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AIRLINE DISASTERS AND THE PERFORMANCE OF TOURISM AND HOSPITALITY STOCKS

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Prior research examines the link between the airline industry and the tourism industry and shows that the robustness of tourism is heavily dependent upon air transport. To further document the strength of this link, this study examines the impact of major airline disasters on the stock prices of US tourism and hospitality firms. Results show that, relative to the rest of the market, the stock prices of tourism and hospitality firms markedly decrease following major airline crashes. The negative stock price reaction is the most pronounced when examining the September 11, 2001 (9/11) terrorist attacks. However, when excluding this particular event, results continue to show that the stock returns for tourism and hospitality firms are significantly negative surrounding other large-scale airline disasters. Consistent with the existing literature that highlights the association between air transport and the tourism industry, the conclusions from this study seem to indicate that the value of tourism and hospitality firms is particularly sensitive to airline disasters.

Key words: Airline disasters; Stock prices; Terrorism; Tourism economics; Event studies

Introduction

The recent COVID-19 pandemic has highlighted the fragility of the macroeconomy in general and in particular financial markets. The pandemic, combined with other policy changes, resulted in the fastest 30% correction in the history of the US stock market (i.e., 22 trading days). Yet, certain sectors were affected much more than others. For instance, the airline industry dramatically underperformed the rest of the market, which was already in freefall by approximately 50% during the correction. Subsequently, stocks in the tourism industry also dramatically underperformed the entire market during the same period. Among the many lessons that can be learned from the recent pandemic, one such lesson points to the close interaction between the tourism and airline industries.

Prior research has suggested that air transport plays a pivotal role in the tourism and hospitality sector (Bieger & Wittmer, 2006; Chew, 1987; Leiper, 1979). Because the way people perceive

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risk affects decision-making regarding travel (Quintal et al., 2010), shocks to the transport system, such as pandemics, the threat of terrorism, or airline disasters, can reduce travel and tourism (Chew, 1987). According to Slovic (1987), people tend to avoid low-probability, high-consequence events. Thus, the general public's concern for air travel safety following a large-scale aviation disaster can reduce the demand for air transport, which can negatively affect tourism. For example, both the air travel and tourism industries were severely affected by the September 11, 2001 (hereafter 9/11) terrorist attacks. Estimations suggest the US airline industry lost between $1 $2 billion in the weeks following the terrorist attacks due to travel restrictions and public fear (Goodrich, 2002). In response to the tragedy, many individuals and groups canceled travel plans (both leisure and business), which substantially affected the broader tourism industry. In fact, during the 3 months after the attacks, hotel bookings in the US declined by as much as 50% (Goodrich, 2002). Thus, large-scale transportation disasters not only impact firms in the transport industry but might also impact firms in industries reliant on transportation, such as the tourism industry.

The news of a tragic airline crash is likely to have an immediate impact on the airline that crashed in terms of its financial losses and perceived risk (Borenstein & Zimmerman, 1988; Chance & Ferris, 1987). However, people might avoid flying altogether after an aviation disaster due to wide-spread fear, which can influence the business of airlines that did not experience a crash as well as related industries (Gigerenzer, 2004). Ho et al. (2013) noted that this type of contagion effect is only present in large-scale disasters with many fatalities. Collimore et al. (2008) showed that media coverage of traumatic events can induce symptoms of posttraumatic stress disorder (PTSD). For example, Schuster et al. (2002) showed that people across the US experienced trauma-related symptoms of stress after the 9/11 terrorist attacks. More recently, in response to the Lion Air Flight 610 crash, Beech and Suhartono (2019) reported that the spokesman for Garuda Indonesia, the national carrier, stated: "our passengers, psychologically, they don't trust flying with the Max anymore." Therefore, media exposure to airline disasters might induce stress-related symptoms, which may discourage travel and, in turn, reduce tourism.

The main objective of this study is to provide tests of this possibility by examining the stock price reaction of tourism firms to large-scale airline disasters. More specifically, this study tests the hypothesis that large-scale aviation disasters will increase travelers' fear and anxiety, which might deter tourism and, consequently decrease the market value of tourism firms. This hypothesis is based on two streams of theoretical literature, which is mentioned now but discussed in more detail in the following section. The stock prices of tourism firms might decline as investors adjust forecasts of the industry's future cash flows, or as investors' mood changes in response to news coverage. Since the media disproportionally covers aviation disasters, particularly those involving many fatalities (Barnett, 1990; Garner, 1993; Singer & Endreny, 1987), and mood and anxiety can affect asset prices (Baker & Wurgler, 2006; Edmans et al., 2007; Hirshleifer & Shumway, 2003; Saunders, 1993), market participants may predict declines in the performance of tourism firms in response to these events.

