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Are ESG-committed hotels financially resilient to the COVID-19 pandemic? An autoregressive jump intensity trend model

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1. Introduction

Corporate culture has never been more visible or consequential than it is today. Environment, social, and governance (ESG) policies guide corporate operations and educate the public about a company’s beliefs, objectives, and risks (Jamali et al., 2019; Kim et al., 2013). As Gupta (2021) puts it, “while CSR aims to make a business accountable, ESG criteria make such business’ efforts measurable” (p.1). ESG is a measurable indicator of a company’s sustainability and societal efforts, one that utilizes metrics meaningful to stakeholders to identify socially responsible firms that reflect societal developments (Serafeim, 2020). ESG practices have become critical for compliance and risk managers, as well as for consumers and potential investors, who are now evaluating not only the financial performance of a potential target company, but also the way it is run, how it serves society, how it affects the environment, and how all of these factors together contribute to the target company’s overall performance (Claypole, 2021). Today, ESG is constantly discussed in boardrooms, and is demanded by customers, employees, and investors (Porter, 2021).

In the wake of the COVID-19 pandemic and the growing global urgency surrounding climate change, ESG practices have become the lens through which business leaders, consumers, employees, investors, and other stakeholders identify and nurture a thriving responsible corporate behavior. COVID-19 actually emphasized the link between ESG-driven strategy and long-term wealth generation as high social standards and sound corporate governance could emerge as critical measures of company resistance to the pandemic. Scholars and institutional experts now evaluate a company’s risks and growth prospects using non-financial factors — ESG (CFA Institute, 2022).1 Urdangarin and VanderBeek (2015) suggested that ESG might be an appropriate means of evaluating a company’s sustainability and determining whether it is capable of maximizing shareholder profit. According to Polbennikov et al. (2016), ESG rating has a favorable effect on a company’s security performance. Businesses that prioritize ESG are more engaged, have more vital competitive values, healthier balance sheets, and more capable leadership than those that do not (S&P Global, 2020). Additionally, Broadstock

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Abbreviations:
ARJI-trend: Autoregressive jump intensity trend
CFA Institute: Centre for Research in Security Prices
Claypole, R. (2021, April). ESG in a time of crisis. https://www.cfainstitute.org/en/research/esg-investing/
et al. (2020) recently indicated that ESG could influence the post-COVID-19 era by mitigating businesses’ financial risks. In another key study, Giese et al. (2019) presented three transmission channels through which ESG affects a company’s stock valuation and financial performance: cash flow, idiosyncratic risk, and valuation. According to their findings, a company’s ESG helps mitigate fat tail risk.

From a theoretical standpoint, it is crucial to understand how and why company’s ESG implementation could contribute to its values and preserve shareholder capital. A corporation concerned with its ESG engages in the internalization of external cost and the capitalization of its social contribution. According to equity pricing theory, absolute and relative valuation methodologies could be applied to evaluate the intrinsic value of a company’s stock, including the discounted dividend model (DDM), the free cash flow model (FCF), and pricing thorough financial ratio comparisons. In confronting the COVID-19 crisis, however, utilizing these standard stock pricing models has become more difficult than ever as a company’s free cash flow is severely affected and consequently pays no dividends to investors due to negative earnings. This circumstance pushes firms managers and investors to seek other methods of stabilizing and/or improving stock returns by concentrating on lowering the discount rate (cost of capital) involved in the DDM and FCF estimations. When a company has smaller financial and operational risks, its cost of capital (stock price) would decrease (rise) proportionally.

Travel, tourism, and hospitality industries have had to evaluate nearly every area of their operations in the aftermath of COVID-19. The crisis has made it possible for travel and hospitality leaders to establish ESG integration as the ‘new normal’ across their operations. ESG compliance has become critical, as several governments have committed to a ‘green’ recovery to satisfy the United Nations’ sustainable development goals. Among all industries in the United States (U.S.), travel and hospitality have been hardest hit by COVID-19 (U.S. Travel Association, 2022). Due to stay-at-home orders, quarantines, corporate travel limitations, and persistent concern about contagion, the travel industry in the U.S. experienced its lowest recorded level of activity in 2020. According to Oxford Economics (2020), the impact of COVID-19 on the travel industry was nine times worse than the impact of the 9/11 terrorist attacks. According to the U.S. Travel Association (2022), travel spending was reduced by 42% (almost $500 billion) in 2020 compared to 2019; foreign and business travel also saw significant declines.

When the travel and hospitality industries came under stress due to the COVID-19 lockdowns, operational resilience and business continuity plan had a direct impact on revenues and share prices. As we begin to absorb the pandemic’s lessons, it is worthwhile to know whether or not incorporating ESG practices into the hotel corporations’ governance structures would ensure their good operational resilience and create real value. Thus, we construct an autoregressive jump intensity trend (ARJI-trend) model to determine if the shares of an ESG-committed hotel corporation could serve as a safe-haven (defensive) asset during such a crisis. The sampling hotel corporations for this study is comprised of 11 hotel chains in the United States. The disastrous effect that the COVID-19 had on the hotel industry from late 2019 to early 2021 underscores the importance of analyzing whether a hotel corporation with a higher ESG rating is more resilient. The results could demonstrate an investment function of defensiveness, and further moderate return volatility, as reducing investment risk is a primary concern of shareholders and potential investors when selecting investments. According to Moody’s Investors Service, 2020 was a significant year for ESG investing, with inflows into ESG products growing by an unprecedented 140%. A poll done by Investopedia and Treehugger demonstrated that many investors began utilizing ESG principles to make investment decisions. The threat of COVID-19 on stock markets provided investors and/or stakeholders a good testing ground to analyze whether top ESG-rated hotel companies could be immune to the negative financial impacts of the COVID-19 crisis; this might explain why timing the market can lead to profitable investments even during a market downturn (market timing strategy).

This study makes a threefold contribution. To begin, this is the first study to examine not only the long-run but also the short-run effects of ESG performance on hotel businesses’ stock return volatility. The model developed in this study decomposes return volatility into permanent (trend) and transitory (cyclical) components during the COVID-19 crisis, particularly when hotel corporations’ ESG ratings were included. We also captured risk associated with a fat-tail feature on financial security’s return. More importantly, the results can be used to determine whether a hotel corporation with a superior ESG performance has a lower risk of its stock return in the long or short term. In addition, rather than relying on CRS, the ESG rating is more appropriate for use as an indicator as a proxy for a hotel corporation’s sustainability-impact efforts, as ESG quantifies the risks, values, and goals associated with the hotel corporation. Unlike most recent examinations of the impact of the COVID-19 on the stock markets, this study used thorough econometric methodologies to define the pandemic interval scientifically. Lastly, we constructed investment portfolios using the ARJI-trend models to predict parameters to ascertain that a hotel corporation that makes such an ESG commitment generate a higher rate of return on its stock than hotels that do not.

The remainder of this paper is structured as follows. Section 2 reviews the literature and formulates hypotheses. The third section discusses data usage and the construction of the model. Section 4 summarizes the findings of the empirical tests. Section 5 presents the discussion and implications, and Section 6 concludes, describing the limitations of this study, and offering directions for future research.

