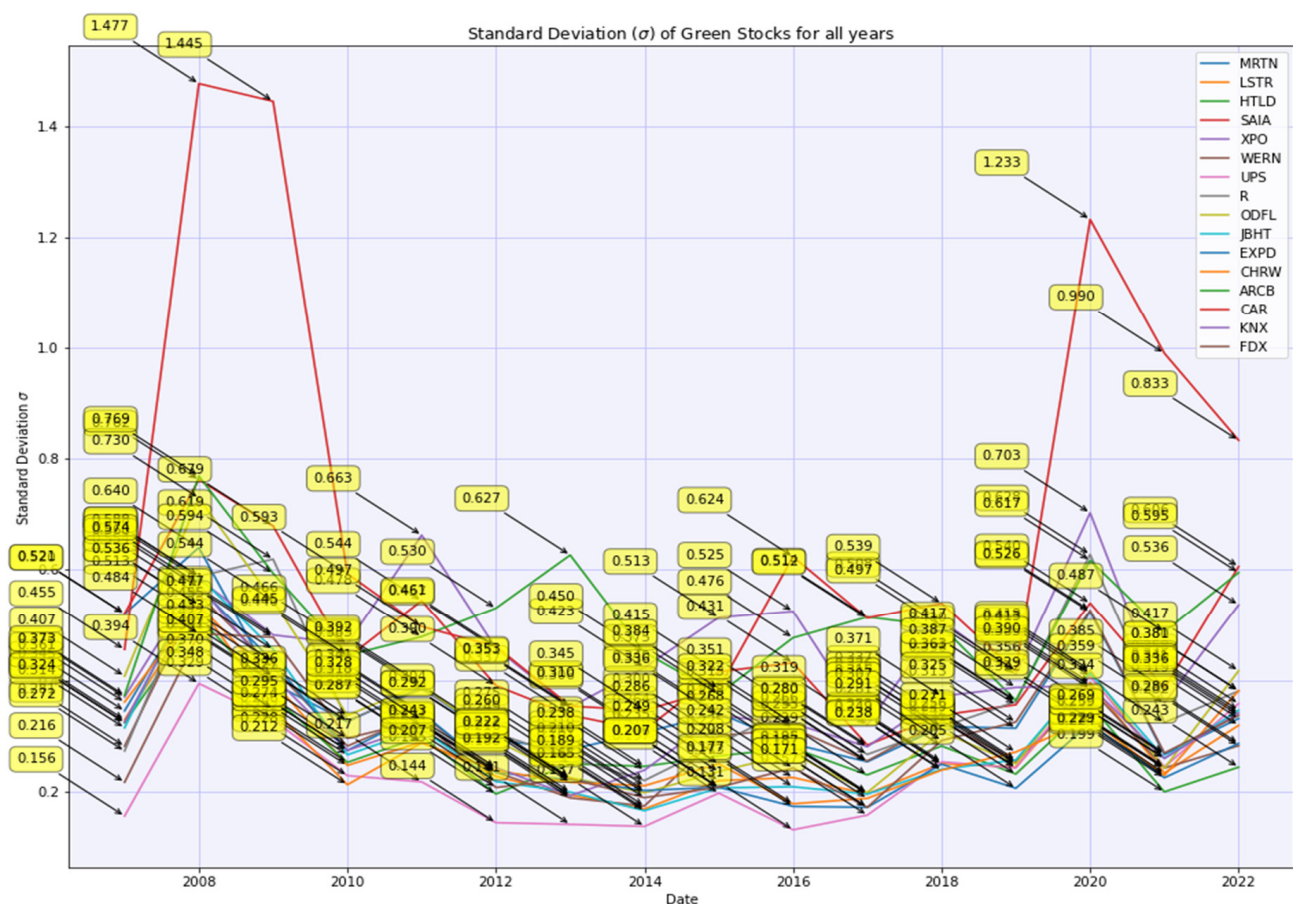


Figure A1. Standard deviation of green stocks.