This article examines 14 large-scale commercial aviation disasters that occurred between 1990 and 2017, which resulted in more than 200 fatalities per event. The results show that, relative to the rest of the market, the stock prices of tourism and hospitality firms markedly decrease following major airline crashes. While the 9/11 terrorist attacks are included in the sample, the results do not seem to be entirely driven by the attacks.

The findings in this study can contribute to the existing literature on the link between travel and tourism by showing that shocks to the airline industry substantially affect the security prices of tourism firms. In addition, this study contributes to a broader literature in the tourism and hospitality literature that examine stock price reactions to a myriad of different events that, both directly and indirectly, influence demand for tourism (see, e.g., Barrows & Naka, 1994; D.-H. Chen & Bin, 2001; M.-H. Chen, 2007; M.-H. Chen et al., 2005, 2007, 2012, 2013; Gim & Jang, 2020; Graf, 2009; Lee & Jang, 2012; Leung & Lee, 2006; among others). Interestingly, while 11 of the 13 (non-9/11) airline crashes in the sample occurred outside of the US, results show that these events still had a substantial

negative effect on US tourism stocks. These findings provide support for the notion that investors expected a decline in tourism, and the respective cash flows of tourism firms, following aviation disasters. However, the results might also be due to enhanced fear and anxiety associated with air transport after large-scale crashes, as the market response associated with the 9/11 terrorist attacks is larger.

The results in this study can also contribute to the literature that examines aviation disasters and stock markets. Kaplanski and Levy (2010) showed a negative stock market reaction to aviation disasters generally. Specifically, this study contributes by showing that stock prices in the tourism industry decline significantly more than the overall market index surrounding large-scale airline crashes—a finding that, to our knowledge, has not been documented in the existing literature. The implications from the study are important and suggest that, given the value effects associated with airline disasters, the tourism industry is likely to support careful and stringent regulation of the airline sector.

Related Literature

The tests in this study are motivated by two strings of existing theories. First, prior research carefully links air transport to the tourism industry. Second, the theory of efficient markets (Fama, 1970) suggests that stock prices will respond to new and relevant information. Details on both sets of theories are discussed in the following subsections.

Terrorism, Airline Disasters, and the Tourism Industry

The theoretical link between transport and tourism has been discussed by researchers since the 1970s (see, e.g., Lundgren, 1975). When describing the elements associated with the tourism system, Leiper (1979) highlighted, among other things, the importance of tourism carriers, and, in particular, the airline industry. Chew (1987) argued that tourism increases with the help of improved air transport and that air transport has created a robust tourism industry that could withstand economic recessions. Mill and Morrison (2002) outlined the tourism system as an exchange between consumers and suppliers that are connected by four mechanisms: the market, *the travel element*, the destination, and the marketing campaign. Bieger and Wittmer (2006) developed a model to show that air transport and tourism are interconnected in the following bidirectional system (see Fig. 4 in Bieger & Wittmer, 2006, p. 43). The theory provided in Bieger and Wittner (2006) shows the links between air transport and tourism and provides motivation for the tests.

The World Tourism Organization (WTO) reported that, in 1950, tourism arrivals in the US numbered about 25 million. Nearly 50 years later, the WTO recorded tourism arrivals had increased nearly 25 times to 613 million. In dollar terms (without controls for inflation), receipts in 1950 were about $2.1 billion, and 50 years later that number exceeded $443 billion. While the affordability and accessibility of air travel have undoubtedly influenced the growth of the tourism industry over time (Lumsdon & Page, 2007), Chew (1987) noted that tourism is sensitive to both travel restrictions and threats of terrorism. Goodrich (2002) analyzed the effects of the 9/11 terrorist attacks on the tourism industry and reported that during the 2 days after the attacks, the airline industry lost well over $100 million in revenue. Within a month, major airlines were proposing tens of thousands of employee layoffs. Therefore, both transport firms and tourism firms were adversely affected by the terrorist attacks.

More broadly, prior research has also examined how general (non-terrorism-related) airline disasters have influenced firms. In particular, Chance and Ferris (1987) showed that airline crashes adversely affect the stock prices of airline carriers. However, the stock prices of competing airlines seem to be unaffected—as do the stock prices of airline manufacturers. Similar results are found in Borenstein and Zimmerman (1988) as airline crashes are associated with significant declines in the stock prices of airline carriers. Ho et al. (2013) showed that the stock price response to airline crashes is driven by the number of fatalities that occur during the crash. Furthermore, the authors showed that airline disasters with many fatalities adversely affect the stock prices of rival airlines.

This particular study might be one of the first to explore how airline crashes affect the stock prices of firms in the tourism industry. Relatedly,

however, Chew (1987) argued that the performance of the tourism industry is sensitive to costs associated with air transport. This argument is the motivation for the initial set of tests in this study that explore the stock prices of tourism firms immediately following large-scale aviation disasters. Chew (1987) also argued that the performance of the tourism industry is affected by threats of terrorism. This conjecture motivates the second set of tests that examine whether the effect of airline disasters on the prices of tourism stocks is stronger after the 9/11 terrorist attacks.

