

# Impact of the Germanwings Flight 9525 Air Crash: Financial Analysis and Relationship with the Media



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**Abstract** On March 24, 2015, the largest air accident on the European continent of the last decade took place; the Germanwings Flight 9525 crashed. The main objective of this research is to determine the economic-financial impact of this air crash on the market stock price of the involved companies, Lufthansa airline, and its manufacturer Airbus. This study also contributes to determining whether the financial value of both companies was impacted by the media activity after the event. The primary methodology used is the event study methodology, applying both the market model and the Fama–French model. The results reveal that the impact of the Germanwings Flight 9525 on the financial value of the companies involved is different, since there is a significant effect on the financial value of Lufthansa under the market model, and this effect is immediate, but there is no significant effect on the financial value of Airbus with any of the models analyzed. In the same way, it happens when analyzing the impact of the media, since there is only a significant relationship between Lufthansa’s share prices and the impact of media research with the market model. These results are important for the companies involved, and especially for their investors. It also shows that the manufacturing company is less vulnerable to the impact of the media, and it does not suffer significant losses on the stock market.

**Keywords** Air crash · Event study methodology · Germanwings

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## 1 Introduction

The airline sector is known worldwide as the safest way to travel (World Health Organization, 2015); however, accidents still happen. In fact, on the morning of March 24, 2015, the worst European aviation catastrophe of the last decade took place (El País, 2015), Germanwings Flight 9525 crashed in the French Alps as a result of a fall deliberately caused by the co-pilot claiming the lives of the 150 people on board. Thus, an Airbus A320-211 took off from Barcelona Airport (Spain), and its destination at Düsseldorf International Airport (Germany) operated the flight. A short time later, it became known that the co-pilot had planned the multiple homicides.

Many questions arise as a result of the fatality, however official investigations ignore the economic aspects caused by it. Indeed, when stock markets react to air crashes, in most cases, information about the crash is not entirely available because the cause of the crash and details remains unknown. The financial impact of these devastating events on the commercial airline industry (Kaplanski & Levi, 2010) has captured the interest of many economists. In addition, for the companies involved in the event and for their investors, it is important to know if there is a negative effect after the air crash and quantify this loss.

Besides the uncertainty generated by the event, the publication of evidence obtained from research in the media can influence the decision-making of consumers and investors, so it can cause a greater decrease in the cash flow of the companies involved (Alcaide et al., 2022). This is because as the causes of the event and those responsible for it are known; thus, consumers and investors can be influenced differently by them. (Alcaide et al., 2021).

Thus, this research work focuses on analyzing the impact of the Germanwings air crash on the financial value of both the airline and the involved manufacturer, and on determining whether this financial value can be affected by the impact of the media after the event. Furthermore, our two objectives are analyzed by firstly modeling the stock prices reactions of the firms involved through the market model and Fama–French Model; secondly analyzing the impact of media on the financial value of firms empirically by applying the Event Study Methodology to both models. Hence, two research questions (RQ) are built:

*RQ 1. Is there a relation between the Germanwings Flight 9525 air crash and the financial value of the involved firm, both the airline and the manufacturer?*

There are very few authors who analyze the effect of air crashes on the share price of the manufacturers involved in these events and they obtain divergent conclusions. This makes it necessary to bring clarity to this issue. In addition, previous studies do not analyze a single accident, but the average of a set of air accidents.

*RQ 2. In the Germanwings Flight 9525 air crash, is there a relation between the financial value of the companies involved, Lufthansa and Airbus, and the advancement of research in the media?*

Most of the literature considers airlines solely responsible for accidents, and therefore the only ones affected. However, other factors can also affect the financial value of the companies involved in an air crash such as the reaction of the media. The

Germanwings Flight 9525 caused a stir in the media due to the magnitude of the event, being the only European accident because of a deliberate act, (El País, 2015). For all these reasons, it is necessary to check whether the publication of news in the media about the investigation of Germanwings Flight 9525 caused a reaction in the investors of the companies involved in the accident and consequently, in its financial value.