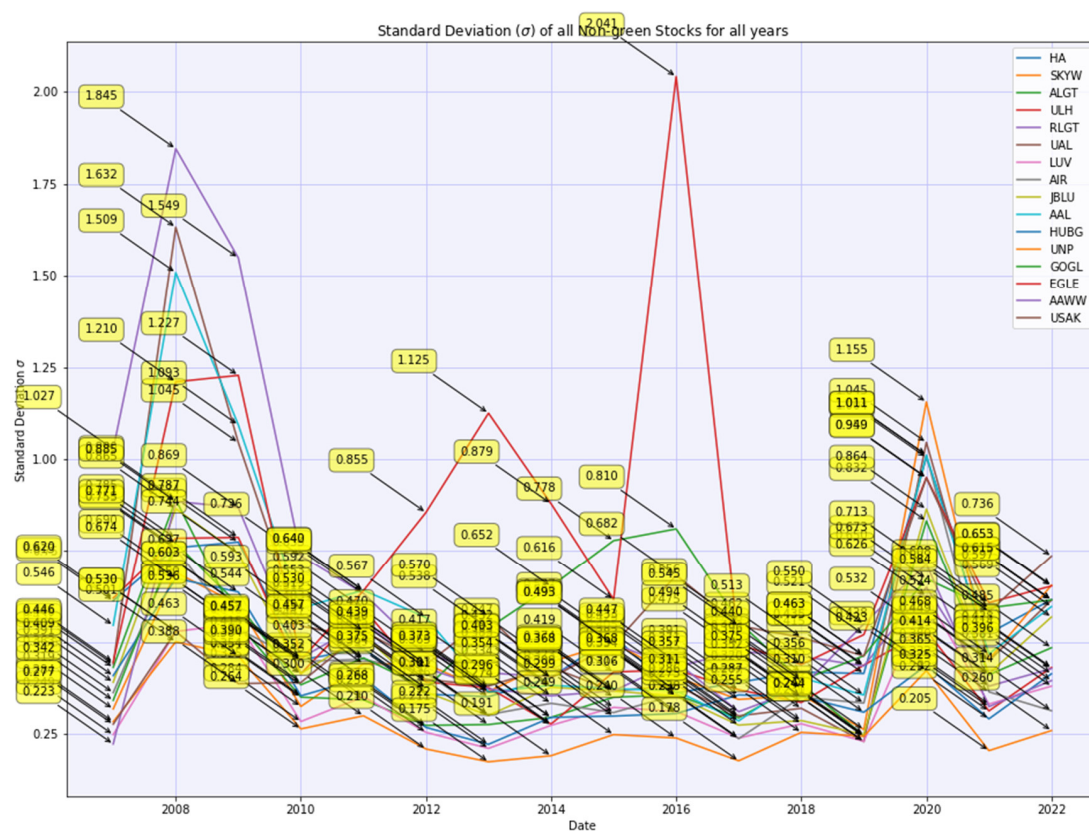


Figure A2. Standard deviation of non-green stocks.

