11-1-2021

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Maksim Godovykh
University of Central Florida, maksim.godovykh@ucf.edu

Jorge Ridderstaat
University of Central Florida, Jorge.Ridderstaat@ucf.edu

Carissa Baker
University of Central Florida, carissa.baker@ucf.edu

Alan Fyall
University of Central Florida, alan.fyall@ucf.edu

Original Citation

Godovykh, M., Ridderstaat, J., Baker, C., & Fyall, A. COVID-19 and Tourism: Analyzing the Effects of COVID-19 Statistics and Media Coverage on Attitudes toward Tourism. *Forecasting* 2021, *3*(4), 870-883; https://doi.org/10.3390/forecast3040053

forecasting

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COVID-19 and Tourism: Analyzing the Effects of COVID-19 Statistics and Media Coverage on Attitudes toward Tourism

Maksim Godovykh *, Jorge Ridderstaat, Carissa Baker and Alan Fyall

Rosen College of Hospitality Management, University of Central Florida, Orlando, FL 32819, USA; Jorge.Ridderstaat@ucf.edu (J.R.); carissa.baker@ucf.edu (C.B.); alan.fyall@ucf.edu (A.F.)
* Correspondence: maksim.godovykh@ucf.edu

Abstract: COVID-19 has significantly influenced tourism, including tourists' and residents' attitudes toward tourism. At the same time, attitudes and consumer confidence are important for economic recovery in the tourism sector. This study explores the effects of the COVID-19 pandemic on people's attitudes toward tourism by analyzing time-series data on the number of COVID-19 positive cases, vaccinations, news sentiment, a total number of daily mentions of tourism, and the share of voice for positive and negative sentiment toward tourism. The applied data analysis techniques include descriptive analysis, visual representation of data, data decomposition into trend and cycle components, unit root tests, Granger causality test, and multiple time series regression. The results demonstrate that the COVID-19 statistics and media coverage have significant effects on interest in tourism in general, as well as the positive and negative sentiment toward tourism. The results contribute to knowledge and practice by describing the effects of the disease statistics on attitudes toward tourism, introducing social media sentiment analysis as an opportunity to measure positive and negative sentiment toward tourism, and providing recommendations for government authorities, destination management organizations, and tourism providers.

Keywords: tourism; attitudes; COVID-19; sentiment analysis; time-series analysis

Citation: Godovykh, M.; Ridderstaat, J.; Baker, C.; Fyall, A. COVID-19 and Tourism: Analyzing the Effects of COVID-19 Statistics and Media Coverage on Attitudes toward Tourism. *Forecasting* **2021**, *3*, 870–883. https://doi.org/10.3390/forecast3040053

Academic Editor: João Paulo Ramos Teixeira

Received: 7 October 2021
Accepted: 15 November 2021
Published: 17 November 2021

1. Introduction

Infectious disease crises are major risks to economic growth [1]. Past infectious diseases (including previous coronaviruses such as SARS and MERS) have likewise been detrimental to the tourism sector [2,3]. These previous crises demonstrated the fragile nature of tourism [4] and the concerns of spreading viruses through the human interactions inherent in hospitality and tourism [5]. Like previous pandemics, COVID-19 had an immediate and destructive impact on the tourism industry [6]. Pandemics overall lead to a significant decline in tourist arrivals [7], and the spread of COVID-19 preceded a damaging fall in international tourism worldwide [8]. Supply, demand, spending, and consumer confidence have all eroded during the COVID-19 pandemic [9].

The consumer confidence aspect of travel is important for economic recovery in the tourism sector, and confidence is understood by measuring attitudes [10]. Attitudes are predispositions toward a subject (such as a tourist destination) that cause them to react in a consistent way [11,12]. Attitudes toward tourism vary depending on cognitive, sociocultural, affective, and individual factors. Though attitudes may differ from the real impacts that a visitor would encounter, they influence both behavioral intentions and real behavior in choosing travel [12]. The theory of planned behavior posits that behavioral intentions can be predicted by understanding the attitudes, subjective norms, and perceived behavior controls [13]. To understand behavioral intentions, including the choice to travel to a destination, it is, thus, important to grasp attitudes.

Despite its significance, it is not easy to measure attitudes, especially across a broad section of visitors. There are no easily accessible secondary data sets regarding attitudes

toward tourism. One way to measure the attitudes of a large swath of people is through social media analytics. More than 55% of the global population utilizes social media actively, with penetration in several world markets [14]. In sentiment analysis, negative or positive word polarity is mined along with other language attributes that allow researchers to interpret consumer loyalty, interest, or brand sentiment [15]. Considering the frequent and easy use of social platforms, sentiment on social media provides some of the most up-to-date information [16]. Sentiment analysis is a way to gauge peoples' attitudes quickly and account for change over time. Furthermore, several recent studies suggested that online sentiment can be used as an indicator of tourism demand [17–19]. Therefore, it is important to model and forecast future tourism demand by exploring the effects of COVID-19 statistics on sentiments toward tourism.