It should be noted that this work is a preliminary study, so it only analyzes an air crash, which allows its analysis in greater detail. Even so, the selected accident has very unique characteristics that make its study have a special interest in literature. Specifically, this accident has been selected because it is the most recent air crash with fatalities of those that happened in the EU, it is also the first accident of a low-cost line in this continent, and it is also considered the worst catastrophe of European aviation of the 2010s (El País, 2015), in addition to being the only European accident as a result of a deliberate act.

## 2 Literature Review

A large literature body exists about the relation between air crashes and companies' financial value. Moreover, the vast majority used the Event Study Methodology.

Many authors focus on studying the impact of an aggregate set of air crashes (Ho et al., 2013; Ho et al., 2011; Bosch et al., 1998; Davidson et al., 1989; Mansur et al., 1989; Borenstein & Zimmerman, 1988; Barrett et al., 1987); generally, these studies focus only on the financial consequences on the airline involved, and not on the manufacturer, and many compare their results with rival airlines. They all reveal that the listings value of the involved air companies, and those of rival firms, quickly react to events. For instance, Borenstein and Zimmerman (1988) indicate that airlines suffering from a crash bring shareholders to lose around one percent of their wealth. Consequently, air crashes negatively affect the price of these firms' shares during and after aviation disasters. Regarding competition, studies conclude that fatal accidents impact negatively rival airlines, while less serious ones can positively influence competing airlines. Also, the more fatalities there are, the more the profits of the company fall (Ho et al., 2013).

In contrast, very few researches have investigated the effect of air crashes on the manufacturers of these airlines. Furthermore, the financial consequences on manufacturers are inconclusive. Chance and Ferris (1987) determine that the share price of participating companies is negatively affected on the day the event takes place and a few days after the event. In the same year, Chalk (1987) analyzed a sample of air crashes to determine whether such events were related to the manufacturer, concluding almost immediate negative ARs, especially on the first day, 3 days, and 8 days after the event. While Rose (1991) shows that aircraft manufacturers are not significantly affected.

The vast majority of research has centered on the US airline industry and in the study of an average sample of companies. However, there are no studies that focus

on the study case of one air crash, as our paper proposes; only, Nethercutt and Pruitt (1996) study the effect of one crash, the US ValueJet Flight 592. They investigate the effect on the quote of both the airline and its competitors with an event-time analysis. In addition, these authors distinguish between “low cost” companies, such as the airline of the flight analyzed, and main airline companies.

It is worth considering the existence of factors whose influence may favor such an impact. One of them is the media’s presence because it affects the feelings of investors on the Stock Exchange. After all, the media’s activity influences investors’ decisions, whose concerns are reflected in the lower demand for risk assets (Kaplanski & Levi, 2010). Consequently, the involved companies lose their reputation (Cocis et al., 2021; Li et al., 2015). Only a few authors have studied the effect of the media on-air accidents (Rodríguez-Toubes and Dominguez-Lopez, 2017; Dimitriou and Antoniou, 2017; Henderson, 2003; Boin et al., 2001), but they do not analyze their effect on the firms’ share price. Thus, Walker et al. (2014) consider the link between the hypotheses of mechanical failures put forward in the media and the effect on listings. Krieger and Chen (2015) observe that when the media potentially blame a manufacturer’s fault, the initial reactions in these firms are significantly negative, but the impact is insignificant if this is not the case.

The present study contributes and updates the literature about the subject, especially by analyzing a recent air crash separately, and not in an aggregate manner as other studies have done. In addition, the air crash is on a low-cost European company, while all the previous literature focuses on American airlines. Moreover, it studies the impact on the financial value of the involved manufacturer for which not so many previous pieces of evidence are available. This paper also examines the causes of the accident when abnormal results exist to investigate the relation between the factor that triggered the accident and the market’s reaction, and whether the market reaction can be attributed to the media. Thus, the relation between an air crash and the media impact has barely been studied, which adds value to this work. In addition, we also focus on verifying our results with the Event Study Methodology through both the Market and Fama–French models to determine if the results differ when studying a single event. Previous studies only apply the market model.