Stock Prices and Negative News

In the context of Fama's (1970) theory, financial markets are likely to anticipate rising costs and shrinking demand for tourism activities following large-scale disasters. For instance, Goodrich (2002) suggested that the airline industry was not the only tourism-related sector affected by the 9/11 attacks. During the 3 months following the attacks, hotel bookings in the US declined between 20% and 50%, and consequently, hotel managers lowered room rates by similar percentages. Likewise, casinos in Las Vegas reported declines in patronage of up to 50%. Given the theory in financial economics that suggests that asset prices should simply equal the present value of all future cash flows to the firm (Cochrane, 2009), investors likely price tourism stocks lower as demand for tourism services are expected to decline when large-scale negative events, like terrorism and airline disasters, occur.

A second and perhaps subtler explanation for how stock prices might respond to these types of negative events is based on the literature in behavioral finance and psychology. For instance, Singer and Endreny (1987) argued that the media disproportionately covers extreme negative events. Similarly, Garner (1993) examined media reports in response to the Delta 1141 crash, which occurred at the Dallas/Fort Worth airport in August of 1988, and highlighted that the media reports focused much more heavily on the fatalities and the destruction of the airline crash than on identifying the cause of the crash or the reaffirming of flying safety. Along these same lines, Collimore et al. (2008) tested whether media coverage of the 9/11 attacks influenced the anxiety sensitivity of a group of 143 subjects. Results show that anxiety sensitivity, which is the fear of events that might have harmful consequences (Reiss & McNally, 1985), as well as posttraumatic stress disorder (PTSD), increased among the subjects and correlated with the media exposure to the attacks. To the extent that media coverage affects the level of anxiety sensitivity and PTSD of the greater population, individuals might be less likely to use tourism services after large-scale disasters. This expected reduction in demand might also be reflected in lower prices of tourism stocks.

Additionally, a growing body of literature in finance suggests that mood, or investor sentiment, can affect asset prices. For instance, Saunders (1993) showed that weather in New York City (NYC) influences the prices of stocks listed on exchanges housed within the city limits. In particular, cloudy days in NYC are associated with lower stock prices. Additionally, Hirshleifer and Shumway (2003) examined the stock markets of 26 countries and found a significant link between sunshine and positive stock returns in the country's stock market index. The link between mood and stock prices is not isolated to weather patterns. Baker and Wurgler (2006) provided much broader evidence that investor sentiment affects the cross-section of stock returns. Furthermore, Edmans et al. (2007) examined the relation between the results from international soccer games and stock prices in various countries and show that a loss in the World Cup elimination stage is associated with negative stock returns in that particular country on the day after the loss. More closely related to this study, Dragouni et al. (2016) found that "mood" or "sentiment" significantly affect (outbound) tourism demand.

Large-scale aviation disasters might not only lead to lower stock price performance of tourism firms in a rational manner (lower expected demand and subsequently lower future cash flows), but also in an irrational manner (heightened anxiety and lower sentiment). The main objective of the study is to provide tests of the following two hypotheses.

Hypothesis 1: The stock prices of tourism stocks will decrease in response to airline crashes.

Hypothesis 2: The effect of airline crashes on the prices of tourism stocks is greater after the 9/11 terrorist attacks.

Data Description

The data used throughout the analysis come primarily from the Center for Research in Security Prices (CRSP). To determine the sample of tourism firms, SIC codes are obtained from CRSP. Table 1 reports the SIC codes for the different types of firms included in the analysis. The first grouping of SIC codes (4724, 4725, 4729, and 4789) are firms classified in the "Transportation Services" industry. The second grouping (SIC codes of 7011, 7021, and 7033) are firms classified in the "Lodging" industry. The final grouping of SIC codes, which consist of the four-digit SIC codes from 7900 to 7999, are considered firms in the "Amusement and Recreation" industry.

Table 2 reports a description of the events. As mentioned previously, to be considered a large-scale aviation disaster, the event must occur on a commercial airliner with at least 200 fatalities. Table 2 reports the event dates, which can be different from the actual date on which the disaster occurred. For instance, the first event—the Lauda Air Flight 003 disaster—occurred on 5/26/1991, which was a Sunday. However, the event day is the next available day when US financial markets were open. Because the following day was Memorial Day (on Monday 5/27/1991), the event day is 5/28/1991. Additionally, the event day for the 9/11 attacks is 9/17/2001, which is the first day that markets opened after the attacks. The table also reports the number of firms that are available to analyze for each event. A brief description of each disaster is also provided.