2. Literature review and hypothesis development

2.1. From idea (CSR) to action (ESG): Why does ESG matter?

Businesses have recently come under increased pressure for accountability from environmental groups and non-governmental organizations. At the same time, they are contending with emerging legislation and initiatives such as the Task Force of Climate-related Financial Disclosures (Climate Disclosure Standards Board, 2021) and the Biden administration’s proposals for reinvigorating ESG policies (Kimpel et al., 2021). From a social standpoint, a business is accountable to its shareholders and its stakeholders: its customers, employees, the community, and the government (Carnevale & Mazzauc, 2014; Freudenreich et al., 2020). CSR and ESG are related but distinct concepts. CSR is an umbrella term that encompasses the social, environmental, and economic issues that guide a business’s policies, operations, and decision-making; ESG evaluates a company’s sustainability practices in terms of its environmental, social, and governance factors. To put it simply, the objective of CSR is to hold businesses accountable, while ESG standards quantify those efforts.

The acronym ESG expands upon CSR, transforming CSR from abstract altruism into a tangible set of data that customers and investors can use to assess a company’s philanthropic, social, and internal governance policies (Su & Chen, 2020). While the travel and hospitality

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2 https://www.ustravel.org/sites/default/files/media_root/document/Coronavirus2020_Impacts_April15.pdf.
3 https://www.ustravel.org/toolkit/covid-19-travel-industry-research.
4 https://www.moodys.com/research/Moodys-ESG-investing-a-boon-for-asset-managers-as-product-PBC_1265808.
5 Su and Chen (2020) suggested companies pursue inclusion within relevant ESG indices to comprehend the full benefit of a proactive stance on best ESG practices. They also argued that ESG profiles are related to different firm characteristics and that hospitality firms have greater positive reactions to additions to the Dow Jones Sustainability North America Index (DJSI) than do non-hospitality firms.
industries are in a position to make a positive impact through the adoption of sustainable design and practices, most of the research published between 2020 and 2021 either focuses on CSR or models corporate sustainability through CSR (e.g. Cantele & Cassia, 2020; Chen et al., 2021; Franco et al., 2020; Kim & Lee, 2020; Koseoglu et al., 2021; Qiu et al., 2021), which is time-consuming and does not accurately reflect the sustainability initiatives adopted by the travel industry (Park & Lee, 2009). For example, Nicolau (2008) used an event study research approach to assess abnormal stock returns associated with the announcements of two hotel companies’ CSR initiatives and discovered a positive abnormal return on the day following the event. According to Kim and Kim (2014), a restaurant group with a better CSR reputation boosts shareholder values as a result of a higher Tobin’s Q. Using Freeman’s (1984) stakeholder theory, Park et al. (2017) found that CSR initiatives may not affect restaurants’ beta risks unless its CSR practices were accompanied by geographical diversification. Theodoulidis et al. (2017) examined restaurant companies and concluded that when particular environmental and social criteria are included, CSR may directly affect companies’ CFP.

In comparison to CSR, ESG offers a mechanism for measuring a business’s sustainability credentials for stakeholders. ESG provides quantitative indications of accountability, covering environmental, ethical, and corporate governance problems such as controlling a company’s carbon footprint and ensuring processes for corporate’s ESG practices are in place to quantify how hotels incorporate sustainability into their operations. Both Fatemi et al. (2018) and Cek and Eyupoglu (2020) demonstrated a favorable and persistent correlation between ESG adoption and business value. According to HSBC Global Research (Paun, 2020), shares of ESG-committed companies outperform those of other companies. Broadstock et al. (2020) found that portfolios with higher ESG metric scores outperform those with lower ESG metric scores during times of crisis. Su and Chen (2020) validated that higher ESG metric scores send a good signal to stakeholders and improve the financial performance of hospitality firms.

Notably, recent research implicating the COVID-19 raises significant concerns about the definition and selection of crisis periods. To be more precise, the ESG studies cited above were published when the financial and stock markets are only half-way through the pandemic period, and we are unclear how the aggregate influence of COVID-19 could be measured while the pandemic was still underway. That is, their sample periods were still inside the COVID-19 continuing period and were determined subjectively without any theoretical or economic estimations to justify the appropriate length of the crisis. To mitigate this possible disadvantage, this study applies rigorous econometric methodologies to determine the ideal length of the crisis period, making the results more convincing and realistic in light of changing stock market conditions. The preceding reasons form the basis for the following hypothesis.

**Hypothesis 1.** (H1): Hotel corporation’s ESG rating is positively related to its stock return during the COVID-19 pandemic.

**Hypothesis 2.** (H2): The stock of a high ESG-committed hotel corporation is a safe-haven asset during the COVID-19 pandemic.

### 2.2. Applications of autoregressive jump intensity trend model

The purpose of this study is to determine whether a strong ESG-committed hotel corporation may be considered a defensive stock (more immune) during the global crisis. An autoregressive jump intensity trend model (ARJI-trend model) is developed by integrating Chan and Mahieu’s (2002) ARJI and Engle and Lee’s (1999) component models to elucidate the effects of permanent and transitory components of COVID-19 and ESG performance on sampling hotel corporations’ stock return and volatility.

Investors evaluate investment risk and return when investing in financial markets. In particular, time series of stock returns commonly experience volatility clustering behavior,\(^6\) and such a volatility pattern deserves consideration when investing. According to Efficient Market Hypothesis, the U.S. stock market is one of the world’s most efficient markets, with stock price/returns reflecting the arrival of news and thereby influencing investors’ market insights. Numerous studies have been undertaken regarding the characteristics of stock return volatility. For instance, Kho (1996), Fong and See (2002), Normandin and Phaneuf (2004), and Caporale et al. (2017) demonstrated that time-varying conditional volatility is a typical feature of financial asset and derivative returns. Daal et al. (2007) and Kuttu (2017), Bégin et al. (2020), and Dutta et al. (2021) found that conditional jump risk matters when pricing equity values. Engle and Lee (1999), Adrian and Rosenberg (2008), and Liu (2021) characterized permanent and transitory components for evaluating the volatility of an equity’s returns and demonstrated that the model incorporating these two components outperforms other models.

Discontinuous jumps are also acknowledged as important features in the dynamics of stock returns (Andersen et al., 2007; Maheu & McCurdy, 2004). Discontinuous jumps in stock returns are typically associated with unexpected events, such as sudden market crises. However, given the possibility of unexpected shocks, only a few studies have examined the jump risks associated with return volatility in the hospitality industry (e.g., Wang, 2013). As a result, this study uses the component model in conjunction with the ARJI model to investigate the effects of COVID-19 and ESG metric scores on stochastic return volatility for the major hotel corporations in the United States.

As Koekebakker and Lien (2004) indicated, stock returns tend to be fat-tailed and exhibit discrete price jumps in response to unexpected news, necessitating the distinction between discontinuous volatility (jump) and generalized variance. As Chiang et al. (2019), Haase et al. (2019), and Chen et al. (2020) demonstrated that financial securities contain both permanent and transitory impacts/shocks, this study decomposes conditional volatility into permanent and transitory components by simultaneously incorporating a company’s ESG performance as an exogenous variable and internalizing the COVID-19 impacts. As a result, the model developed in this study distinguishes the time-varying dynamics of stock returns and improves the understanding of the risk characteristics to hotel executives and investors. The findings in the literature support the following testable hypothesis.