### 3 Methodology

This research examines the Germanwings Flight 9525 air accident. Specifically, this paper focuses on two research questions (RQ).

According to RQ 1, this work studies the effect of an air crash on the Stock Exchange value of both involved companies, the airline Lufthansa, and the manufacturer Airbus. To this end, the closing prices of the shares of both companies were collected from the electronic trading platform of the German Stock Exchange: The XETRA system, since it is the quotation market of the country of destination of the flight. The employed data also include the average yield obtained with the DAX Stock Exchange rate and the yields of the risk-free assets issued by the German

government. This last piece of information includes the yields of both the bonds issued by the German government and of the shares of the main firms comprising this market index at the time of the accident and their market capitalization volume. All these data were obtained daily from Eurostat and Investing.com (Eurostat, 2021; Investing, 2021).

To fulfill our objective, firstly a descriptive data analysis was performed. Then the following data assumptions were verified: linearity, multicollinearity, homoscedasticity, normality.

Secondly, the methodology followed was the Event Study Methodology (Sorescu, 2017). The date when the event took place, March 24, 2015, is defined as the event day ( $t = 0$ ). Then, we first calculate the daily stock returns for both firms (Lufthansa and Airbus) as:

$$R_{it} = (P_{it} - P_{it-1}) / P_{it-1} \cdot 100 \quad (1)$$

where:  $R_{it}$  represents the daily profitability of the shares of a firm  $i$  on day  $t$  belonging to the estimation window;  $P_{it}$  represents prices of the shares of a firm  $i$  on day  $t$  belonging to the estimation window.

Then we calculate the ARs ( $AR_{it}$ ) for each firm  $i$  on day  $t$  as:

$$AR_{it} = R_{it} - E(R_{it}) \quad (2)$$

Three models exist to make the short-term calculation  $E(R_{it})$  (Sorescu, 2017): The market model (Brenner, 1979), the market-adjusted model (Brown & Warner, 1985), the Fama–French model (Fama & French, 1993). However, the results of the first two models are similar over a short-term window. This is why the present study selects the Market model, which has been widely used in the literature, and, the Fama–French model.

According to the Market model,  $E(R_{it})$  is:

$$E(R_{it}) = r_{ft} + B_i \cdot [E(R_{mt}) - r_{ft}] \quad (3)$$

where:  $R_{mt}$  is the average rate of return of all the stocks trading on the DAX stock market at time  $t$ ,  $r_{ft}$  is the risk-free rate of return at time  $t$ , and  $\beta$  is the risk factor estimated from regression.

The employed risk-free assets are calculated by applying an arithmetical rate according to Expression 1. To calculate the market's yield, the rate defined by Expression 4 is applied.

$$E(R_{mt}) = (M_{it} - M_{(it-1)}) / M_{(it-1)} \cdot 100 \dots \quad (4)$$

where  $M_{it}$  refers to the market index value at time  $t$ .

According to the Fama–French model,  $E(R_{it})$  is defined as:

$$E(R_{it}) = r_{ft} + B(i1) \cdot * \cdot [E(R_{mt}) - r_{ft}] + B(i2) \cdot * \cdot SMB \cdot + \cdot B(i3) \cdot * \cdot HML \quad (5)$$

The three risk factors  $\beta(i1)$ ,  $\beta(i2)$ ,  $\beta(i3)$  are obtained by OLS regression. The two new variables, Small Minus Big (SMB) and High Minus Low (HML) are obtained with the data from the German market. SMB represents the risk size and is calculated as the daily difference of the mean of the yields of the three companies with less market capitalization and the mean of the three companies with more capitalization. Factor HML represents the risk value and is estimated as the daily difference of the mean of the yields of the three firms with a high listing price and the mean of the three firms with a low listing price (Hunga & Liu, 2005).