Table 3 reports several statistics that describe the sample. From CRSP, various stock characteristics for the sample firms are obtained on the event days. MktCap is the market capitalization, or price times shares outstanding. Price is the CRSP closing price. Turnover is the ratio of daily volume to shares outstanding. Illiquidity is the Amihud (2002) measure of daily illiquidity, which is the ratio of the absolute daily return to total dollar volume—scaled by 10^6. Volatility is the difference between the natural log of the intraday high price and the natural log of the intraday low price. Lodging, Recreation, and Travel are indicator variables equal to 1 if the firm belongs to that specific industry and zero otherwise. Table 3 shows that the average firm in the sample has a market capitalization of $1.7 billion, a share price of $18.27, turnover of 0.64, illiquidity of 2.79, and volatility of 5.22%. It should also be noted that 58% of the sample is in the lodging industry, 40% is in the recreation industry, and 2% is in the travel industry.

Empirical Findings

This section begins by conducting standard event studies by examining the stock returns of tourism

Table 1
Description of the Sample Tourism Firms

SIC Code	Description
4724	Travel Agencies
4725	Tour Operators
4729	Arrangement of Passenger Transportation, Not Elsewhere Classified
4789	Transportation Services, Not Elsewhere Classified
7011	Hotels and Motels
7021	Rooming and Boarding Houses
7033	Recreational Vehicle Parks and Campsites
7922	Theatrical Producers (except Motion Pictures) and Miscellaneous Services
7933	Bowling Centers
7941	Professional Sports Clubs and Promoters
7948	Racing, including Track Operation
7991	Physical Fitness Facilities
7992	Public Golf Courses
7993	Coin-Operated Amusement Devices
7996	Amusement Parks
7997	Membership Sports and Recreation Clubs
7999	Amusement and Recreation Services, Not Elsewhere Classified

Table 2
Description of Aviation Disasters

Event Date	No. of Tourism Firms	Description
5/28/1991	40	Lauda Air Flight 003 exploded mid-air over Thailand on 5/26/1991. A total of 223 fatalities occurred due to the explosion and subsequent crash.
7/11/1991	41	Nigeria Airways Flight 2120 crashed shortly after takeoff from Jeddah Saudi Arabia on 7/11/1991. A total of 261 fatalities were reported.
4/26/1994	43	China Airlines Flight 140 crashed upon landing in Nagoya Japan on 4/26/1994. A total of 264 fatalities occurred due to the crash.
7/17/1996	52	TWA Flight 800 exploded mid-air over the state of New York on 7/17/1996. A total of 230 fatalities were reported.
8/6/1997	60	Korean Air Flight 801 crashed upon landing in Guam on 8/6/1997. A total of 254 fatalities were reported.
9/26/1997	63	Garuda Indonesia Flight 152 crashed into the side of a mountain in Indonesia on 9/26/1997. A total of 234 fatalities were reported.
9/2/1998	61	Swissair Flight 111 crashed into the Atlantic Ocean just off of the coast of Nova Scotia, Canada on 9/2/1998. A total of 229 fatalities were reported.
11/1/1999	63	EgyptAir Flight 990 crashed into the Atlantic Ocean just off of the coast of Massachusetts on 10/31/1999. A total of 217 fatalities were reported.
9/17/2001	59	4 Airliners crashed due to high jacking on 9/11/2001: Two in the World Trade Center Towers, One in the Pentagon, and One in Somerset County, Pennsylvania. A total of 381 fatalities due to the crashes. A total of 2,977 fatalities were reported due to the entirety of the attacks.
5/28/2002	56	China Airlines Flight 611 crashed in Taiwan on 5/25/2002. A total of 225 fatalities were reported.
6/1/2009	52	Air France Flight 447 crashed on 6/1/2009 in the Atlantic Ocean on route to Brazil. A total of 228 fatalities were reported.
3/10/2014	49	Malaysia Airlines Flight 370 crashed in the southern Indian Ocean – on route to China – on 3/8/2014. A total of 239 fatalities were reported.
7/17/2014	50	Malaysia Airlines Flight 17 was shot down on 7/17/2014 in Eastern Ukraine during the Donbass Armed Conflict. A total of 298 fatalities were reported.
11/2/2015	50	Metrojet Flight 9268 crashed in the Sinai Peninsula on 10/31/2015. A total of 224 fatalities were reported.

firms in the sample surrounding the airline disaster events described in Table 2. After conducting these studies, the events are then separated by the 9/11 terrorist attack and the non-9/11 events to ensure that the findings are not simply an artifact of the attacks. Next, a series of multivariate regressions are estimated to test whether a specific subindustry within tourism (i.e., lodging, recreation, or travel) is driving the results. The final set of tests compares the stock price effects of pre-9/11 aviation disasters to the stock price effects of post-9/11 aviation disasters.