**Hypothesis 3.** (H3): When the ESG rating of a hotel corporation is included in the ARJI-trend model, both the permanent and transitory components of stock return volatility are reduced.

While most firms foresee value creation through environmental, social, and governance stewardship, the question of quantifying the benefits of ESG implementation is still in its infancy in the travel and hospitality industries and requires further analysis. This study therefore applies a constructive model to demonstrate how ESG profiles benefit hotel corporations’ values, with special attention to the long- and short-run effectiveness of ESG performance, and to bolster theoretical and empirical evidence of ESG, as well as the transformation of hospitality business climates in line with corporate sustainability ambitions and shareholder expectations. Fig. 1 depicts the research framework and the formulation of hypotheses.

### 3. Data and model

#### 3.1. Data

In the current business paradigm, shareholders solicit companies to disclose and publish information about sustainability efforts in their annual ESG reports. Over the past decades, there has been a notable

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\(^6\) Large and/or small changes in equity prices cluster together, resulting in high levels of persistence.
change in the way in which the hotel companies view their business and their role in the market. Examples include the increased use of low-carbon technology, water conservation, and the use of eco-friendly material and the maximization of support for economic development by consolidating social benefits to make significant advances across ESG.

Employing a firm-level dataset, the stock returns are calculated using the daily closing stock prices to fit the ARJI-trend models and estimate return volatility behaviors. The sample companies consist of 11 firms with 627 firm-month observations: Hilton Worldwide Holdings Inc. (ticker: HLT), MGM Resorts International (MGM), Park Hotels & Resorts Inc. (PK), Marriott International Inc. (MAR), Vail Resorts, Inc. (MTN), Choice Hotels International Inc. (CHH), Las Vegas Sands Corp. (LVS), Wynn Resorts, Limited (WYNN), Hyatt Hotels Corporation (H), Caesars Entertainment Inc. (CZR), and Wyndham Hotels & Resorts Inc. (WH). 8

In terms of the investigation period, this paper adopts econometric techniques to define the period when the COVID-19 crisis affected the U.S. stock market rather than subjectively selecting a crisis period without supporting evidence. After we verified the crisis period, we extended the sample length, covering 57-month daily data from January 1, 2017 through September 31, 2021. Chow (1960; exogenous detection) and Bai and Perron (1998 and 2003; endogenous detection) tests are utilized to determine the potential period of the COVID-19 pandemic’s impact on the stock market. 9 As presented in Table 1, F-statistics are all significant, meaning the null hypothesis of no break under the estimations of Chow test was rejected.

Based on the results of Bai-Perron test, we observe that stock market turmoil is largely consistent with the period of COVID-19 since the hotel corporation’s stock price/return time series has structural breaks or changes in the months surrounding February 2020 and February 2021, and the stock price of hotel corporation also experienced a severe downward trend and hit its lowest point since late 2019. The period from February 2020 through February 2021 is recognized as the COVID-19 pandemic period of stock market and is supported in terms of both exogenous and endogenous detections. 10 The ESG rating scores for hotel companies are estimated by Sustainalytics. The daily stock prices of hotel companies and ESG rating scores are obtained from the Bloomberg database.

3.2. Model constructions

To capture discontinuity (discrete changes) and to measure movement patterns for the stock prices/returns of hotel companies, we apply the ARJI model coupled with an extended component model to break down the generalized autoregressive conditional heteroskedasticity (GARCH) conditional variance into permanent and transitory components, in which the jump intensity is to follow an autoregressive moving average (ARMA) process. The information set is assumed to follow the past returns at time t, \( \Phi_t = \{ R_t, \ldots, R_1 \} \) and the model parameterizations appear as follows:

\[
R_t = \mu_0 + \phi_1 R_{t-1} + \sqrt{h_t} Z_t + \sum_{k=1}^{\infty} \rho_k Z_{t-k},
\]

(1a)

\[
R_t = \mu_0 + \phi_1 R_{t-1} + \phi_2 \text{ESG}_t + \sqrt{h_t} Z_t + \sum_{k=1}^{\infty} \rho_k Z_{t-k},
\]

(1b)

\[
h_t = q_t + \alpha (\varepsilon_{t-1}^2 - q_{t-1}) + \beta (h_{t-1} - q_{t-1})
\]

(2)

\[
q_t = \omega_0 + \rho q_{t-1} + \xi (\varepsilon_{t-1}^2 - h_{t-1})
\]

(3)

\[
\lambda_t = \lambda_0 + (\tau - \gamma) \lambda_{t-1} + \gamma E[p_{t-1} | \Phi_{t-1}]
\]

(4)

\[Z_t \sim NID(0, 1), \, \varepsilon_{t} \sim N(0, \sigma_{t}^2).\]

The component model, Equations (2) and (3), is embedded to distinguish conditional return volatility components for the permanent (trend) and transitory (cyclical) components. Here, \( R_t \) denotes the stock return series for the hotel companies on day \( t \); \( \text{ESG}_t \) is the ESG rating score for the hotel companies during the specific month; \( h_t \) denotes the conditional variance of return that can be estimated using a GARCH (1,1) process with respect to the information set of \( \Phi_{t-1} \); \( \varepsilon_t = R_t - \mu_0 - \phi_1 R_{t-1} - \phi_2 \text{ESG}_t \), involving the expected jump component, and interferes with future return volatility via the conditional variance of the GARCH model; \( q_t \) denotes the permanent/jump component embedded in the conditional variance equation of GARCH parameterization that characterizes the time-varying dependence of long-run return volatility with the mean-reverting speed (\( \rho \)); \( \sigma_t \) stands for the discontinuous

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7 For detailed ESG engagements by the sample U.S. hotel companies, please refer to http://serve360.marriott.com/wp-content/uploads/2021/09/2021Serve360_Report.pdf. https://corporate.wyndhamhotels.com/wp-content/uploads/2021/04/2021WH-ESG-Report.pdf. https://cr.hilton.com/wp-content/uploads/2021/04/Hilton-2020-ESG-Report.pdf. https://www.choicehotels.com/about/responsibility. https://investor.caesars.com/esg-hub/esg-resource-hub.

8 Both Caesars Entertainment Inc. and Wyndham Hotels & Resorts Inc. have a slight shortage of ESG data.

9 Cró and Martins (2017) presented consistent dates of tourism crises versus structural breaks by using the Bai and Perron test. In addition, Bai-Perron has a computational advantage in dealing with multiple breaks.

10 Instead of using the number of COVID-19 infections and deaths, we analyze the stock market condition to define the COVID-19 pandemic period since this paper studies the stock performance and return dynamics when a company is more committed to ESG.