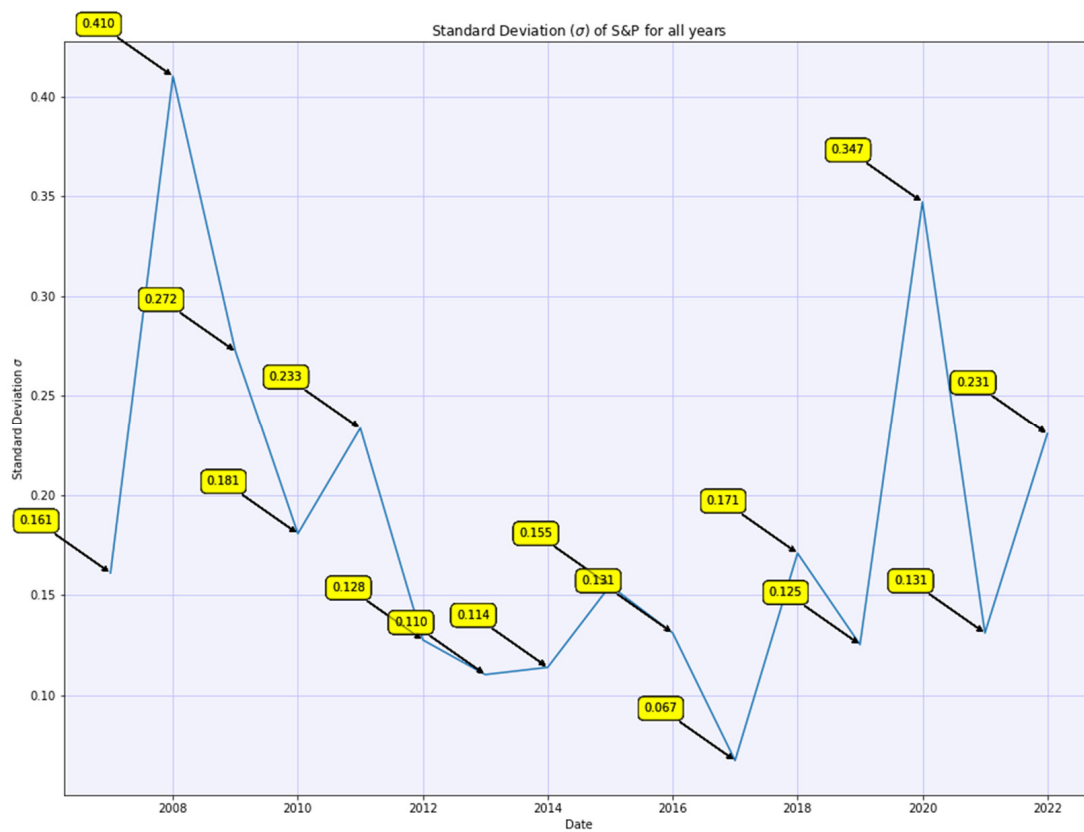


Figure A3. Standard deviation of S&P 500.

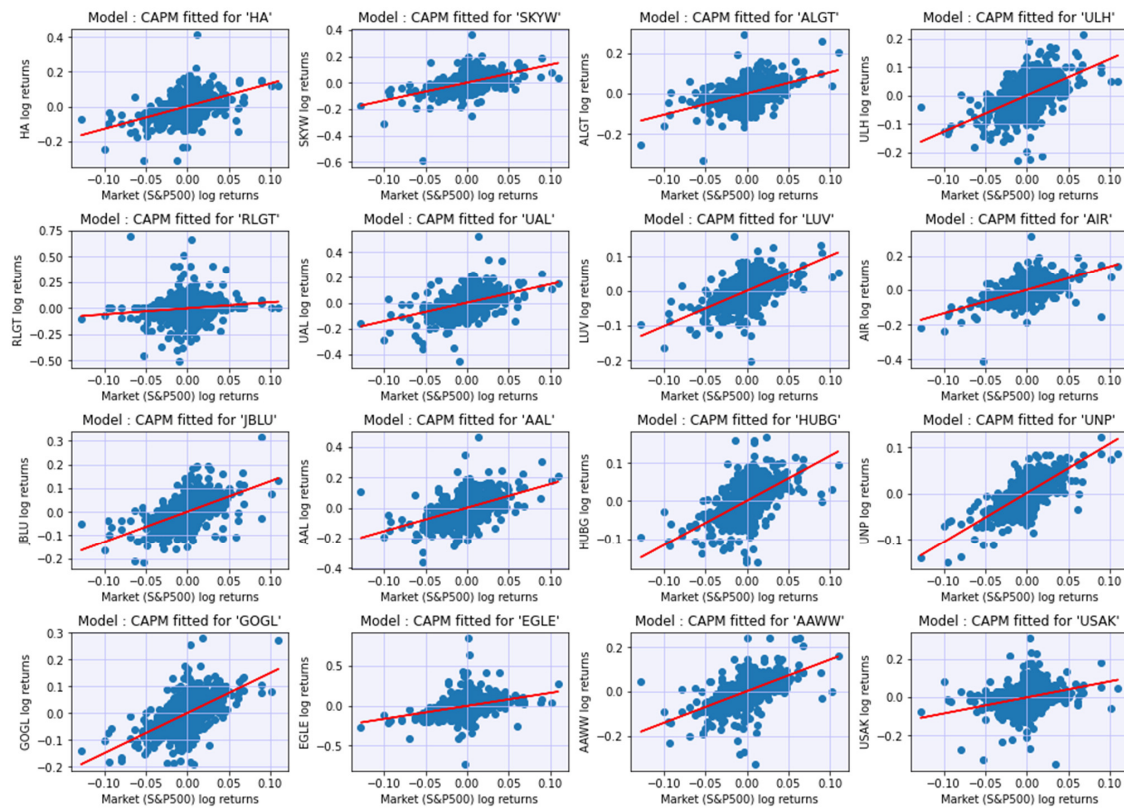


Figure A4. CAPM of non-green stocks.