COVID-19 had an instant impact on tourism, and it is possible that it also had an impact on sentiment over time. This study aims to explore the effects of COVID-19 statistics on people's attitudes toward tourism by using time-series analysis of COVID-19 statistics and social media sentiment toward tourism. The study analyzes secondary data over a two-year time period on COVID-19 positive cases, COVID-19 vaccination rates, news sentiment, and social media sentiment. The results contribute to the knowledge and practice by describing the effects of the COVID-19 statistics on attitudes toward tourism, introducing social media sentiment analysis as an opportunity to measure positive and negative sentiment toward tourism, and providing recommendations for government authorities, destination management organizations, and tourism providers.

2. Literature Review

2.1. Tourism Impacts and Resident Support for Tourism Development

Tourism impacts destination communities in several ways that may influence sentiment. Tourism's positive outcomes in a community include cultural exchange and economic benefits, such as employment rate, increased economic activity, infrastructure for commerce, and a higher quality of life [20–22]. Nonetheless, tourism may also cause conflict over resources, degradation of the physical environment, and negative social effects, such as the introduction of crime [23–25]. Tourism may have simultaneous impacts, as is the case with ethnic tourism, which may assist with cultural preservation but also lead to commoditization and inaccurate representation [26]. Similarly, major economic benefits may come to a community from tourism development, but communities may be impacted by gentrification or displacement [27].

Those within a destination community have a range of potential reactions to tourism. Gursoy and Rutherford [28] found that multiple factors influence host community perception: level of community concern, involvement in tourism, community attachment, the state of the local economy, economic and social benefits, and socio-cultural costs. Several theories have been developed to approach the study of tourism impacts. These include the equity theory, wherein residents perceive a positive effect if there is a balance between positive and negative consequences or a preponderance of positive; the growth machine theory, with some stakeholders maximizing personal economic returns; the lifecycle theory, a multi-stage process wherein attitudes change as tourism goes through its lifecycle; the power theory, where personal power to exploit exchanges impacts the perception of tourism development; and the social exchange theory, where actions are motivated by expected returns, including profit [29]. Even within resident communities, personal and demographic factors (age, gender, income, education, location, etc.) result in the perception of positive or negative impacts. Macro characteristics, such as the change of place attributes over time, are also predictors of evolving attitudes [30]. Though it is difficult to predict resident attitudes toward tourism because of the complexity of community systems and their "disparate variables" [31], it is still possible to detect patterns.

2.2. Traveler Attitudes toward Tourism

Over the years, several theories and models have been developed to understand the motivation of the traveler. Socio-psychological motivations for travel include education, escape, kinship relationships, novelty, prestige, relaxation, regression, self-exploration, and social interaction [32]. Both sociological and psychological reasons for travel have been studied extensively, though both approaches have drawbacks [33]. Maslow's classic hierarchy of needs, which positions self-actualization at the top of a pyramid with physiological needs on the bottom, forms the foundation for several tourism principles despite its simplistic construction. Modified pyramids have been constructed over the years that have added additional levels, but every version of the pyramid includes "safety and security" as a basic human need [33]. Travel inherently poses risks to basic safety and security needs, with financial, psychological, social, functional, and time risks [34].

Health risk perceptions have become an important factor influencing tourists' behavior during the COVID-19 pandemic [35]. The perceived risk theory encompasses uncertainty and perceived consequences in consumer behavior with several types of defined risk, including social, physical, psychological, etc. [36]. The theory helps explain how consumers view risk in purchase decisions as well as risk perception's impact on behavioral intentions; consumers are less likely to purchase if there is uncertainty and a perceived potential for loss or unhappiness [37]. Mitchell [36] defines physical risk as "the risk that the performance of the service will result in a health hazard to the consumer" (p. 27). Since tourism is the potential service, it follows that COVID-19 can be interpreted as a health hazard and that consumer perception of risk would be higher during a pandemic.

2.3. Sentiment Analysis as a Measure of People's Attitudes

In tourism research, attitudes are particularly important for understanding intentions. In a prior study during the pandemic [38], attitudes had the strongest effect on the intention to travel or not, even amongst at-risk group members. Sentiment analysis, or opinion mining, allows researchers to analyze people's attitudes and emotions expressed in written text [39]. It enables scholars or industry practitioners to learn more about participants' sentiments and trends related to interests or behavioral intentions. Social media sentiment analysis specifically is a way to gather the attitudes of a large group of people by using algorithms to mine social platforms [40]. It can be used to recognize consumer behavior for businesses or identify social phenomena that impact public perception.

Social media sentiment analysis allows agencies to examine public sentiment in a way that can help change public policy. For example, researchers analyzed Tweets about the COVID-19 vaccine to capture public perceptions so that future communications could be shaped to address prevalent concerns or misinformation [41]. In a study analyzing selected Twitter posts, Nemes and Kiss [42] found that sentiment toward COVID-19 was largely negative. Using a time-series analysis of sentiment related to tourism during the pandemic period can connect tourism attitudes and the perception of risk that COVID-19 produced.