Table 3
Summary Statistics of the Sample Tourism Firms

	Mean	*SD*	25th Percentile	Median	75th Percentile
MktCap	1,709,395,549	5,207,192,039	56,166,000	331,214,671	1,232,528,500
Price	18.27	16.86	6.45	14.00	24.38
Turnover	0.6431	1.3304	0.0780	0.2590	0.6644
Illiquidity	2.7857	25.4641	0.0008	0.0102	0.1258
Volatility	0.0522	0.0990	0.0173	0.0313	0.0616
Lodging ($N = 110$)	0.5778	0.4942	0.0000	1.0000	1.0000
Recreation ($N = 79$)	0.4019	0.4906	0.0000	0.0000	1.0000
Travel ($N = 6$)	0.0203	0.1411	0.0000	0.0000	0.0000

Univariate Tests: All Events Combined

To better understand how shocks to the travel sector impact the returns of different tourism-related firms, CARs are examined for stocks across different event windows. The methods used are similar to those used in Zach et al. (2020), who examined the stock price reaction of lodging firms to the entry of disruptive innovation in that particular sector. Abnormal returns are calculated as residuals from the following daily market model:

$$R_t = \alpha + \beta Rm_t + \varepsilon_t \quad (1)$$

The dependent variable is the CRSP return for each firm on day t and the independent variable is the market return. The residual, ε, captures the portion of the raw return that is orthogonal to the market-wide return. This residual return is the abnormal return. For robustness, residuals are estimated using both a value-weighted and an equal-weighted index from CRSP. Equation (1) is estimated during an estimation period that precedes each event. In particular, the preestimation period ends 46 days before the event day (about 2 months) and uses a maximum of 255 trading days (about 1 year of trading data). After estimating equation (1) during the preestimation period and obtaining parameter estimates for α and β, abnormal returns (residuals) are then calculated and summed across different time windows surrounding the events. The summed residuals are denoted as CARs. Once CARs have been estimated for each firm and each event, cross-sectional means and t statistics are calculated to test whether mean CARs are significantly different from zero. A mean CAR that is not statistically significant suggests that tourism firms neither outperformed nor underperformed the market index, on average, surrounding the airline crashes.

Table 4 reports the daily CARs for various windows averaged across the different events in the sample. Event windows range from (−1,1), which covers the 3 days from 1 day before the event to 1 day after the event, to (0,10), which covers the 11 days from the event day to 10 days after. Mean and median CARs with accompanying t statistics (in parentheses) are reported in each column. Section A of Table 4 reports CARs that employ a market model using the CRSP value-weighted market return as the appropriate benchmark. Mean CARs are negative and statistically significant across each of the event windows. CARs range from −0.0057 with a t statistic of −1.95 in the (−1,1) window to −0.0246 with a t statistic of −5.18 for the (0,10) window. While returns have the potential to be larger (in absolute value) over larger event windows, the negative news associated with the events generally peaks around day 5. For instance, the mean CAR for the (0,5) window is −2.15%, which, when annualized represents an underperformance of tourism firms of nearly 90%. Similar results are found in section B, which uses a market model using CRSP equal-weighted returns for the benchmark index. Mean CARs range from −0.0095 for the (−1,1) window to −0.0306 for the (0,10) window. Once again, all of the mean CARs are negative and economically significant.

Univariate Tests: 9/11 and Non-9/11 Events Separated

While the results in Table 4 indicate a strong negative reaction to airline crashes, the results might be driven entirely by the events of 9/11. Table 5

Table 4
Cumulative Abnormal Returns: All Events Combined (N = 739)

	1: CAR(−1,1)	2: CAR(0,1)	3: CAR(0,3)	4: CAR(0,5)	5: CAR(0,7)	6: CAR(0,10)
A: CARs using the CRSP value-weighted market index						
Mean	−0.0057*	−0.0074***	−0.0103***	−0.0215***	−0.0205***	−0.0246***
Median	−0.0016	−0.0015	−0.0028	−0.0087	−0.0089	−0.0155
tStatistic	(−1.95)	(−2.75)	(−3.48)	(−5.25)	(−4.64)	(−5.18)
B: CARs using the CRSP equal-weighted market index						
Mean	−0.0095***	−0.0119***	−0.0191***	−0.0266***	−0.0265***	−0.0306***
Median	−0.0055	−0.0043	−0.0075	−0.0147	−0.0161	−0.0209
tStatistic	(−3.34)	(−4.53)	(−5.35)	(−6.68)	(−6.10)	(−6.53)

