ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis [Economics and Business Economics: Financial Accounting]

# The Effect of Airline Disasters on the Stock Market

Name student: Jonathan Schuitemaker

Student ID: 426426

Supervisor: Dr. I. Dittmann

Second assessor: R. Barahona

Date version: 1-3-2021

# Contents

# Introduction

According to *spacemag.com* a total of 3.5 billion airline passengers buckled up for take-off in 2015[1]. In recent years till the COVID-19 pandemic the number of airline flights has been increasing about 5% yearly.[2] The International Air Transport Association (IATA) estimated in 2018 that by 2037 almost 8.2 billion people will be transported by aeroplane, which is nearly twice the number of that in 2017.[3]

After the 9/11 Twin Tower terrorist attacks some new rules and changes were introduced in order to improve the safety of air transport (Blalock, Kadiyali and Simon 2007). These new rules and changes have contributed to the declining number of aircraft crashes per year. Despite transport by airplane now being the safest way to travel[4], major air disasters still happen.[5] Subsequently, if more planes will take-off, the number of airline crashes will increase.

An air disaster will have some negative financial impact on the involved airline company.[6] Namely, the costs of the loss of an aeroplane, the financial compensation for the families of the victims. Also, there is the possible loss of income due to a possible reduction of passengers travelling with the airline company involved with the disaster.

Therefore, the main question of this thesis is: ''*What is the effect of airline disasters on the stock market?*''

The main question is answered by a couple of sub-questions.

[1] Spacemag (2016, January 6). How Much of the World's population Has Flown in an Airplane? Airspacemag.com https://www.airspacemag.com/daily-planet/how-much-worlds-population-has-flown-airplane-180957719/
[2] Statista (2020, November 27). Global air traffic - annual growth of passenger demand 2006-2021. Statista.com https://www.statista.com/statistics/193533/growth-of-global-air-traffic-passenger-demand/
[3] IATA (2018, October 24). Forecast Predicts 8.2 billion Air Travelers in 2037. Iata.org https://www.iata.org/en/pressroom/pr/2018-10-24-02/
[4] Morris, E. (2018, January 24). Why Air Travel is The Safest Mode of... Sheffield.com https://www.sheffield.com/air-travel-safest-mode-transportation#:%7E:text=Air%20travel%20resulted%20in%200.07,and%20you%20continue%20to%20fly!
[5] Bureau of Aircraft Accidents Archives. (n.d.). Home van https://www.baaa-acro.com/
[6] Palrecha, H. N. D. (2020, August 26). How are air crash victims and kins compensated? Thedailyguradian.com https://thedailyguardian.com/how-are-air-crash-victims-and-kins-compensated/#:%7E:text=And%20when%20an%20airline%20is,rights%20(%E2%80%9CSDRs%E2%80%9D).&text=Such%20plane%20crash%20compensation%20currently%20equals%20to%20approximately%20%24170%2C000%20per%20passenger.

As indicated above, the aviation industry is growing and the popularity of air travel is on the increase. This is illustrated by the finding of the Swedish company Flightradar24 that on the 24th of July in 2019 there were 230.409 airplanes in the sky, which is a record up to date[7].

The number of planes in the air and take-offs is on the increase, the likelihood of an airliner crash will increase too. Therefore, it is important to know the possible economic implications of an airline disaster.

The first-sub question is: ''*Do companies experience a negative stock return after a crash happened?*''

Moreover, competing airline companies, which are not directly involved with a disaster, may also suffer financially due to the negative media coverage concerning airlines and the subsequent possible fear of people for air transport due to the crash.[8] Therefore, the next question is: *''Do other (non-involved) aviation companies experience a negative stock return after a crash?*''

Most of the researches about this topic include only aircraft crashes of American airline companies. We do not know much about the effects on European companies. Hence, the following sub-question is:

*''Is there a difference between financial returns of European companies and American companies as the result of a disaster?*''

Additionally, airplane crashes have a high mortality rate. Despite the decrease in number of flights due to the pandemic, the total number of deaths resulting from an aviation disaster increased in 2020 compared to 2019.[9] The post disaster media coverage plays an important role (Vasterman, Yzermans and Dirkzwager 2005). If there are more deaths in a disaster it seems likely that there will be more media attention. Therefore, the following sub-question

[7] Flightradar24 (2019, July 26). Wednesday was one of the busiest recorded days in aviation history — and it's going to keep getting busier. Businessinsider.nl https://www.businessinsider.nl/most-flights-ever-225000-flightradar24-flight-tracking-2019-7?international=true&r=US#:%7E:text=More%20than%20225%2C000%20flights%20were,the%20flight%2Dtracking%20service%20Flightradar24.

[8] Choice (2019, April 17). After boeing crash more people want help, taming fear of flying Choice.npr https://choice.npr.org/index.html?origin=https://www.npr.org/2019/04/17/711820160/after-boeing-crashes-more-people-want-help-taming-fear-of-flying?t=1612439178057

[9] The Guardian (2021, January 2). Plane crash deaths rose in 2020 despite pandemic. Theguardian.com https://www.theguardian.com/world/2021/jan/02/plane-crash-deaths-rose-in-2020-despite-pandemic

is: ''*Is there a relation between the number of deaths in a disaster and the negative financial return?*''

There are different causes for an airplane to crash.[10] In this study causes are distinguished in internal and external factors. Internal factors are those where the cause is within the responsibility of the aviation company. For instance, there may be a defect in the equipment, such as a defective engine or damaged wing or a crash may be caused by human involvement, such as a pilot error. These are all examples of internal factors. A bird flying in the engine, a terrorist attack, or a war related accident, such as the crash of flight MH17 on 24th of July in 2014, are examples of external factors.