2.4. The Effects of COVID-19 on Attitudes towards Tourism

The COVID-19 pandemic posed an immediate risk to the tourism industry and instantly altered travel-related decision making. Unlike in previous pandemics, which were more gradual, most of the world's markets were faced with pandemic-related hardships concurrently. Most sectors of the service industry found themselves impacted by government lockdowns, quarantines, capacity limits, and travel hesitancy prior to vaccinations. Though the pandemic had a correlation with better air quality [43], it had negative impacts related to economic activity, unemployment, revenue loss, and business closure [44]. In tourist destinations especially, concerns surrounded communal health and wellbeing diminishing because of tourists and likewise the economic detriment of tourism cessation, illustrating the consistently equivocal social impacts that tourism has on communities [45].

In addition to altering people's ways of life and the economic condition of a community, the pandemic quickly changed perceptions of tourism. COVID-19 had an influence on

perceived risk, but it is also significant to note that the pandemic presented an actual risk, with both inbound and outbound tourism accounting for higher levels of infection and death prior to vaccination regimens [46]. Residents of tourist locales have attitudes toward tourism that illustrate concerns about the virus mingling with understanding economic impacts [47]. In one study [48], residents were concerned about the return of tourists; their perceived risk of infections decreased their general support for tourism and emotional solidarity. In another study [49], researchers found that risk perceptions influenced the perception of recreation site quality and that the pandemic had a negative impact on visits. Both travel behavior and economic values were changed because of the pandemic's impact on attitudes. Considering the potential effects of people's perceptions of the COVID-19 pandemics on attitudes toward tourism, this study hypothesizes that COVID-19 statistics (the number of positive cases, vaccinations) influence attitudes toward tourism.

3. Methods

The first data point used in the study is the number of COVID-19 positive cases in the United States. The data on COVID-19 cases and the number of vaccinated people were obtained from the Centers for Disease Control and Prevention COVID Data Tracker [50]. The data on COVID-19 cases from the CDC provide case and death totals reported through 60 U.S.-affiliated jurisdictions at the state and county level. The daily data on COVID-19 cases in the U.S. are presented in Figure 1. The visual assessment of the data demonstrates the zero level of reported COVID-19 cases in the U.S. before March 2020, the increasing trend of COVID-19 cases from March 2020 to February 2021, then the decrease in COVID-19 cases from February 2021 to August 2021, and a new wave of positive cases beginning August 2021.

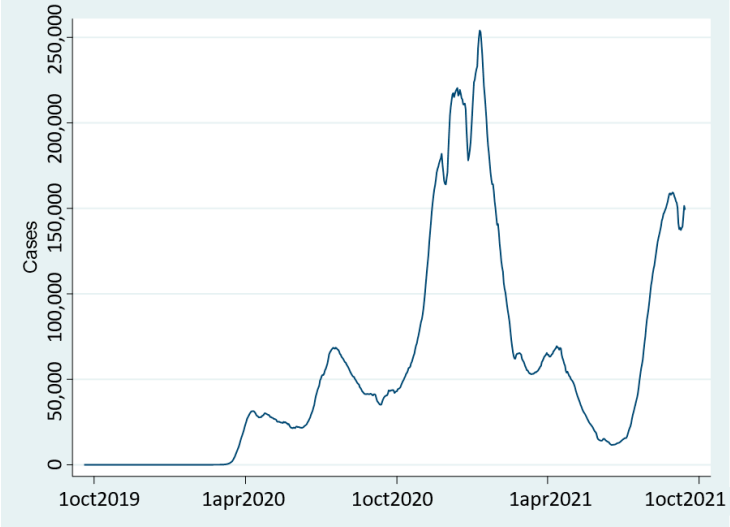

Figure 1. COVID-19 cases.

Next, the data on U.S. vaccinations were collected from the COVID Data Tracker [50]. The COVID data tracker represents data individually by each agency and includes vaccination data into national progress metrics. The number of fully vaccinated people represents individuals who have received a second dose of the vaccine (primarily Pfizer-BioNTech or Moderna) or one dose of Johnson and Johnson's Janssen vaccine [50]. The daily data on COVID-19 vaccinations are demonstrated in Figure 2. The visual assessment of the data demonstrates the zero level of vaccinated people in the U.S. before December 2020, the increasing vaccinating trend from December 2020 to April 2021, with the following decrease in the number of vaccinated people per day after April 2021.

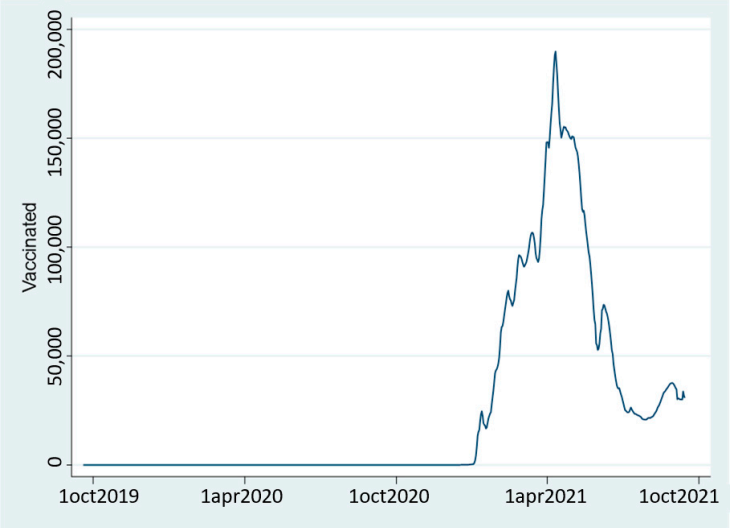

Figure 2. COVID-19 vaccinations.