Both the Market and Fama–French models estimate the expected returns ( $E(R_{it})$ ) of the airline and involved manufacturer when no accident occurs. To estimate models, we use data from 255 to 46 days before of event (Ho et al., 2013; Nethercutt & Pruitt, 1996).

Having obtained the ARs ( $AR_{it}$ ), we then calculate the CARs ( $CAR_{ie}$ ) for each firm  $i$  as follows:

$$CAR_{ie} = \sum_{t=t_1}^{t_2} AR_{it} \quad (6)$$

where  $t_1$  and  $t_2$  respectively represent the start and end of the event window.

For our study, we define an event window from 7 days before the event day ( $t = 0$ ), and 7 days after the event (Nethercutt & Pruitt, 1996); that is, from March 4 to April 2, 2015.

Finally, to test the significance of the impact, that is, if the effect on the listings of the involved firms is strong, a significance test is used (T-Test) according to Expression 7:

$$T - Test = AR_{it} \cdot / \cdot SE \quad (7)$$

where SE is the standard error or standard deviation of all the collected daily data. The hypothesis that no relation exists between an accident happening and companies' stock market listing is rejected if the absolute T-Test value is higher than 1.96 (Corrado & Zivney, 1992).

According to the RQ 2, we propose a case study of the different media, mainly written and digital press, which published news about the Germanwings air crash from the same day of the event and during the following 7 days, that is, from March 24 to April 2, 2015.

This information will be compared daily with the ARs obtained in the RQ1. We will consider that the media caused an impact on the quotes of both companies analyzed, if, on the same day that the news is published in the media about the investigation of the air crash, the AR is significant.

In addition, as ARs are calculated with two different valuation models, the market and Fama–French model, it will be possible to find out if there are differences in terms of the possible relation between the financial value of companies and publications in the media, depending on the model used.

## 4 Results and Discussion

### 4.1 RQ 1. Is There a Relation Between the Germanwings Flight 9525 Air Crash and the Financial Value of the Companies Involved, Lufthansa and Airbus?

First, the results obtained for the airline Lufthansa are analyzed (Table 1), justifying its variations in the shares' price with the news published in the media, which are the basis for the analysis of RQ 2.

According to the obtained AR in Table 1, we confirm a significant effect between the event and Lufthansa's financial value on the event day according to the Market model. It is observed that Lufthansa's risk premium on the day of the event was 4.22% below that expected in the absence of the event. This is a significant drop, and

**Table 1** Daily abnormal returns (AR), cumulative abnormal returns (CAR), and daily T-statistics for Lufthansa

Event date	Market Model			Fama–French Model			Reaction in the media
	AR	CAR	T-Test	AR	CAR	T-Test	
– 7	5.04%	16.00%	2.9699	– 0.59%	– 5.52%	– 0.3289	
– 6	–1.31%	14.69%	–0.7713	– 1.35%	– 6.87%	– 0.7497	
– 5	12.53%	27.22%	7.37861*	2.80%	– 4.07%	1.55897	
– 4	–2.36%	24.85%	–1.3922	1.64%	– 2.43%	0.91411	
– 3	3.86%	28.71%	2.27078*	2.19%	– 0.24%	1.22226	
– 2	–0.44%	28.27%	–0.2599	0.72%	0.48%	0.40082	
– 1	–9.75%	18.52%	–5.7402*	– 0.48%	0.00%	– 0.2681	
0	–4.22%	14.30%	–2.483*	– 2.05%	– 2.05%	– 1.1452	YES
1	–9.28%	5.02%	–5.4639*	– 2.81%	– 4.87%	– 1.5688	YES
2	4.51%	9.53%	2.65354*	– 3.00%	– 7.86%	– 1.6694	NO
3	1.50%	11.03%	0.88131	0.08%	– 7.78%	0.04704	NO
4	5.24%	16.27%	3.08856*	– 0.84%	– 8.62%	– 0.4677	YES
5	–6.80%	9.47%	–4.0046*	0.38%	– 8.24%	0.21395	YES
6	–2.22%	7.25%	–1.3082	0.25%	– 7.99%	0.13945	NO
7	0.14%	7.39%	0.07997	– 2.61%	– 10.59%	– 1.4529	YES