Table 5
Cumulative Abnormal Returns: 9/11 Events and Non-9/11 Events Separated

	9/11 Event			Non-9/11 Events		
	1: CAR(0,1)	2: CAR(0,5)	3: CAR(0,10)	4: CAR(0,1)	5: CAR(0,5)	6: CAR(0,10)
A: CARs using the CRSP value-weighted market index						
Mean	−0.1299***	−0.2038***	−0.1983***	0.0033	−0.0057*	−0.0095**
Median	−0.1261	−0.1517	−0.1676	0.0003	−0.0050	−0.0106
*t*Statistic	(−8.59)	(−8.85)	(−6.91)	(1.51)	(−1.70)	(−2.36)
N	59	59	59	680	680	680
B: CARs using the CRSP equal-weighted market index						
Mean	−0.1238***	−0.1830***	−0.1670***	−0.0022	−0.0130***	−0.0187***
Median	−0.1252	−0.1317	−0.1381	−0.0029	−0.0108	−0.0166
*t*Statistic	(−8.12)	(−7.88)	(−5.79)	(−1.01)	(−3.87)	(−4.53)
N	59	59	59	680	680	680

separates the CARs associated with 9/11 from the other events. Once again, section A of Table 5 reports results that use value-weighted market returns in the estimation of equation (1), while the bottom section reports results when using equal-weighted market returns as the market benchmark. For brevity, only the (0,1), (0,5), and (0,10) event windows are reported. Columns 1, 2, and 3 report CARs for the respective event windows for 9/11, while columns 4, 5, and 6 report CARs for the non-9/11 events.

As seen in Table 5, the results for 9/11 are orders of magnitude larger than the other events. However, the CARs for non-9/11 events are still negative and statistically significant. Even though the CARs from non-9/11 events are much smaller, they are still economically significant. For example, the −0.57% return over the (0,5) window for non-9/11 events equates to an annualized return of −23.75%. Once again, similar results can be found in the section B, which uses the CRSP equal-weighted index instead of the value-weighted index. For instance, the mean CAR for the (0,5) window is −32.05% annualized. These findings highlight two important points. First, the 9/11 attacks had a dramatic effect on the stock prices of tourism firms. Second, while smaller, the stock price effects of large-scale aviation disasters outside of the 9/11 attacks are still negative and significant.

Multivariate Tests: Cross-Sectional Determinants

So far, the results indicate a significant and negative price response to airline crashes by firms in tourism-related industries. The next step in the analysis is to determine which if any, firm type drives the results. To do this, various specifications of the following cross-sectional regression are estimated:

$$\begin{aligned} CAR(0,5)_i = {} & \beta_1 9/11_i + \beta_2 Travel_i + \beta_3 Lodging_i \\ & + \beta_4 \ln(MktCap)_i + \beta 5 \ln(Price)_i \\ & + \beta 6 Turnover_i + \beta 7 Volatility_i \\ & + \beta 8 \ln(Illiq)_i + \alpha + \varepsilon \end{aligned} \quad (2)$$

The dependent variable is the cumulative abnormal return from day 0 to day 5, where day 0 represents the event day. The independent variables include the following: *9/11* is an indicator variable equal to one if the event in question is the 9/11 terrorist attacks and zero otherwise. The remaining independent variables have previously been defined.

Table 6 reports the estimated coefficients from equation (2), along with *t* statistics in parentheses that are calculated using White's (1980) robust standard errors. Columns 1 and 2 report the results when CARs are estimated using the CRSP value-weighted market index, while columns 3 and 4 show the results when CARs are estimated using the CRSP equal-weighted market index. Columns 1 and 3 are baseline specifications that only include the indicator variables Travel and Lodging. Columns 2 and 4 report the full specifications that include all of the control variables. The insignificant coefficients on the *Travel* and *Lodging* variables across each of the four columns indicate

Table 6
Cross-Sectional Regressions: Firm Type

	CAR(0,5) Value-Weighted Market Returns		CAR(0,5) Equal-Weighted Market Returns	
	1	2	3	4
9/11	−0.1971***	−0.2133***	−0.1689***	−0.1823***
	(−8.65)	(−8.16)	(−7.37)	(−6.93)
Travel	−0.0447	−0.0408	−0.0458	−0.0392
	(−1.46)	(−1.26)	(−1.48)	(−1.19)
Lodging	−0.0043	−0.0014	−0.0039	−0.0009
	(−0.55)	(−0.15)	(−0.50)	(−0.10)
ln(MktCap)		−0.0006		−0.0031
		(−0.11)		(−0.57)
ln(Price)		0.0072		0.0111
		(0.93)		(1.40)
Turnover		0.0008		−0.0002
		(0.21)		(−0.04)
Volatility		0.1768		0.1601
		(0.50)		(0.45)
ln(Illiq)		0.0028		0.0024
		(0.79)		(0.65)
Constant	−0.0024	−0.0081	−0.0100	0.0235
	(−0.36)	(−0.09)	(−1.49)	(0.25)
Adjusted R^2	0.2328	0.2369	0.1812	0.1854
Robust *SE*s	Yes	Yes	Yes	Yes
N	739	637	739	637

that the negative CARs are not driven by a specific subindustry within the tourism sector. Not surprisingly, given the results in the previous table, the only variable that is significant in the cross-sectional regressions is the indicator variable *9/11*, which is both negative and significant in each specification.