The daily data on news sentiment were obtained from the Daily News Sentiment Index [51]. The news sentiment scores were developed from economics-related news articles in major U.S. newspapers, including *The New York Times* and *The Washington Post* by using the news aggregator service Factiva [52]. The daily data on news sentiment score in the U.S. are expressed in Figure 3. The news sentiment score decreased from January 2020 to May 2020, which might be explained by the beginning of the global COVID-19 pandemic, and then increased after May 2020.

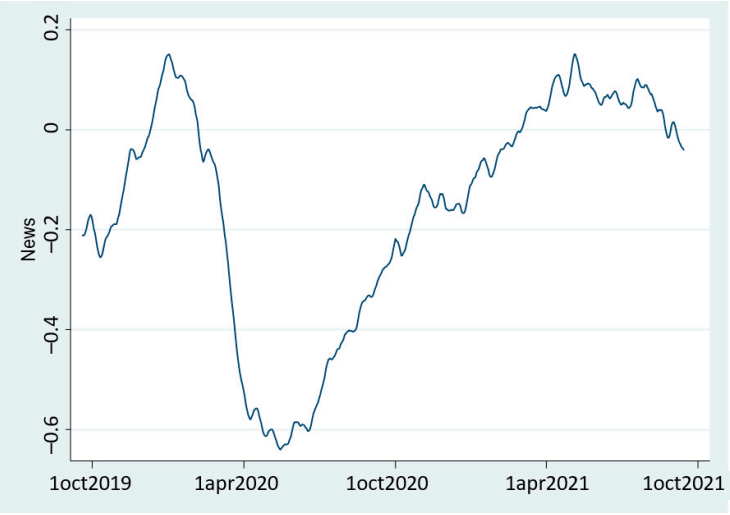

Figure 3. News sentiment.

The data on attitudes toward tourism were collected from social media sentiment analysis. Sentiment analysis helps to evaluate attitudes and emotional states from different communication sources [53]. The data on attitudes towards tourism were obtained by using a social media listening platform (using the search term "tourism") that provides a social media library with more than a trillion historical and real-time posts across a variety of social media contexts. The total number of daily mentions of tourism in the U.S. over time was considered a proxy of interest toward tourism (Figure 4). The share of voice for sentiment towards tourism during the selected time period was considered a proxy of positive and negative attitudes toward tourism (Figures 5 and 6).

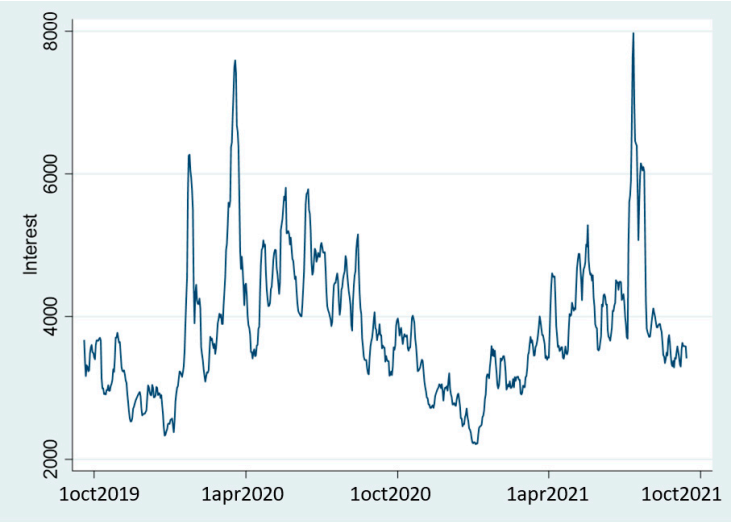

Figure 4. Daily mentions of tourism.

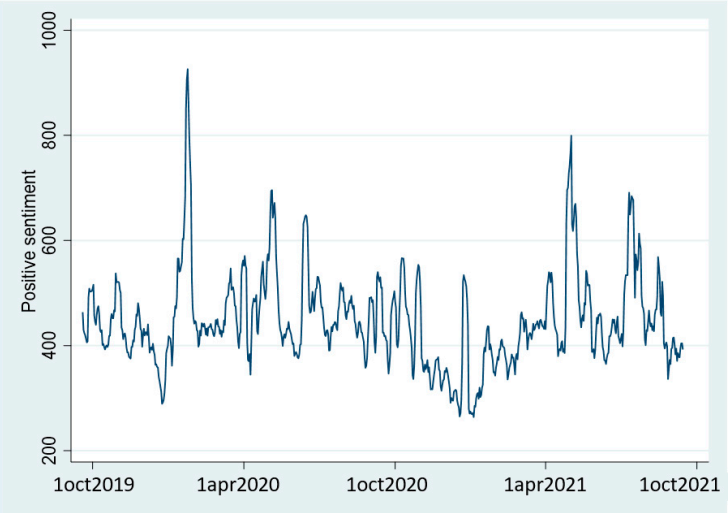

Figure 5. Positive sentiment toward tourism.