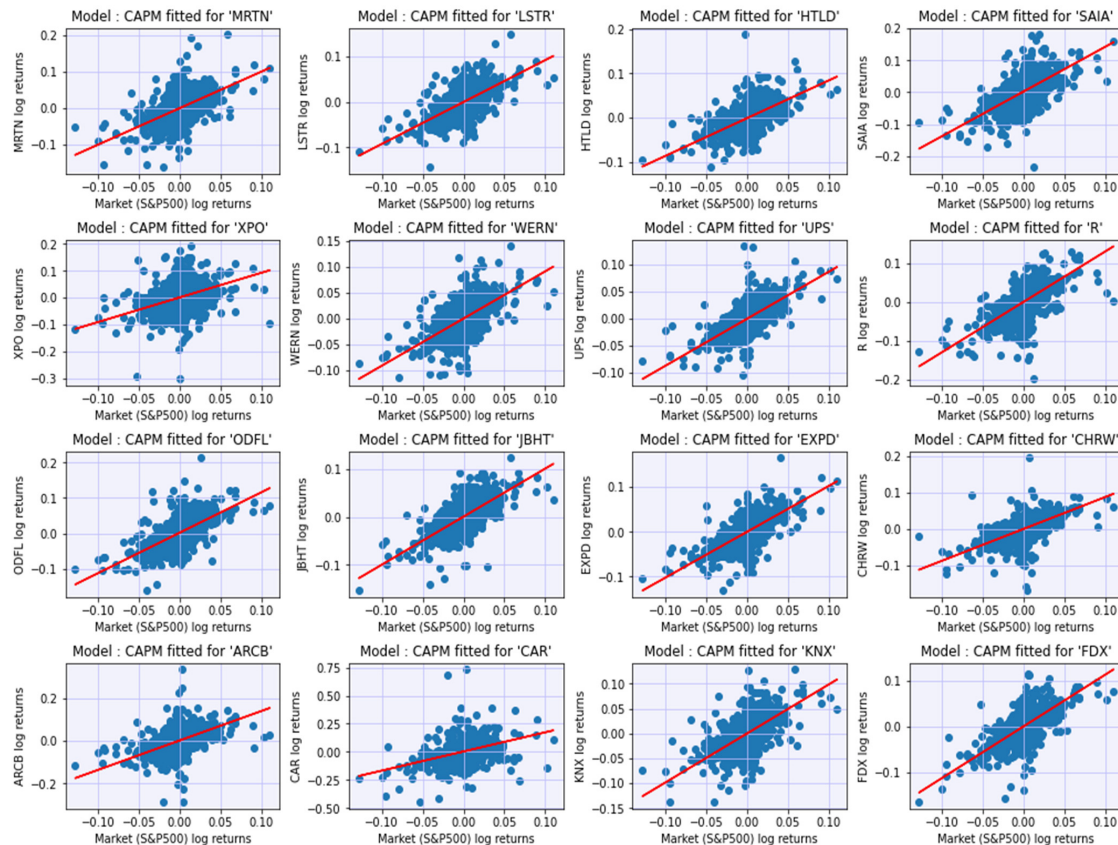


Figure A5. CAPM of green stocks.

Appendix B

Table A1. Stock coefficients of determination on S&P 500.