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Fig. 1. The research framework with hypothesis setting.
counting process between \( t - 1 \) and \( t \), governing the number of price jump arrivals, and is Poisson-distributed with a jump parameter \( \lambda_i \) higher than 0 (\( > 0 \)). Its probability density function is:

\[
P(n_i = j|\Phi_{t-1}) = \frac{e^{-\lambda_i}\lambda_i^j}{j!}, \quad j = 0, 1, 2, \ldots
\]  

We note that \( \lambda_i \equiv E[n_i|\Phi_{t-1}] \) is the conditional expected value of the jump intensity and follows an ARMA process. Hence, the residual shock of jump intensity could be measured by:

\[
\xi_{t-1} \equiv E[n_i|\Phi_{t-1}] - \lambda_{t-1} = \sum_{j=0}^{\infty} P(n_i = j|\Phi_{t-1}) - \lambda_{t-1}.
\]

While \( R_i \) is observed and the Bayes rule is employed, the conditional stock return density is:

\[
P(R_i|\Phi_{t-1}) = \sum_{j=0}^{\infty} f(R_i|n_i = j, \Phi_{t-1}) P(n_i = j|\Phi_{t-1}).
\]

Given the condition that the \( j \) jumps are normally distributed, we can construct the maximum likelihood function as:

\[
f(R_i|n_i = j, \Phi_{t-1}) = \left(2\pi\sigma^2\right)^{-\frac{1}{2}} \exp \left\{ -\frac{(R_i - \mu_i)^2}{2\sigma^2}\right\}.
\]

The following log-likelihood function is used to estimate parameters:

\[
L(\Psi) = \sum_{i=1}^{T} \log f(R_i|\Phi_{t-1}; \Psi),
\]

where \( \Psi \) consists of the parameters \((\phi_0, \phi_1, \phi_2, \omega_0, \alpha, \beta, \theta, \delta, \lambda_0, \tau, \gamma)\) to be computed.

More specifically, the ARJI-trend model imposes several restrictions: \( \phi_i \) slowly approaches an unconditional variance, because of \( 0 < \rho < 1 \), while \( h_0 - \delta_i \) refers to the transitory/temporary (short-run) component, is more volatile, fades with time, and eventually reverts to 0. The forecasting error term, \( \epsilon_{t-1} - h_{t-1} \), is serially independent and zero-mean, and is an evolution-driven factor for the permanent component (long-run). The sum of \( \alpha \) and \( \beta \) represents the persistence of the transitory innovation, while \( \tau \) is the stability term, \( \alpha > 0, \beta > 0, \) and \( \alpha + \beta < 1 \) are restricted given the assumption that the returns process \( R_i \) is covariance stationary. The convergence speed of the transitory component is faster than that of the permanent component when \( \rho < \alpha + \beta \).

Based on the sample period selected herein, the stock prices of hotel companies have been affected by both the COVID-19 and their ESG rating scores. As shown by Su and Chen (2020), ESG and financial performance positively correlate in the hospitality industry. We thus examine whether an ESG-committed hotel corporation experiences moderate negative impacts upon its stock returns during such a crisis, thus stabilizing return volatility.

### 3.3. Descriptive data statistics

Table 2 displays the basic information for sample hotel companies, including companies’ tickers, net incomes, and market values from 2019 through 2021. The average ESG scores are calculated for the COVID-19 pandemic period (February 2020 through February 2021).

LVS, MGM, and MAR are the three largest companies in terms of net income in 2019 (pre-COVID-19 period, thereafter pre-COVID period). MAR, WYNN, and HLT are the top three companies based on market value (capitalization). As expected, the net incomes for most hotels except for MTN and CHH turn negative in 2020, and the market values of these two companies are smaller than those of the other hotel companies. In accordance with companies’ quarterly financial statements, the net income improves in 2021 and 4 out of 11 companies earn positive profits (MAR, CHH, WH, and HLT). However, for companies with greater negative net income in 2020, WYNN, CZR, H, and PK, and MGM still report negative net income as of June 30, 2021 (six months ended).

During the pandemic period, the market capitalization for most of the hotel companies decreases by 10%–58% (June 2019 versus June 2020). The two companies with the greatest declines in market value are PK (–58.06%) and MGM (–46.01%); the only company with the positive change in market value is CZR, reporting an increase of about 7.25%. During the post-COVID-19 period (thereafter post-COVID period), the hotel corporation shows a great recovery as market values increase by more than 100% on average and 8 out of 11 companies gain greater market values than those of the pre-COVID period. The company with the highest growth:

| Company | 2019 Net Income | 2020 Net Income |
|---------|-----------------|-----------------|
| LVS     | 7.25%           | –68.94%         |
| MGM     | (–55.74%)       | (–58.06%)       |
| MAR     | 20.3%           | (–24.03%)       |
| WYNN    | (–31.31%)       | (–46.01%)       |
| HLT     | (–46.45%)       | (–81.34%)       |
| CHH     | (–19.82%)       | (–41.48%)       |
| LVS     | (–47.75%)       | (–55.7%)        |
| MGM     | (–58.06%)       | (–58.06%)       |
| MAR     | (–24.03%)       | (–24.03%)       |
| WYNN    | (–46.01%)       | (–46.01%)       |
| HLT     | (–81.34%)       | (–81.34%)       |
| CHH     | (–41.48%)       | (–41.48%)       |

### Table 2

The results of COVID-19 impacting period selections - Chow and Bai-Perron tests.

| Panel A: Chow Test | HLT | MGM | PK | MAR | MTN | CHH | LVS | WYNN | H | CZR | WH |
|-------------------|-----|-----|----|-----|-----|-----|-----|------|---|-----|----|
| Structural Break at Observation Feb. 1, 2020: F (3,1059) | 38.46*** | 28.36*** | 27.61*** | 30.32*** | 35.92*** | 29.05*** | 55.57*** | 27.29*** | 36.58*** | 20.82*** | 17.30*** |
| Structural Break at Observation Feb. 28, 2021: F (3,416) | 64.08*** | 39.05*** | 18.11*** | 44.07*** | 92.21*** | 51.33*** | 76.44*** | 76.14*** | 36.13*** | 39.15*** | 30.85*** |

### Table 3

| Panel B: Bai-Perron Test | HLT | MGM | PK | MAR | MTN | CHH | LVS | WYNN | H | CZR | WH |
|--------------------------|-----|-----|----|-----|-----|-----|-----|------|---|-----|----|
| Break Point 1 | Feb. 11, 2020 | Feb. 19, 2020 | Feb. 20, 2020 | Feb. 19, 2020 | Feb. 13, 2020 | Feb. 11, 2020 | Feb. 18, 2020 | Feb. 19, 2020 | Feb. 20, 2020 | Feb. 13, 2020 | Feb. 5, 2021 |
| Break Point 2 | Feb. 8, 2021 | Feb. 12, 2021 | Feb. 22, 2021 | Feb. 10, 2021 | Feb. 19, 2021 | Feb. 4, 2021 | Feb. 10, 2021 | Feb. 23, 2021 | Feb. 17, 2021 | Feb. 19, 2021 | Feb. 5, 2021 |

5. The jump probability is time-varying and relates to different conditions of stock markets and/or economy.
6. Since the error terms of the GARCH-family models experience non-normal distributions and are non-stationary, the quasi-maximum likelihood estimation (QMLE) method that has a feature of asymptotic normality is usually applied to resolve this issue and offers robust results (Jensen & Rahbek, 2004).
7. Model 1a consists of Equations (1a), (2) and (3), and (4); Model 1b consists of Equations (1b), (2) and (3), and (4).
returns of all sample companies are leptokurtic (more peaked and with fatter tails) during this period, and such kurtosis identifies that the tails of returns for the hotel companies during three sub-sample periods. During June 2020 versus June 2021. The average of ESG score is calculated during the sample period of February 2020 through February 2021.