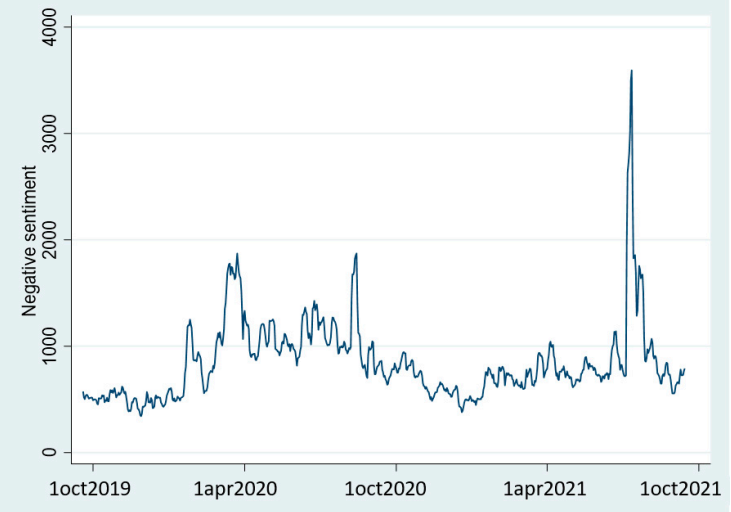

Figure 6. Negative sentiment toward tourism.

The data analysis in Stata version 16 included several stages. The descriptive analysis and visual representation of the data were applied at the first stage of data analysis. The data on COVID-19 cases, vaccinations, interest toward tourism, and positive and negative sentiment were transformed into logarithms to narrow the range of the data [54]. A 7-day moving average was used to highlight longer-term trends and cycles, as well as to smooth out short-term fluctuations of the data [55]. All data were decomposed into trend and cycle components, using the Hodrick–Prescott filter [56,57].

All variables were tested for stationarity by applying the Augmented Dickey–Fuller test and the Kwiatkowski–Phillips–Schmidt–Shin test (KPSS) unit root tests [58,59]. The Granger causality test was used to determine the ability of variables to predict future values of other variables [60]. The final stage of data analysis included using multiple time-series regression to explore the relationships between trend and cycle components of COVID-19 cases, vaccinations, news sentiment, interest toward tourism, and positive and negative sentiments toward tourism. The study applied the following models:

$$\ln \text{INTEREST}_t = \alpha_0 + \alpha_1 \times \ln \text{CASES}_t + \alpha_2 \times \ln \text{VACCINATIONS}_t + \alpha_3 \times \ln \text{NEWS}_t + \varepsilon_{1t} \quad (1)$$

$$\ln \text{POSITIVE}_t = \alpha_0 + \alpha_1 \times \ln \text{CASES}_t + \alpha_2 \times \ln \text{VACCINATIONS}_t + \alpha_3 \times \ln \text{NEWS}_t + \varepsilon_{2t} \quad (2)$$

$$\ln \text{NEGATIVE}_t = \alpha_0 + \alpha_1 \times \ln \text{CASES}_t + \alpha_2 \times \ln \text{VACCINATIONS}_t + \alpha_3 \times \ln \text{NEWS}_t + \varepsilon_{3t} \quad (3)$$

4. Results

The descriptive statistics for COVID-cases, vaccinations, news sentiment, interest towards tourism, and positive and negative sentiment toward tourism are shown in Table 1. The total number of mentions of tourism fluctuates from 2209 to 7975 mentions per day (Mean = 3822, SD = 946). The share of positive sentiment toward tourism for the selected period ranges from 0.067 to 0.211 (Mean = 0.12, SD = 0.022), while the share of negative sentiment is much higher and represents values from 0.122 to 0.477 (Mean = 0.22, SD = 0.048). The mean value of COVID-19 cases per day is 56,498 (SD = 62309), while the number of fully vaccinated people per day is 246,955 (SD = 442117). The news sentiment scores for the selected period are mostly negative and represent values from −0.640 to 0.152 (Mean = −0.155, SD = 0.230).

Table 1. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Interest	727	3822.343	946.5366	2209	7975
Positive sentiment	727	0.1201	0.0219502	0.0673491	0.2105171
Negative sentiment	727	0.2159	0.0475	0.1224687	0.4772551
COVID-19 cases	727	56,498.32	62,309.94	0	254,014.3
Vaccinations	727	246,955.5	442,117.6	0	1,898,309
News	727	−0.155122	0.2299361	−0.6402459	0.1515863

The augmented Dickey–Fuller (ADF) test and the Kwiatkowski–Phillips–Schmidt–Shin test (KPSS) unit root tests [58,59] were applied to test the stationarity of all variables. Tables 2 and 3 represent the results of the unit root tests for the standardized trend and cycle components of COVID-19 cases, vaccinations, news sentiment, interest toward tourism, and positive and negative sentiments toward tourism. The results show that all variables are stationary at the level form.