\* Significant T-Test

undoubtedly justifiable, as a perfectly equipped aircraft had crashed for no apparent reason. This trend is maintained the day after the event, when the AR is even more significant, at  $-9.28\%$ , this fall could be due to the first interventions of the authorities in the media, who raised the possibility that the accident had been the result of a deliberate act. However, 2 days after the accident, Lufthansa's risk premium results in a positive value, of  $4.51\%$ . The causes that could have caused this sudden increase are unknown. The same happens 4 days later, with a significant AR of  $5.24\%$  higher than expected. On the same day, the Düsseldorf Public Prosecutor's Office revealed that Andrea Lubitz, co-pilot of the aircraft, had previously been treated for suicidal tendencies for a long period several years before obtaining his license. The 5th day after the event, March 31, 2015, stands out for obtaining again a negative and significant AR, of  $-6.80\%$ . This may have been due to news that the company knew the medical history of the co-pilot, who a few years earlier had directly informed Lufthansa that he had suffered from an episode of severe depression.

The results obtained with the Fama–French Model are substantially different. Although ARs show a generally negative trend, they do not show any significance on either the day of the event or the day after.

According to the obtained AR in Table 2, we confirm that there is no significant effect between the event and the Airbus's financial value on the event day according to the Market model, specifically it is shown that the risk premium of Airbus on the day of the event is only  $0.74\%$  below expectations, not being a significant fall. The small impact on the financial value of the manufacturer may be since the causes of the impact are not yet known, and several hypotheses are considered as a possible terrorist attack. The day after the event, the AR falls more below expectations,  $-2.56\%$ , although it is not significant either. It may be logical that negative values appear after the tragic event since shareholders can show rejection towards the firm, causing the decline of its value on the stock market. Especially, the day following the event, knowledge of the crashed model and suspicions about a possible depressurization of the aircraft could have influenced the fall in the value of Airbus shares. In general, the following days show values close to  $0\%$ , although they are not significant either.

Regarding Airbus' results under the Fama–French model, they are similar to those shown with the previous financial asset valuation model. Therefore, according to the Fama–French model, we confirm that there is also no significant effect between the event and Airbus's financial value on the event day. Airbus' AR on the same day of the event was not significant at  $-0.85\%$ . While the AR of the day immediately following is significant, taking a value of  $-3.87\%$ .



**Table 2** Daily abnormal returns (AR), cumulative abnormal returns (CAR), and daily T-statistics for Airbus

Event date	Market model			Fama–French model			Reaction in the media
	AR	CAR	T-Test	AR	CAR	T-Test	
– 7	1.29%	7.06%	0.68519	1.69%	7.59%	0.87004	
– 6	–1.94%	5.12%	–1.0305	–2.82%	4.77%	–1.4491	
– 5	–3.42%	1.70%	–1.8133	–2.50%	2.26%	–1.2882	
– 4	0.63%	2.33%	0.3339	0.39%	2.65%	0.19854	
– 3	–0.20%	2.13%	–0.1073	–0.40%	2.25%	–0.2076	
– 2	0.25%	2.38%	0.13289	–0.59%	1.66%	–0.3025	
– 1	–2.38%	0.00%	–1.2621	–1.66%	0.00%	–0.8531	
0	–0.74%	–0.74%	–0.3906	–0.85%	–0.85%	–0.4355	YES
1	–2.56%	–3.30%	–1.3603	–3.87%	–4.72%	–1.9922*	YES
0.2	1.13%	–2.17%	0.59857	1.93%	–2.79%	0.99434	NO
3	0.13%	–2.04%	0.07146	0.89%	–1.90%	0.45726	NO
4	–0.91%	–2.95%	–0.4819	–1.08%	–2.97%	–0.5535	YES
5	0.20%	–2.75%	0.40441	–0.40%	–3.38%	–0.208	YES
6	–0.07%	–2.82%	–0.0352	–0.24%	–3.62%	–0.1244	NO
7	–0.28%	–3.10%	–0.1494	0.30%	–3.32%	0.15416	YES