In Panel B (pandemic period), the standard deviation, as expected, is larger (with lower standard deviations of 1.2158 and 1.2810, respectively), while HLT, CZR, and WYNN are riskier companies with standard deviations that are all higher than 2 (4.2314, 2.5081, and 2.4352, respectively). Some of the return distributions skew to the left (negatively) except for HLT, CZR, H, LVS, and CHH. The returns of all sample companies are leptokurtic (more peaked and with fatter tails) during this period, and such kurtosis identifies that the tails of the given return distributions contain extreme values (tail risk). The Jarque-Bera tests for normality reveal that the returns of companies are non-normal distributed.

In Panel B (pandemic period), the standard deviation, as expected, is greatly magnified. Most of the hotel stocks still show positive average returns during the pandemic period; however, the level of risk is almost double or even triple the risk of the pre-COVID period. CZR, PK, and MGM have the highest standard deviations. The statistical results of skewness, kurtosis, and Jarque-Bera are quite similar in the pre-COVID and pandemic periods. During the post-COVID period (Panel C), the returns become much less volatile than they had been during the pandemic period as the standard deviations are smaller and closer to the levels of pre-COVID period. More than 70% (8 out of 11) of the sample hotel companies experience normal distributions and have no significant skewness in terms of stock return series. Only four companies (WYNN, MTN, LVS, and H) still present heavier tails, meaning that their return series appear to be leptokurtic distributions.

Fig. 2a plots the stock price from January 2018 through October 2021. As we observed, the stock prices of sample companies fell more than 50% and hit bottom in March 2020. The stock prices then rose over the next two months, followed by another slight decline from June 2020 until November 2020. The stock prices of the hotel companies then kept increasing, returning to their original 2019 levels after March 2021. A review of Fig. 2b shows that the average high and low deviations of stock returns were between −5% and +5% during 2019 with a few return movements exceeding this range for MTN, WYNN, and HLT. From January 2020, the stock returns became very volatile, particularly after February 2020. The daily high and low stock returns exceeded 20% and dropped to about −30%, respectively; this volatility lasted until July 2020. The stock price of PK was prone to higher volatility among the sample companies. There were large positive returns in the second week of November 2020. After November 2021, the trends of hotel stock

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Table 2

| Company Name                  | Ticker | NI in 2019 | NI in 2020 | NI in 2021* | Market Cap. (June 30, 2020) | Market Cap. (June 30, 2021) | Market Cap. (June 30, 2021) | Average ESG Score |
|------------------------------|--------|-----------|-----------|------------|---------------------------|----------------------------|----------------------------|------------------|
| Hilton Worldwide             | HLT    | 886       | −720      | 19         | 28,488.50                 | 20,364.82                  | [−28.42%]                  | 66.34            |
| Holdings Inc.                |        |           |           |            |                           |                           |                           |                  |
| MGM Resorts International    | MGM    | 2214      | −1320     | −246       | 15,347.83                 | 8286.06                   | [−46.01%]                  | 55.41            |
| Park Hotels & Resorts Inc.   | PK     | 336       | −1444     | −350       | 5555.49                   | 2330.02                   | [−58.06%]                  | 45.46            |
| Marriott International Inc.  | MAR    | 1273      | −267      | 411        | 46,215.03                 | 27,798.47                 | [−40.49%]                  | 60.76            |
| Vail Resorts, Inc.           | MTN    | 323       | 109       | −8         | 8972.28                   | 7308.22                   | [−18.55%]                  |                  |
| Choice Hotels                | CHH    | 223       | 75        | 108        | 4841.32                   | 4367.67                   | [−9.78%]                   | 54.95            |
| International Inc.           | CZR    | 81        | −1757     | −352       | 3580.56                   | 3840.19                   | [7.25%]                    |                  |
| Las Vegas Sands Corp.        | LVS    | 3304      | −2143     | −24        | 13,349.01                 | 8035.09                   | [39.81%]                   | 47.19            |
| Wyndham Resorts, Limited     | WYNN   | 123       | −2067     | −510       | 45,664.99                 | 34,780.26                 | [23.84%]                   |                  |
| Hyatt Hotels Corporation     | H      | 766       | −703      | −313       | 2909.46                   | 1790.73                   | [−38.45%]                  | 61.25            |
| Caesars Entertainment Inc.   | CZR    | 81        | −1757     | −352       | 3580.56                   | 3840.19                   | [7.25%]                    |                  |
| Wyndham Hotels & Resorts Inc. | WH    | 157       | −152      | 93         | 4423.17                   | 3967.54                   | [−10.30%]                 | 47.21            |

Notes: The data is collected from company’s official website and Bloomberg database. NI represents net income and NI and market capitalization are shown in millions of dollars. NI in 2021 is the net income for six months ended (June 30) in 2021. [ ] shows the percentage changes of market values in June 2019 versus June 2020 and in June 2020 versus June 2021. The average of ESG score is calculated during the sample period of February 2020 through February 2021.

4. Empirical test results: parameter estimations of ARJI-trend model

4.1. Effects of COVID-19 on stock returns

This study first analyzes the return volatility patterns of U.S. hotel companies during the pandemic period and the estimation results are displayed in Table 4. Given the model coefficients, most of the hotel stock returns seem to experience autocorrelation (ρ is significantly either positive or negative), except for HLT, MAR, and WH; and by applying Ljung-Box Q test, the results reject the null hypothesis of no serial correlation on stock returns. The permanent (trend/long-run) component of the GARCH conditional variance exhibits stronger degrees of volatility persistence for LVS, CHH, MTN, and WH (ρ = 0.9539, 0.9201, 0.8934, and 0.8893); however, the ρ values of WYNN, HLT, and H are smaller (0.6555, 0.6757, and 0.6820). The ρ values are around 0.7 to 0.8 for other companies. In accordance with the long-run half-life measurement, the half-life of permanent response to a shock is the shortest in WYNN (1.64). Conversely, the news shock generates a greater long-run persistency for both LVS (14.69 trading days) and CHH (8.32 trading days).

The sums of α + β for most sample companies are around 0.7 to 0.9, and the smallest value of α + β is 0.7524 for HLT. The companies’ respective half-lives range from 2.44 (HLT) to 16.39 (WYNN) trading days. Except for MTN, LVS, and CHH, we find the transitory shocks are greater than permanent shocks (α + β > ρ) for most of the hotel companies. The jump-size means (θ) for most of the hotel companies (7 of 11) are different from 0 at the 1% or 5% significance level (e.g., HLT, PK, CHH, LVS, WYNN, H, and WH). Most of the parameters τ and γ are statistically significant. The unconditional jump intensities for these companies are between 0.0907 (HLT) and 2.4122 (WYNN).15

4.2. Effects of ESG performance on hotel stock returns during the pandemic period

When ESG score is considered with the model (Table 5), the coefficients of ϕ1 are greater than those without considering ESG score/
Preliminary statistics of daily stock returns (%) for sampling hotel corporations.