Table 2. Stationarity test results for trend components.

	ADF		KPSS		Integration
	Level	**First Difference**	**Level**	**First Difference**	
Interest	−56.264 ***	−14.338 ***	1.09 ***	0.793 ***	I(0) or I(1)
Positive sentiment	−34.259 ***	−17.664 ***	1.28 ***	0.774 ***	I(0) or I(1)
Negative sentiment	−14.852 ***	−16.474 ***	1.74 ***	1.33 ***	I(0) or I(1)
COVID-19 cases	−11.432 ***	−21.501 ***	1.47 ***	1.56 ***	I(0) or I(1)
Vaccinations	−93.217 ***	−34.295 ***	1.05 ***	1.17 ***	I(0) or I(1)
News sentiment	−26.010 ***	−34.759 ***	1.8 ***	0.889 ***	I(0) or I(1)

Note: The symbol *** indicates the 1% significance level.

Table 3. Stationarity test results for the cycle components.

	ADF		KPSS		Integration
	Level	**First Difference**	**Level**	**First Difference**	
Interest	−6.504 ***	−15.347 ***	0.200 ***	0.017	I(0)
Positive sentiment	−7.882 ***	−17.885 ***	0.140 *	0.008	I(0)
Negative sentiment	−7.487 ***	−17.686 ***	0.229 ***	0.009	I(0)
COVID-19 cases	−2.763 ***	−13.468 ***	0.920 ***	0.280 ***	I(0) or I(1)
Vaccinations	−3.178 ***	−8.319 ***	1.230 ***	0.898 ***	I(0) or I(1)
News sentiment	−4.806 ***	−8.108 ***	1.290 ***	0.177 **	I(0) or I(1)

Note: The symbols *, **, and *** indicate the 10%, 5%, and 1% significance levels.

The Granger causality test results are demonstrated in Tables 4 and 5. A Granger test is applied to determine whether a time series is useful for causing another time series [60]. The results show that the null hypotheses that trend components of COVID-19 cases, number of vaccinated people, and news sentiment cause trend components of interest toward tourism, positive sentiment, and negative sentiment cannot be rejected, with the exception of the effects of vaccination on interest towards tourism. The causality is strong for the effects of COVID-19 cases, vaccines, and news on positive sentiment toward tourism, as well as for the effects of news on negative sentiment toward tourism. At the same time, only the cycle component of COVID-19 cases has the potential to predict interest in tourism, while cycle components of all independent variables (COVID-19 cases, vaccines, and news sentiment) have the ability to predict future values of positive sentiment toward tourism.

Table 4. Granger causality test results with trend components.

	Lags	**Chi2**	**Prob > Chi2**
COVID-19 cases → Interest	4	6.656	0.084 *
Vaccinations → Interest	4	1.410	0.703
News sentiment → Interest	4	6.967	0.073 *
COVID-19 cases → Positive sentiment	4	13.426	0.004 ***
Vaccinations → Positive sentiment	4	42.2	0.000 ***
News sentiment → Positive sentiment	4	31.124	0.000 ***
COVID-19 cases → Negative sentiment	4	24.484	0.000 *
Vaccinations → Negative sentiment	4	6.471	0.091 *
News sentiment → Negative sentiment	4	14.703	0.002 ***

Note: The symbols * and *** indicate the 10% and 1% significance levels.

Table 5. Granger causality test results with cycle components.

	Lags	Chi2	Prob > Chi2
COVID-19 cases → Interest	2	5.294	0.071 *
Vaccinations → Interest	2	0.487	0.784
News sentiment → Interest	2	1.922	0.383
COVID-19 cases → Positive sentiment	2	5.042	0.080 *
Vaccinations → Positive sentiment	2	7.901	0.019 **
News sentiment → Positive sentiment	2	5.256	0.072 *
COVID-19 cases → Negative sentiment	2	17.744	0.418
Vaccinations → Negative sentiment	2	4.56	0.102
News sentiment → Negative sentiment	2	0.749	0.688

Note: The symbols * and ** indicate the 10% and 5% significance levels.

The regression results demonstrate the significant effects of trend components of COVID-19 cases, vaccinations, and news sentiment on interest toward tourism and positive sentiment toward tourism. The number of COVID-19 cases negatively affects people's interest in tourism. A 1% growth in COVID-19 cases has an estimated 0.416% decrease effect on the number of daily mentions of tourism on social media. The effects of news sentiment are also negative. A 1% increase in news sentiment score leads to a 1.25% decrease in the interest toward tourism. The influence of the number of vaccinated people on the interest in tourism is positive and significant.