\* Significant T-Test

#### **4.2 RQ 2. In the Germanwings Flight 9525 Air Crash, is There a Relation Between the Financial Value of the Companies Involved, Lufthansa and Airbus, and the Advancement of Research in the Media?**

The last column of Tables 1 and 2 indicates whether (YES) or not (NO) there was impact news in the media about the Germanwings air crash.

Based on these results, we can conclude that, in the case of the airline Lufthansa, there are differences depending on the asset valuation model applied when estimating a relationship between Lufthansa's listings value and the progress of the research in the media.

According to the market model, there is a relationship between the financial value of the airline and the progress of research in the media, because the days that there was new news in the media, the impact was significant on Lufthansa's ARs. Only two exceptions appear, the second and seventh days after the event, but in which we can find a possible explanation. On the 2<sup>nd</sup> day after the event, there was no impact on the media, but the AR was significant, however, with a positive value, possibly the shareholders when there was no news, returned to trust the company. On the 7<sup>th</sup> day the opposite happened, there was news in the media (appearance of the second

black box), but the return was not significant, possibly because the value of this AR was close to 0%, not very significant.

However, the Fama–French model contradicts these results, as it shows no relation between Lufthansa’s financial value after the accident and the progress of the investigation in the media.

In the case of the manufacturer Airbus, with both models the results are similar, since there is no relation between the company’s listings value and the impact on the media, there is only one exception. This is the case of the first day after the event with the Fama–French model, in which the AR is significant and there was news in the media.

## 5 Conclusion

Firstly, this research studies the impact of a specific air accident, the Germanwings Flight 9525, which occurred on March 24, 2015, on the financial value of the companies involved, the airline Lufthansa and the manufacturer Airbus.

We confirm a significant impact of the event on Lufthansa’s financial value on the event day, and also 1 and 2 after according to the Market model. However, according to the Fama–French model, this relation is not significant. Despite this, both valuation models show that investors in the airline Lufthansa do react immediately to the accident since negative AR is shown in the short term, as evidenced by other studies (Ho et al., 2013, Chance & Ferris, 1987). Also, the results show there is no significant impact between the event and Airbus’s financial value with any of the valuation models. Investors in the manufacturer Airbus react to the event, however, the fall in the financial value of Airbus is not significant.

These results are in line with the literature, as other studies also show an effect between accidents and airlines (Kaplanski & Levy, 2010), but not with manufacturing companies (Chance & Ferris, 1987). However, this study is a pioneer in analyzing the same air event with different valuation models.

Secondly, we analyzed whether there is a relation between the financial value of the companies involved in the Germanwings accident and the impact of the progress of the investigation on the media.

We conclude that in the case of the airline Lufthansa, there are differences depending on the asset valuation model applied since there is only a relation between Lufthansa’s quotes and the progress of research in the media with the market model. In the case of the manufacturer Airbus, with both models the results are similar, confirming that there is no relation between the company’s listings value and the impact on the media, which contradicts other authors (Krieger and Chen, 2015).

These results are important for airlines, for manufacturers, and especially for investors in them, since although we cannot prevent air accidents, it does allow us to estimate that their financial consequences are immediate, but they only affect in the short term. Furthermore, it is observed that the most affected company is the airline since no significant relationship has been found between the financial value

of Airbus and the air crash, nor between it and the progress of the investigation in the media. Therefore, the manufacturing company is less vulnerable to the impact that the news had on the media, and equally, its stock market values do not suffer significant losses.

The main limitation of this research is that only one air accident was studied, so it is not possible to draw general conclusions. Despite this, our results do coincide with the literature. Future lines of research will expand the sample to all air accidents of the XXI century to corroborate these preliminary results.

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