Panel A: Pre-COVID Period

| Corporation | Mean | Standard Deviation | Skewness | Kurtosis |
|-------------|------|-------------------|----------|----------|
| HLT         | 0.0330 | 0.0116             | 0.4917*** | 0.4254*** |
| MGM         | 0.0783 | 0.0200             | 0.2383*** | 2.6627*** |
| PK          | 0.0625 | 0.0226             | 1.9380*** | 2.1003*** |
| MAR         | 0.0842 | 0.0105             | 0.2155*** | 8.1600*** |
| MTN         | 0.0412 | 0.0165             | 0.4655*** | 3.7324*** |
| CHH         | 0.0770 | 0.0155             | 0.5419*** | 4.5257*** |
| LVS         | 0.0616 | 0.0150             | 0.4974*** | 2.7657*** |
| WYNN        | 0.1935 | 0.0163             | 0.5076*** | 7.2607*** |
| H           | 0.2383 | 0.0163             | 0.2256**  | 5.1523*** |
| CZR         | 0.0612 | 0.0150             | 0.0512    | 6.8393*** |
| WH          | 0.0660 | 0.0150             | 0.0668*** | 6.6393*** |

Note: *, ** and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel B: Pandemic Period

| Corporation | Mean | Standard Deviation | Skewness | Kurtosis |
|-------------|------|-------------------|----------|----------|
| HLT         | 0.1028 | 0.0330             | 0.0901  | 3.2359*** |
| MGM         | 0.2483 | 0.0609             | 0.0100  | 8.9456*** |
| PK          | 0.2009 | 0.0190             | 0.6730***| 8.1600*** |
| MAR         | 0.1055 | 0.0324             | 0.5326***| 3.7324*** |
| MTN         | 0.0511 | 0.0304             | 1.7429** | 2.5277*** |
| CHH         | 0.0707 | 0.0202             | 0.5419***| 4.5257*** |
| LVS         | 0.0511 | 0.0150             | 0.4655***| 2.7657*** |
| WYNN        | 0.1565 | 0.0150             | 0.4974***| 2.7657*** |
| H           | 0.0918 | 0.0150             | 0.4974***| 2.7657*** |
| CZR         | 0.1368 | 0.0150             | 0.4974***| 2.7657*** |
| WH          | 0.1248 | 0.0150             | 0.4974***| 2.7657*** |

Panel C: Post-COVID Period

| Corporation | Mean | Standard Deviation | Skewness | Kurtosis |
|-------------|------|-------------------|----------|----------|
| HLT         | 0.0569 | 0.0150             | 0.1265  | 3.2359*** |
| MGM         | 0.1196 | 0.0150             | 0.1605  | 8.9456*** |
| PK          | 0.0519 | 0.0150             | 0.2435  | 8.1600*** |
| MAR         | 0.1290 | 0.0150             | 0.2606  | 3.7324*** |
| MTN         | 0.0695 | 0.0150             | 0.0023  | 4.5257*** |
| CHH         | 0.1341 | 0.0150             | 0.0076  | 2.7657*** |
| LVS         | 0.3288 | 0.0150             | 0.3481  | 2.7657*** |
| WYNN        | 0.1604 | 0.0150             | 0.0199  | 2.7657*** |
| H           | 0.1248 | 0.0150             | 0.0512  | 2.7657*** |
| CZR         | 0.1234 | 0.0150             | 0.0199  | 2.7657*** |
| WH          | 0.3481 | 0.0150             | 0.0512  | 2.7657*** |

Note: *, ** and *** denote significance at the 10%, 5%, and 1% level, respectively.

As mentioned in the section on model specifications, the total conditional variance is decomposed into GARCH (permanent and transitory) and jump conditional variances. Observing the results of Table 6, the permanent component still dominates the total conditional variance for all companies during the pandemic period.

For robustness analysis of whether or not an ESG-committed hotel corporation is a safe-haven asset during the pandemic period, portfolios are formed to examine whether portfolio returns are statistically significantly different when sorting hotel stocks in ascending order according to their jump intensities, permanent, and transitory components. Portfolio 1 (3) is the portfolio of companies with the lowest (highest) jump intensities, permanent components, or transitory components, each portfolio consists of three hotel companies. Row “1–3” refers to the difference in time-series parameters between portfolio 1 and portfolio 3. The results of Table 7 show that the portfolio with lower transitory component has a statistically higher return than does the portfolio with higher transitory component by 0.05% at 5% significance level during the pandemic period.

5. Discussion and implications

By examining the hotel corporations’ revenues and market values from 2019 to 2021 (as of June 2021), it is clear that approximately half of the sampling hotel corporations have not yet recovered from the lockdowns and travel restrictions of the COVID-19 crisis. Our results support the argument that most of the recent literature on the impact of COVID-19 fails to recognize the duration of COVID-19’s impact; as a result, the actual impact of by the crisis is weakened in terms of demonstrating sampling hotel corporations’ financial performance. Besides, although the lodging market values plummeted by as much as 58% during the pandemic period (Lockhead, 2022), in 2021, the CZR hotel chain had the largest gain in market capitalization – 463.84% – which could be ascribed to its acquisition event in July 2020, while CZR’s net income remains lacklustre in 2021 in demand for casino hotels remains low throughout COVID-19. Additionally, we found that large hotel corporations’ stock performance and revenues exhibit a more resilient recovery, particularly when the hotel is committed to ESG practices.
Compared to pre-COVID stock performance, the sampling hotel corporations’ standard deviations (risks) significantly increase, and the levels of risk nearly double or even triple during the pandemic period. Throughout the pre-COVID and pandemic periods, the stock return series for most of the sampling hotels are high-peaked, fat-tailed, and non-normally distributed, showing that the ARCH effect is present in stock returns and arguing for the use of the ARJI-trend model in this study. Certain hotels with higher standard deviations may have a greater conditional jump in intensity or size. The returns are less variable during the post-COVID period, indicating that the COVID-19 pandemic period determination is appropriate for fitting ARJT-trend model estimations. As illustrated in Fig. 1a and b, stock values plummeted by more than
50% in March 2020, suggesting that the sampling hotels experienced significant fluctuation in their returns throughout the pandemic era. After several months of stock market recession, prices have rebounded, and COVID-19 vaccines became available in November 2020, which could have driven gains in hotel stock prices. After March 2021, stock values rebounded to 2019 levels.

5.1. Parameter estimations of ARJI-trend model

5.1.1. Effects of the COVID-19 on hotel stock returns

Without regard for the ESG metric scores, this study begins by analyzing the return volatility patterns of U.S. hotel corporations over the pandemic period. Other GARCH family models, including GARCH (1,1), component-GARCH, and GARCH-Jump with constant jump intensity and size, as well as exponential GARCH (EGARCH) models, are also used to assess model robustness, and the likelihood (LR) ratio test is applied. The LR tests for the sampling hotels indicate that these GARCH family models are rejected at the 1% significance level, whereas the ARJI-trend model has the best goodness-of-fit.\(^\text{16}\)

Given the model coefficients, \(\phi_1\) is significantly positive or negative, implying that serial correlation exists in hotel stock returns, the weak-form efficient market hypothesis does not hold true during the pandemic, and the hotel stock return may exhibit clustered volatility. The permanent (trend/long-run) component \(\rho\) of the GARCH conditional variance represents exhibits degrees of volatility persistence. The \(\rho\) values of WYNN, HLT, and H are smaller (0.6555, 0.6757, and 0.6820) – indicating that the sampling hotels exhibit a faster convergence speed and lower persistence than do the other companies.\(^\text{17}\)

For the long-run half-life measurement: \(LR_{\text{HI}}(\rho) = \log(0.5)/\log(\rho)\), the half-life of permanent response to a shock is the shortest in WYNN, suggesting that the influence of news shock on WYNN almost dies away in two days during the pandemic period. At the same time, the news shock results in greater long-run persistency for both LVS (14.69 trading days) and CHH (8.32 trading days), and the stock return volatility converges slowly to the steady state. When the sum of \(\alpha + \beta\) (transitory component) is closer to 1, the short-run influence is projected to drop more slowly, but values closer to 0 have the opposite effect. Therefore, the value (\(\alpha + \beta\)) is a measure of how long this decline from the short-run influence is. The sums of \(\alpha + \beta\) for most of the sampling hotels are around 0.7 to 0.9, and the smallest value of \(\alpha + \beta\) is 0.7524 for HLT. We discover that some hotel corporations had unique characteristics in

\(^{16}\) The results of GARCH family models are available upon request.