Univariate Tests: Comparing Tourism Stock Price Reaction Pre- Versus Post-9/11

Even though the results in Table 4 show that the stock prices of tourism firms respond negatively to non-9/11 aviation disasters, the results in Tables 5 and 6 show that 9/11 had an extremely profound effect on tourism firm stock prices. This raises a potentially new and relevant question. Is it possible that 9/11 shaped the way that investors view aviation disasters as they relate to the stock prices of tourism firms? In particular, due to the dramatic stock price responses to 9/11, investors might bid down tourism stock prices more during the post-9/11 period vis-à-vis the pre-9/11 period. This subsection provides tests of this assertion.

Table 7 replicates Table 5, but analyzes the eight events during the pre-9/11 period in the stop section while the bottom section analyzes the five events during the post-9/11 period. The difference in means is then compared to determine whether the price responses to aviation disasters have become more severe in the more recent period. Section A shows the mean CARs for the three different time windows surrounding the pre-9/11 disasters. Columns 1–3 report the CARs when using the CRSP value-weighted market return as the benchmark, while columns 4–6 show the results when the CRSP equal-weighted market return is used. Interestingly, the tests do not find mean CARs to be reliably different from zero in the first three columns of the panel. Results do show evidence that when using the equal-weighted market index, the mean CAR for the (0,5) window is negative and significant (CAR = −0.0083, *t* statistic = −1.94). Similar results are found in column 6. These results provide limited evidence

Table 7
Cumulative Abnormal Returns: Comparing Tourism Stock Price Reaction Pre- Versus Post-9/11

	Value-Weighted Market Index			Equal-Weighted Market Index		
	1: CAR(0,1)	2: CAR(0,5)	3: CAR(0,10)	4: CAR(0,1)	5: CAR(0,5)	6: CAR(0,10)
A: CARs prior to 9/11						
Mean	0.0045	−0.0013	−0.0041	−0.0017	−0.0083*	−0.0191***
Median	0.0019	−0.0038	−0.0032	−0.0032	−0.0095	−0.0164
t Statistic	(1.43)	(−0.31)	(−0.79)	(−0.54)	(−1.94)	(−3.03)S
N	423	423	423	423	423	423
B: CARs after 9/11						
Mean	0.0013	−0.0130**	−0.0185***	−0.0030	−0.0209***	−0.0234***
Median	−0.0010	−0.0071	−0.0178	−0.0023	−0.0140	−0.0172
t Statistic	(0.50)	(−2.39)	(−2.89)	(−1.21)	(−3.81)	(−3.48)
N	257	257	257	257	257	257
C: Differences in means						
Difference	−0.0032	−0.0116*	−0.0144*	−0.0013	−0.0126*	−0.0074
t Statistic	(−0.80)	(−1.69)	(−1.75)	(−0.32)	(−1.81)	(−0.87)

that pre-9/11 disasters significantly affected tourism stock prices.

Section B reports the results using the five post-9/11 disasters. As seen in the section, mean CARs are negative and significant in columns 2 and 3. These CARs are not only statistically significant but are also economically meaningful. For instance, the mean CAR of −1.3% in column 2 represents an underperformance of the value-weighted market index of 54.17% when annualized. If anything, stronger results are found when focusing on the latter three columns. In economic terms, the mean CAR for the (0,5) window is slightly more than −87% when annualized. Section C compares the mean CARs in sections A and B. Across each of the columns in this last section, negative differences in mean CARs are found. In Columns 2, 3, and 5, the difference in means is significant at (at least) the 0.10 level. These results provide some evidence that the negative stock price response to non-9/11 aviation disasters is stronger during the more recent period—after the 9/11 attacks.

Multivariate Tests: Comparing Tourism Stock Price Reaction Pre- Versus Post-9/11

The final set of tests estimates another series of multivariate regressions to determine whether the negative stock price reaction in tourism firms around aviation disasters is stronger post-9/11, relative to pre-9/11, other factors held constant. To do so, specifications of the following cross-sectional regression equation are estimated:

$$\begin{aligned} CAR(0,5)_i = {} & \beta_1 Post\text{-}9/11_i + \beta_2 Travel_i \\ & + \beta_3 Lodging_i + \beta_4 \ln(MktCap)_i \\ & + \beta 5 \ln(Price)_i + \beta 6 Turnover_i \\ & + \beta 7 Volatility_i + \beta 8 \ln(Illiq)_i + \alpha + \varepsilon \end{aligned} \quad (3)$$

The dependent variable is the CAR from day 0 to day 5, where day 0 represents the event day. As before, columns 1 and 2 report the results when CARs are estimated using the CRSP value-weighted market index, while columns 3 and 4 show the results when CARs are estimated using the CRSP equal-weighted market index. *Post-9/11* is an indicator variable equal to 1 if the event in question occurred after the 9/11 attacks and zero otherwise. *Developed* is an indicator variable equal to unity if the airline crash occurred in (or nearby) a developed country and zero otherwise. The remaining independent variables have previously been defined.