The effects of trend components of daily COVID-19 cases and the number of vaccinated people on positive sentiment toward tourism is negative and significant. A 1% increase in COVID-19 cases leads to a 0.091% decrease effect on the positive sentiment, while a 1% increase in the number of vaccinations has an estimated 0.84% decrease effect on the positive sentiment. News sentiment positively affects positive sentiment toward tourism ($\beta = 1.070$ ***).

The influence of trend components of COVID-19 cases and news sentiment also have significant effects on negative sentiment toward tourism, while the influence of trend components of vaccinations on negative sentiment is not significant. A 1% increase in trend components of COVID-19 cases leads to a 0.657% increase in trend components of negative sentiment toward tourism, while a 1% increase in trend components of news sentiment has an estimated 0.405% decrease effect on the trend components of negative sentiment.

The results also demonstrate significant effects of cycle components of COVID-19 cases on interest toward tourism ($\beta = -0.179$ ***) and negative sentiment ($\beta = 0.657$ ***), the significant effects of cycle components of vaccination on positive sentiment toward tourism ($\beta = 0.090$ **), as well as the negative effects of cycle components of news sentiment on interest toward tourism ($\beta = -0.126$ *). However, considering the Granger causality test results, only the effects of the cycle components of COVID-19 cases on interest toward tourism and the influence of cycle components of the number of vaccinated people on positive sentiment toward tourism should be taken into account. The estimated effects of COVID-19 statistics and news sentiment on attitudes toward tourism are shown in Table 6.

Table 6. Estimated effects of COVID-19 statistics and news sentiment on attitudes towards tourism.

	Interest		Positive Sentiment		Negative Sentiment	
	Trend $R^2 = 0.456$; F = 202.46	**Cycles $R^2 = 0.020$; F = 4.97**	**Trend $R^2 = 0.695$; F = 550.87**	**Cycles $R^2 = 0.012$; F = 2.89**	**Trend $R^2 = 0.667$; F = 482.85**	**Cycles $R^2 = 0.027$; F = 6.77**
COVID-19 cases	−0.4159 ***	−0.1790 ***	−0.0910 ***	−0.0298	0.6568 ***	0.2025 ***
Vaccinations	1.1099 ***	−0.0521	−0.8393 ***	0.0902 **	−0.0682	0.0338
News sentiment	−1.2594 ***	−0.1265 *	1.0704 ***	0.0375	−0.4051 ***	0.0787

Note: The symbols *, **, and *** indicate the 10%, 5%, and 1% significance levels.

5. Discussion

The COVID-19 pandemic has influenced peoples' lives in many ways, including their attitudes toward tourism. This study analyzed the effects of COVID-19 cases, the number of vaccinated people, and news sentiment on attitudes toward tourism in the U.S. by using time-series analysis. The results demonstrate that COVID-19 statistics and media coverage have significant effects on interest toward tourism, as well as the positive and negative sentiment toward tourism. The study found that the number of COVID-19 cases negatively affects people's interest toward tourism. These results can be explained by travel bans and other restrictions caused by the COVID-19 pandemic, as well as people's risk perceptions for catching the disease.

At the same time, the regression results demonstrate that the number of vaccinated people positively influenced the number of mentions of tourism in social media. These results might be explained by the notion that the presence of more vaccinated individuals will increase the opportunities to travel, thus lessening fear. Additionally, many regions or specific businesses have required proof of vaccination, which might decrease hesitancy. Simultaneously, the effects of the number of vaccinated people on positive sentiment toward tourism are negative. These effects might be attributed to obligatory travel vaccination requirements introduced by governments, tourist destinations, and tourism providers. These requirements intensified as the number of people vaccinated increased, which could be negatively perceived by travelers. On the other hand, vaccine confidence influences people's willingness to travel that in the case of travel restrictions might cause negative attitudes toward tourism. The negative effects of vaccinations on positive sentiment toward tourism demand additional investigation in cross-sectional studies.

The study results demonstrate that the influence of daily COVID-19 cases and the number of vaccinated people on positive sentiment toward tourism is negative and significant, while there is a positive relationship between the number of COVID-19 cases and negative sentiment toward tourism. Previous studies show that the spread of disease increases people's health risk perception related to travel activities. Higher levels of risk perceptions lead to lower travel intentions [35,61]. This pandemic has been punctuated by the presence of strict travel bans and variant strains that initiated additional fear or re-closures. It is no surprise, then, that greater numbers of COVID-19 cases increased the number of mentions of tourism in social media attached to negative sentiment.

The effects of the news sentiment index on interest toward tourism are negative and significant. The Daily News Sentiment Index represents sentiment scores for economic-related news articles in the U.S. [51], which increased after May 2020 due to relief payments, homeowner assistance, COVID-19 recovery funds, and other governmental resources in the U.S. However, travel restrictions remained effective in 2020–2021, which might result in lower interest toward tourism. The relationships between news media coverage and interest towards tourism demand additional investigation in future studies. On the one hand, tourists' risk perceptions are influenced by negative media coverage and framing of risk information [62,63]. On the other hand, knowledge about the current situation and availability of information might positively affect people's intentions to travel [64].