Green Logistics Stocks																
Ticker	HA	SKYW	ALGT	ULH	RLGT	UAL	LUV	AIR	JBLU	AAL	HUBG	UNP	GOGL	EGLE	AAWW	USAK
R-squared	0.211	0.270	0.211	0.253	0.025	0.223	0.312	0.343	0.272	0.231	0.334	0.511	0.243	0.134	0.307	0.086
Non-green logistics stocks																
Ticker	MRTN	LSTR	HTLD	SAIA	XPO	WERN	UPS	R	ODFL	JBHT	EXPD	CHRW	ARCB	CAR	KNX	FDX
R-squared	0.268	0/377	0.315	0.321	0.126	0.317	0.482	0.431	0.385	0.415	0.465	0.340	0.250	0.206	0.311	0.485

Table A2. Stock optimal weights for non-green portfolios.

Optimised portfolio	HA	SKYW	ALGT	ULH	RLGT	UAL	LUV	AIR	JBLU	AAL	HUBG	UNP	GOGL	EGLE	AAWW	USAK
Max Sharpe ratio	0.049	0.001	0.018	0.016	0.142	0.141	0.059	0.030	0.004	0.106	0.023	0.051	0.132	0.000	0.071	0.156
Min risk	0.073	0.104	0.105	0.093	0.054	0.006	0.014	0.100	0.072	0.022	0.101	0.118	0.004	0.046	0.082	0.007

Table A3. Stock optimal weights for green portfolios.

Optimised portfolio	MRTN	LSTR	HTLD	SAIA	XPO	WERN	UPS	R	ODFL	JBHT	EXPD	CHRW	ARCB	CAR	KNX	FDX
Max Sharpe ratio	0.060	0.085	0.005	0.100	0.091	0.047	0.070	0.029	0.091	0.011	0.081	0.084	0.092	0.072	0.019	0.063
Min risk	0.040	0.519	0.072	0.026	0.023	0.043	0.066	0.008	0.014	0.003	0.034	0.056	0.002	0.056	0.030	0.008

References

1. Serafeim, G.; Amel-Zadeh, A. Why and How Investors Use ESG Information: Evidence from a Global Survey. *Financ. Anal. J.* **2018**, *74*, 87–103.
2. Dimeson, E.; Karakas, O.; Li, X. Activism on Corporate Social Responsibility. *SSRN Electron. J.* **2012**, *7*, 34–43. [\[CrossRef\]](#)
3. Escrig-Olmedo, E.; Fernández-Izquierdo, M.Á.; Ferrero-Ferrero, I.; Rivera-Lirio, J.M.; Muñoz-Torres, M.J. Rating the Raters: Evaluating how ESG Rating Agencies Integrate Sustainability Principles. *Sustainability* **2019**, *11*, 915. [\[CrossRef\]](#)
4. Flammer, C. Corporate Green Bonds. *Acad. Manag. J.* **2019**, *324*, 75–95. [\[CrossRef\]](#)
5. Guenster, N.; Bauer, R.; Derwall, J.; Koedijk, K. The Economic Value of Corporate Eco-Efficiency. *Eur. Financ. Manag.* **2011**, *17*, 679–704. [\[CrossRef\]](#)
6. Sustainable Investing: Resilience Amid Uncertainty. BlackRock: Official Website. Available online: <https://www.blackrock.com/institutions/en-us/solutions/sustainable-investing/> (accessed on 11 January 2021).
7. Eccles, R.G.; Ioannou, I.; Serafeim, G. The Impact of Corporate Sustainability on Organizational Processes and Performance. *Manag. Sci.* **2014**, *60*, 2835–2857. [\[CrossRef\]](#)
8. Landi, G.; Sciarrelli, M. Towards a More Ethical Market: The Impact of ESG Rating on Corporate Financial Performance. *Soc. Responsib. J.* **2018**, *15*, 11–27. [\[CrossRef\]](#)
9. Buchanan, B.; Cao, C.X.; Chen, C. Corporate Social Responsibility, Firm Value, and Influential Institutional Ownership. *J. Corp. Financ.* **2018**, *52*, 73–95. [\[CrossRef\]](#)
10. Cao, J.; Liang, H.; Zhan, X. Peer Effects of Corporate Social Responsibility. *Manag. Sci.* **2019**, *65*, 5487–5503. [\[CrossRef\]](#)
11. Hu, Y.; Chen, S.; Shao, Y.; Gao, S. CSR and Firm Value: Evidence from China. *Sustainability* **2018**, *10*, 4597. [\[CrossRef\]](#)
12. Gillan, S.L.; Koch, A.; Starks, L.T. Firms and Social Responsibility: A Review of ESG and CSR Research in Corporate Finance. *J. Corp. Financ.* **2021**, *66*, 1–16. [\[CrossRef\]](#)
13. Zhou, D.; Zhou, R. ESG Performance and Stock Price Volatility in Public Health Crisis: Evidence from COVID-19 Pandemic. *Int. J. Environ. Res. Public Health* **2022**, *19*, 202. [\[CrossRef\]](#)
14. Engelhardt, N.; Ekkenga, J.; Posch, P. ESG Ratings and Stock Performance during the COVID-19 Crisis. *Sustainability* **2021**, *13*, 7133. [\[CrossRef\]](#)
15. Xiong, J.X. The Impact of ESG Risk on Stocks. *J. Impact ESG Invest.* **2021**, *2*, 7–18. [\[CrossRef\]](#)
16. La Torre, M.; Mango, F.; Cafaro, A.; Leo, S. Does the ESG Index Affect Stock Return? Evidence from the Eurostoxx50. *Sustainability* **2020**, *12*, 6387. [\[CrossRef\]](#)