Table 8 reports the estimated coefficients from equation (3), as well as *t* statistics in parentheses that are calculated using White's (1980) robust standard errors. In each of the specifications in Table 8, the coefficient on *Post-9/11* is negative and statistically different from zero. For instance, in column 1, the estimate for *Post-9/11* is −0.0125, which suggests that relative to pre-9/11 events, the post-9/11 disasters exhibited a price response

Table 8
Cross-Sectional Regressions: Comparing Tourism Stock Price Reaction Pre- Versus Post-9/11

	CAR(0,5) Value-Weighted Market Returns		CAR(0,5) Equal-Weighted Market Returns	
	1	2	3	4
Post-9/11	−0.0125*	−0.0160*	−0.0154**	−0.0169*
	(−1.73)	(−1.85)	(−2.11)	(−1.94)
Developed	−0.0056	−0.0173**	−0.0120	−0.0229***
	(−0.73)	(−1.98)	(−1.56)	(−2.58)
Travel	0.0042	0.0117	0.0042	0.0152
	(0.24)	(0.64)	(0.25)	(0.87)
Lodging	0.0063	0.0141*	0.0068	0.0146**
	(0.87)	(1.90)	(0.94)	(1.96)
ln(MktCap)		0.0040		0.0018
		(0.78)		(0.34)
ln(Price)		0.0030		0.0071
		(0.38)		(0.86)
Turnover		0.0008		−0.0008
		(0.19)		(−0.17)
Volatility		0.5777*		0.5484*
		(1.80)		(1.67)
ln(Illiq)		0.0032		0.0032
		(0.94)		(0.88)
Constant	−0.0025	−0.0985	−0.0065	−0.0695
	(−0.37)	(−1.18)	(−0.97)	(−0.79)
Adjusted R^2	0.0005	0.0562	0.0047	0.0503
Robust *SE*s	Yes	Yes	Yes	Yes
N	680	583	680	583

that was 1.25% lower, on average. Similar results are found in column 2. When focusing on the latter two columns, the coefficients on *Post-9/11* are again negative and significant. If anything, the coefficients are slightly more negative, suggesting that the post-9/11 events had a greater effect on the stock prices of tourism firms and are robust across different market (value-weighted vs. equal-weighted) benchmarks. A few other noteworthy results are worth discussing. First, the coefficient on *Developed* is negative and significant in columns 2 and 4, suggesting that when the aviation disaster occurred in or near a developed country, the negative stock price response to tourism firms was greater. Last, the coefficient on the indicator variable *Lodging* is positive and significant (in columns 2 and 4). These latter results suggest that firms in the travel and recreation industries experienced a greater negative price reaction to aviation disasters than firms in the lodging industry.

Conclusion

Historically, the number of large-scale, commercial airline disasters has (thankfully) experienced a negative trend. However, there have been several instances of commercial airline crashes in recent years. Prior research shows that these types of disasters can adversely affect stock prices in financial markets (Borenstein & Zimmerman, 1988; Chance & Ferris, 1987). This study develops and tests the hypothesis that large-scale airline disasters adversely affect the stock prices of firms in the tourism industry. Theory in Bieger and Wittmer (2006) showed that transport and tourism are interconnected and Quintal et al. (2010) argued that risk and uncertainty affect the travel decisions of individuals. To the extent that exogenous events, such as aviation disasters, increase the perceived risk associated with travel, this study posits that investors will bid down the stock prices of tourism firms under the expectation that tourism will be affected by these types of disasters.

Using a sample of 14 commercial airline crashes from 1990 to 2017, results show that tourism stock prices respond negatively to airline disasters. However, much—but not all—of the effect is driven by the 9/11 terrorist attacks. In economic terms, during the 2 days following the 9/11 attacks, the stock prices of tourism firms decreased between 12% and 13%, relative to the rest of the market. When focusing on non-9/11 airline disasters, a significant negative response by the stock prices of tourism firms still exists. However, the effect is much smaller in terms of economic magnitude. Additional multivariate tests do not find that the results are driven by any particular subindustry within tourism (i.e., travel, recreation, or lodging). The final set of tests examines whether the 9/11 attacks shaped the way that investors view aviation disasters as they relate to the stock prices of tourism firms. Both univariate and multivariate tests provide some evidence that, relative to the pre-9/11 period, stock prices in the tourism industry respond more negatively to airline disasters during the post-9/11 period.

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