\(^{17}\) The permanent conditional volatility exhibits long memory when \(\rho\) is significant and closer to 1.
terms of shorter long-run half-life measurement and short-run influence, which might be attributed to their ESG performance since investors terms of shorter long-run half-life measurement and short-run influence, which might be attributed to their ESG performance since investors potentially more defensive since their stock returns recover to their returns tend to deviate from their fundamental values and take longer to C.-D. Chen et al. potentially more defensive since their stock returns recover to their hotel stocks, we find that hotels with better ESG performance are adverse effects of COVID-19 on their stock performance, hence preser

Table 5
Results of ARJI-trend Model with ESG metric scores during the COVID-19 Pandemic Period. This table shows the results of ARJI-trend model 1b involving COVID-19 only. Due to limited space, we only show the estimated coefficients and standard errors. Model 1 constructed by this paper is expressed as: \( R_t = \rho_0 + \rho_1 R_{t-1} + \rho_2 ESG + \sqrt{\hat{\sigma}_t^2} = \sum_{k=1}^{\infty} \sigma_k (1-b) h_k + \omega_0 + \omega_1 h_{t-1} + \gamma ESG + \phi_k (\sigma_0 Z_{t-k} + \sum_{k=1}^{\infty} \sigma_k (1-b) h_k = \omega_0 + \omega_1 h_{t-1} + \gamma ESG + \phi_k (\sigma_0 Z_{t-k} + \sum_{k=1}^{\infty} \sigma_k (1-b) h_k)

| Coefficient | HLT | MGM | PK | MAR | MTN | CHH | LVS | WYNN | H | CZR | WH |
|-------------|-----|-----|----|-----|-----|-----|-----|------|---|-----|----|
| \( \rho_0 \) | 0.2680 | 0.2910 | 0.1242 | 0.2232 | 0.5679 | 0.1488 | 0.2978 | 0.2258 | 0.2238 | 0.2149 | -0.4389 |
| \( \rho_1 \) | (0.0023) | (0.0988) | (0.0006) | (0.0001) | (0.0919) | (0.0058) | (0.0028) | (0.0001) | (0.0001) | (0.0112) | (0.0657) |
| \( \rho_2 (ESG) \) | -0.2818 | -0.0416 | 0.1853 | 0.6555 | -0.2489 | 0.0521 | -0.1466 | 0.1199 | 0.1327 | 0.1207 | 0.2182 |
| \( \phi_0 \) | 0.0047 | 0.0023 | 0.0039 | 0.0028 | 0.0111 | 0.0010 | 0.0087 | 0.0012 | 0.0009 | 0.0001 | 0.0015 |
| \( \phi_1 \) | (0.0001) | (0.0013) | (0.0001) | (0.0001) | (0.019) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0007) | (0.0001) |
| \( \phi_2 \) | 0.2206 | 0.0319 | 2.1549 | 0.1682 | 0.5897 | 0.4947 | 0.0966 | 0.0564 | 0.0630 | 0.6454 | 0.5422 |
| \( \alpha \) | 0.8886 | 0.0345 | 0.0844 | 0.0137 | 0.0769 | 0.2007 | 0.2742 | 0.0911 | 0.0738 | 0.0506 | 0.3364 |
| \( \beta \) | 0.5416 | 0.7812 | 0.7339 | 0.5685 | 0.6099 | 0.4668 | 0.0637 | 0.5490 | 0.5126 | 0.4641 | 0.4149 |
| \( \rho \) | 0.6528 | 0.9058 | 0.8515 | 0.6539 | 0.9081 | 0.8568 | 0.9489 | 0.6523 | 0.6660 | 0.7352 | 0.8946 |
| \( \zeta \) | -0.3586 | -0.0662 | -0.0318 | -0.2642 | 0.5882 | -0.2506 | -0.3124 | -0.0973 | -0.3311 | -0.2959 | -0.3603 |
| \( \delta_0 \) | 0.0295 | 1.9602 | 0.9070 | -1.1288 | 7.0343 | -2.5201 | -0.3411 | 2.8093 | 1.6426 | 2.9420 | 5.1288 |
| \( \delta_1 \) | (0.0007) | (0.2491) | (2.8010) | (0.0223) | (2.4832) | (0.4159) | (0.0046) | (0.0367) | (0.2775) | (0.2685) | (0.2278) |
| \( \tau \) | 0.9846 | -0.2746 | 0.6729 | 0.7355 | -0.9714 | 0.5681 | 0.8615 | 0.1371 | -0.0717 | 0.6306 | 0.5852 |
| \( \gamma \) | -0.2723 | 0.4732 | 0.0642 | 0.2146 | -0.0186 | 0.5890 | 0.2138 | 0.2422 | -0.0731 | 0.4193 | 0.2364 |
| \( Q(4) \) | 34.91*** | 8.05* | 29.42*** | 12.54** | 5.48 | 0.66 | 27.68*** | 33.70*** | 59.70*** | 127.69*** | 38.69*** |
| \( Q^2(4) \) | 92.39*** | 68.59*** | 379.58*** | 35.21*** | 0.15 | 0.55 | 21.11*** | 181.58*** | 96.99*** | 89.76*** | 10.65*** |
| Log\( \text{L} \) | -296.15 | 349.04 | -318.42 | -292.76 | -498.03 | -250.24 | -306.41 | -412.03 | -267.17 | -147.73 | -201.34 |

Notes: See Table 4.

Table 6
Decomposition of total conditional variance (on average) of ARJI-trend model 1b.

|            | HLT | MGM | PK | MAR | MTN | CHH | LVS | WYNN | H | CZR | WH |
|------------|-----|-----|----|-----|-----|-----|-----|------|---|-----|----|
| Total Conditional Variance | 1.30 | 1.47 | 2.74 | 1.77 | 4.66 | 1.92 | 2.60 | 1.24 | 1.47 | 2.97 | 1.89 |
| GARCH Conditional Variance |       |     |    |     |     |     |     |      |   |     |    |
| Permanent Component | 0.90 | 0.88 | 1.62 | 0.84 | 2.26 | 0.97 | 1.53 | 0.76 | 0.83 | 1.63 | 0.74 |
| Transitory Component | 0.20 | 0.29 | 0.68 | 0.43 | 1.42 | 0.39 | 0.73 | 0.36 | 0.24 | 0.84 | 0.62 |
| Conditional Jump Variance | 0.21 | 0.30 | 0.24 | 0.51 | 0.98 | 0.57 | 0.14 | 0.12 | 0.40 | 0.51 | 0.53 |

investigate whether ESG-committed hotels can be more resilient to the adverse effects of COVID-19 on their stock performance, hence preserving stockholder value. If so, the ESG-committed hotel could function as a safe-haven asset during the crisis.