17. 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](#)]
18. Ouchen, A. Is the ESG Portfolio Less Turbulent than a Market Benchmark Portfolio? *Risk Manag.* **2022**, *24*, 1–33. [[CrossRef](#)]
19. Chelawat, C.H.; Trivedi, I. Does ESG Investment Enhance Investment Returns? *Bus. Rev.* **2015**, *10*, 2. [[CrossRef](#)]
20. Zehir, E.; Aybars, A. Is there any Effect of ESG Scores on Portfolio Performance? Evidence from Europe and Turkey. *J. Cap. Mark. Stud.* **2020**, *2*, 129–143. [[CrossRef](#)]
21. Ashwin Kumar, N.C.; Smith, C.; Badis, L.; Wang, N.; Ambrosy, P.; Tavares, R. ESG Factors and Risk-Adjusted Performance: A New Quantitative Model. *J. Sustain. Financ. Invest.* **2016**, *6*, 292–300. [[CrossRef](#)]
22. Broadstock, D.C.; Chan, K.; Cheng, L.T.; Wang, X. The Role of ESG Performance during Times of Financial Crisis: Evidence from COVID-19 in China. *Financ. Res. Lett.* **2021**, *38*, 1–11. [[CrossRef](#)] [[PubMed](#)]
23. Shakil, M.H. Environmental, Social and Governance Performance and Stock Price Volatility: A Moderating Role of Firm Size. *J. Public Aff.* **2020**, *10*, e2574. [[CrossRef](#)]
24. Sabbaghi, O. The Impact of News on the Volatility of ESG firms. *Glob. Financ. J.* **2020**, *4*, 100570. [[CrossRef](#)]
25. Demers, E.; Hendrikse, J.; Joos, P.; Lev, B. ESG Didn't Immunize Stocks against the Covid-19 Market Crash. *J. Bus. Fin. Acc.* **2021**, *48*, 433–462. [[CrossRef](#)] [[PubMed](#)]
26. Ciciretti, R.; Dalò, A.; Dam, L. The Contributions of Betas versus Characteristics to the ESG Premium. *CEIS Work. Pap.* **2019**, *413*, 1–29. [[CrossRef](#)]
27. Evans, J.R.; Peiris, D. The Relationship between Environmental Social Governance Factors and Stock Returns. Available online: <https://ssrn.com/abstract=1725077> (accessed on 9 August 2022).
28. Wharton Research Data Services. Available online: <https://wrds-www.wharton.upenn.edu/> (accessed on 3 March 2022).
29. Yahoo! Finance. Available online: <https://finance.yahoo.com/> (accessed on 10 March 2022).
30. Nieto, B.; Rubio, G. The Effects of the COVID-19 Crisis on Risk Factors and Option-Implied Expected Market Risk Premia: An International Perspective. *J. Risk Financ. Manag.* **2022**, *15*, 13. [[CrossRef](#)]