The negative effects of cycle components of COVID-19 cases on interest toward tourism can be explained by tourists' risk perceptions that are influenced by the gravity of the health risk event [62,65] and have significant effects on travel intentions [66,67]. The effects of the cycle components of the number of vaccinated people on positive sentiment toward tourism can be explained by the hope to travel in the short term. However, it is important to differentiate the long-term effects represented by trend components and short-term effects represented by cycle components. The results demonstrate different magnitudes of the coefficients in the trend and cycle equations. The effect size of the influence of trend components of COVID-19 cases on interest and sentiment toward tourism is larger than that for the cycle components, which can be explained by uncertainty related to travel opportunities in the nearest future and hope for tourism recovery in the long run.

The study results contribute to existing literature by describing additional effects of the COVID-19 pandemic on attitudes toward tourism. Specifically, the study demonstrates significant causal relationships between COVID-19 statistics and positive and negative sentiment toward tourism. Based on the theory of planned behavior, peoples' attitudes influence behavioral intentions and real behavior [68]. Therefore, it is important to explore tourists' and residents' attitudes amid the COVID-19 pandemic to predict their future travel behavior and attitudes toward tourism. It was also supportive of the perceived risk theory's focus on consumers being less likely to partake in potentially risky behavior when deciding to participate. In this case, physical and health risks were both real and perceived and impacted travel intentions.

Methodologically, the study suggests using social media sentiment analysis as an opportunity to measure the total number of daily mentions of tourism as a proxy of interest toward tourism and the share of positive and negative sentiment toward tourism as a proxy of attitudes toward tourism. These metrics can be applied in future studies of residents' and tourists' emotional states, perceptions, and behavioral intentions during and after the COVID-19 pandemic. Additionally, social media sentiment analysis can act as a forecasting device to predict future behavioral patterns based on historical sentiment data. Time series models help predict future trends in tourism based on historical patterns [69], and social media sentiment analysis using a time-series model allows us to view a larger cross-section of people and their immediate thoughts. Additionally, researchers will help reshape the industry in a post-COVID-19 world through innovative research [70], suggesting useful and obtainable methods of data collection that can benefit all stakeholders.

The study also provides important practical implications for government authorities, destination marketing and management organizations, and tourism providers. Tourism stakeholders should understand the effects of the COVID-19 statistics and news coverage on attitudes toward tourism and forecast the demand for tourism products considering the current and prospective rates of the disease. The news sentiment scores based on economics-related news articles were also found to be an important predictor of attitudes toward tourism. Governmental authorities and international organizations might affect tourists' and residents' attitudes through press releases, press conferences, social media posts, and other publicity tools. It might be also useful for destination management organizations and tourism bodies to explore the disease statistics and news sentiment index on a weekly basis and develop policies, programs, and marketing plans considering their effects of attitudes toward tourism. The previous literature describes the effects of online sentiment on tourism demand [17–20]. Therefore, the study results provide an opportunity to regress tourism demand on different sentiment measures with the moderating effects of COVID-19 statistics and generate out-of-sample tourism demand forecasts. Tourism-demand modelling demonstrated the strong impact of COVID-19 statistics on sentiment toward tourism, which will help to improve the out-of-sample accuracy of respective forecasts [71].

Using social media sentiment analysis can be considered a limitation of the study. The sentiment analysis of social media cannot capture the complexity of human language and semantic ambiguity. Though analysis is quantitatively operationalized, the posts themselves are necessarily subjective [39]. Furthermore, social media posts might also contain advertisements, spam, and bipolar texts. The limitations of COVID-19 statistics can also affect the study results. In some cases, COVID-19 causes a mild illness with immediate symptoms, which might lead to delays in COVID-19 cases reported by the Centers for Disease Control and Prevention. There are also variations in reporting techniques by different states and territories. There are likewise potential effects of confounding variables, such as people's health, previous experience, the level of involvement in tourism, etc. [72,73]. The study obtained secondary data from the COVID Data Tracker, News Sentiment Index, and social media listening tools that do not provide an opportunity to differentiate subjects based on their personal, contextual, and demographic characteristics.

To more deeply understand the meanings that people assign to their perceptions of tourism and explore the effects of additional factors, future studies should conduct interviews and cross-sectional surveys by asking questions about respondents' characteristics, attitudes toward tourism, health risk perceptions, and behavioral intentions. In addition, the study was conducted in the U.S., but the effects of COVID-19 statistics on attitudes toward tourism might be different in other countries. Previous studies found that pandemics disproportionately impacted developing countries [7,74]. Therefore, further research might replicate this study in different national and regional destinations.

Author Contributions: Conceptualization, M.G., J.R. and A.F.; Data curation, M.G.; Formal analysis, M.G. and J.R.; Methodology, M.G. and J.R.; Writing—original draft, M.G. and C.B.; Writing—review & editing, M.G., J.R., C.B. and A.F. All authors have read and agreed to the published version of the manuscript.

Funding: The authors would like to acknowledge the financial support of the UCF Seed Funding program (AWD00000898).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

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

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