Furthermore, the transitory volatility component (\( \alpha \)) is larger than that of permanent volatility, suggesting that the shock impact on the transitory volatility component is greater than the permanent volatility component (most of the \( \zeta \) coefficients are negative). The result makes intuitive sense since the transitory volatility component captures the temporary volatility of stock returns caused by noise trading and/or speculative investments due to the COVID-19, and such trading behaviors are extremely sensitive to news shocks. Most hotel corporations in the tourism sector are typically more speculative due to the COVID-19, hence preserving stockholder value. If so, the ESG-committed hotel could function as a safe-haven asset during the crisis.
The coefficients of serial correlation $\phi_1$ are greater when ESG metric scores are included in the model than when it is not, showing a stronger serial correlation of stock return. The coefficients of ESG ($\phi_2$) are all significantly positive, indicating that ESG metric scores are positively related to stock performance for these hotel corporations during the pandemic period. We could argue that a higher ESG rating benefits a hotel corporation’s stock and appears to gain some defensive characteristics, as the higher the ESG rating, the shorter the long-run half-lives.

### 5.1.2. Effects of ESG performance on hotel stock returns during the pandemic period – test of hypotheses 1 and 3

The primary goal of this research is to examine if hotel stock returns are less sensitive to the financial effects of COVID-19 when the hotel corporations are preferably committed to ESG – that is, if a hotel corporation has a higher ESG rating, it may be able to withstand the shocks of COVID-19 (denoting the feature of a defensive stock; immunity; safe-haven asset). We thus incorporate the ESG metric scores as an exogenous variable in the ARJI-trend model to analyze if higher ESG metric scores affect the dynamic linkages between stock returns in terms of the permanent and transitory components and the conditional components jump intensity during the pandemic.

The coefficients of serial correlation $\phi_1$ are greater when ESG metric scores are included in the model than when it is not, showing a stronger serial correlation of stock return. The coefficients of ESG ($\phi_2$) are all significantly positive, indicating that ESG metric scores are positively related to stock performance for these hotel corporations during the pandemic period. We could argue that a higher ESG rating benefits a hotel corporation’s stock and appears to gain some defensive characteristics, supporting Hypothesis 1 (H1). However, because a hotel corporation’s ESG metric scores can change depending on its ESG engagement, this evidence leads us to wonder if and how the permanent and transitory components and the jump behavior of stock return dynamic a hotel corporation’s ESG performance are taken into account.

When we look at the coefficient of permanent component, we see that the $\rho$ is smaller when a hotel corporation has a higher average ESG metric scores; yet we find a greater long-run volatility persistence for hotel corporations with lower ESG metric scores because their $\rho$ estimations are still higher. When the effects of a hotel corporation are compared between Models 1a and 1b, the $\rho$ values all become smaller, indicating a faster convergence (the half-life of a permanent response to a shock) when involving the effects of the hotel corporation’s ESG performance. More specifically, for hotel corporations with better ESG ratings, long-run half-life measures fall by around 10%, implying that

### 5.1.3. Decomposition of total conditional variance under model 1b and robustness analysis – test of Hypothesis 2

The effects of the transitory component are smaller than those of the permanent component when the total conditional variance is decomposed into GARCH (permanent and transitory) and jump conditional variances. However, the permanent component still dominates the total conditional variance for all sampling hotel corporations during the pandemic period because the transitory component is reduced more effectively when the model includes the hotel corporation’s ESG metric scores. For example, if a hotel corporation is devoted to ESG, its idiosyncratic risk may decrease.

Portfolios are formed to examine whether portfolio returns are significantly different when sorting hotel stocks in ascending order according to their jump intensities, and their permanent and transitory components. To confirm the estimation robustness for the hotel corporation to be more immune during the crisis period while involving their ESG performance. The results reveal that the portfolio with the lower transitory component has a statistically higher return than the portfolio with the higher transitory component. Hence, the results confirm Hypothesis 2 (H2), in which a hotel corporation with a high ESG rating and a low transitory component could be a safe-haven asset during a crisis. Based on the information presented here, we can conclude that COVID-19 is the most likely cause of severe short-term return volatility. The
6. Conclusion, limitation, and direction for future research

Sustainability has become an explicit mainstream concept, institutionalizing the focus on the hospitality business. The COVID-19 affected the transition to financial market investing in a variety of ways. COVID-19 wreaked unparalleled economic havoc and contributed to a breakdown in global collaboration, both of which have been detrimental to the hotel industry. At the same time, the pandemic created an opportunity to restructure the political economics of hotel management.

The purpose of this study is to analyze the permanent and transitory components of hotel corporation stock return volatility induced by the hotels’ ESG performance during the COVID-19 pandemic. The findings demonstrate that the ARJI-trend model accurately describes the patterns of permanent and transitory return volatility during the pre-COVID, pandemic, and post-COVID eras. If a hotel corporation is strongly committed to ESG, the transitory component of its stock can be reduced during the pandemic until the transitory component becomes smaller than the permanent component. In other words, a hotel with a higher ESG rating is less susceptible to the negative effects of COVID-19, and this type of hotel stock is to be considered a safe-haven asset and more immune to investment during the crisis period.

The following restrictions apply to this study. The sample in this study is limited to 11 hotel corporations/groups since several hotel corporations are traded on the over-the-counter market and have either no or insufficiently long ESG data. Additionally, it is impossible to evaluate ESG performance across sectors within the travel and hospitality industries, as there are no ESG metric scores that reflect a sector’s total ESG performance. When developing an ESG framework and determining the proper ESG practices for various hotel corporations, we may explore applying environmental, social, or governance ratings separately to determine whether these three components of ESG help hotel corporations in different ways. In future research, we should also broaden our sampling firms to include more sectors of the travel and hospitality industries, such as airlines, travel and leisure, and restaurants.

Credit author statement

Chun-Da Chen: Conceptualization; Methodology; Software; Formal analysis; Data curation; Writing – original draft; Writing – review & editing.; Ching-Hui (Joan) Su: Writing – original draft; Writing – review & editing; Writing – Revision of the final draft.; Ming-Hsiang Chen: Methodology; Structure – Final draft; Writing – Revision of the final draft.

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Impact statement

While most businesses expect value creation via sustainability stewardship, quantifying the benefits of implementing sustainability practices in the travel and hospitality industries is still in its infancy and requires additional investigation. This study uses ESG to quantify how hotels incorporate sustainability activities into their operations; in other words, ESG reflects a corporation’s engagement in the internalization of external cost and capitalization of social contribution. We provide informative evidence by applying a constructive model to demonstrate how ESG can enable stakeholders to assess a business’s sustainability credentials, with particular emphasis on the long- and short-run effectiveness of ESG performance, and to strengthen theoretical foundations.

Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research.
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