Therefore, the next sub-question is: ''*Is there a different effect in stock return for crashes caused by internal factors and crashes caused by external factors?*''

It was not possible to test this third sub-question as the number of crashes caused by an external factor are relatively low. Only one crash in Europe and one crash in the United States met the criteria for crashes by external factors. Which is insufficient to test this sub-question. The criteria the crashes have to meet for this study can be found in the methodology section.

This study finds a negative return on the day of the crash and the day after for American airline companies that experienced the disaster. The higher the number of deaths the more negative this effect on the stock market.

## Literature review

Some research on the effects of aviation disasters on the stock market has been performed. A study from Chance and Ferris (1987) found a negative stock return for the complete aviation industry. However, this negative effect lasted only for one trading day and did not persist after the day of the crash.

[10] The national law review (n.d.). The Most Common Causes of Aviation Accidents. Natlawreview.com https://www.natlawreview.com/article/most-common-causes-aviation-accidents

A study by Bosch et al. (1998) found also a negative stock price reaction. However, this negative response was only significant for two days after the crash and thereafter became insignificant for the third to the fifth days after the crash.

A negative return was also seen in the study by Ho et al. (2013). Additionally, a dependency was noted between the number of fatalities in a crash and the impact on stock return. For crashes with less than ten deaths, the negative return approximately lasted for one week, while the negative impact on the stock return of a crash with fatalities in excess of one hundred lasted longer (Ho et al. 2013). This finding is consistent with the results of the study of Chance and Ferris (1987), who found a negative correlation between the number of fatalities and the abnormal returns.

A study by Borenstein and Zimmerman (1988) also found a negative effect of a crash on the stock returns of an involved company. However, they did not find any evidence for a negative effect on stock returns of a rivalling, non-involved, company.

The study of Bosch et al. (1998) showed a non-involved company flying on the same routes as the company involved with an aircraft crash, had a positive stock return after the crash. While a non-involved company, who did not fly the same routes of the crash had a negative stock return after the crash. According to the study of Ho et al. (2013) this result is true for small crashes only. However, after a big crash, with at least hundred victims, the entire aviation industry suffers a negative stock return.

Not many studies have been carried out on the effect of a crash on the stock returns of airplane manufacturers. Furthermore, the results of studies performed on the effect of a crash on the stock returns of the manufacturers showed inconsistent results. The study of Chance and Ferris (1987) did not find any evidence for an effect on airplane manufacturers stock. On the other hand, the study of Chalk (1987) and the study of Walker et al. (2005) showed a negative effect of a crash on the returns of the manufacturer of the involved aeroplane.

Moreover, the cause of the crash is not often taken into account in most studies. However, according to the studies of Chalk (1987), Krieger and Chen (2005) and Walker et al. (2005), the returns after a crash caused by, for example a terroristic attack, differed from the returns after a crash caused by, for example a bird flying into the engine of the plane.

All of the above mentioned researches are based on companies from the United States. It is hard to find sufficient data of European companies. These companies were not always listed at the time of the crash.

## Hypothesis

### Hypothesis main research question

''*What is the effect of airline disasters on the stock market?*''

It is expected that the companies involved with an airline disaster have a negative stock return immediately after the crash. Besides, it may also be possible that confidence in the aviation industry as a whole may be lost as the result of an airline disaster which may also cause a negative stock return for any other aviation company. This would be consistent with the findings of Chance and Ferris (1987).

### Hypothesis of the first sub-question

*'Do companies experience a negative stock return after a crash happened?''*

If an airline accident is caused by an internal factor, the involved aviation companies experience a negative stock return for a few days after the crash, which is consistent with the results of the study of Bosch et al. (1998).

### Hypothesis of the second sub-question

*''Do other (non-involved) aviation companies experience a negative stock return after a crash?''*

Aviation companies which are not involved with an airplane crash experience a negative stock return after the crash. A big crash, which is in this thesis considered being a crash with at least 35 fatalities, can be expected to result the entire aviation industry experiencing a negative stock return. According to the study of Ho et al. (2013) the entire aviation industry suffered from a negative return after such a crash. Ho et al. placed crashes with 10-99 deaths in the medium-fatality group and crashes with 100+ deaths in the high-fatality group.

### Hypothesis of the third sub-question

*''Is there a difference between financial returns of European companies and American companies as the result of a disaster?''*

All the important researches mentioned in the literature review section are based on data from the United States. It is interesting to include European data. However, it is not expected that there will be a significant difference between the returns of the American and European listed companies that suffered from an airline disaster.

### Hypothesis of the fourth sub-question

''*Is there a relation between the number of deaths in a disaster and the negative financial return?''*

A crash with a lot of fatalities will have a more negative return than a crash with less or even none fatalities, due to more negative media coverage. In addition, the study of Chance and Ferris (1987) finds a negative correlation between the number of fatalities and the abnormal returns.

It was not possible to test a sub-question about the difference in stock reactions after a crash caused by internal factors or external factors. This due to a too small sample, which consisted of only one crash from Europe and one from America. Which is not sufficient to test this sub-question reliably. However, the studies of Chalk (1987), Krieger and Chen (2005) and Walker et al. (2005) all indicated that the returns after a crash differed per cause of the crash.

# Methodology

## List of crashes

I used the archive of the Bureau of Aircraft Accident Archives which collects information about disasters, to assemble a list of crashes. The crashes that will be used for this research have to meet some criteria which are described below.

The first criterium is that the type of the flight is a scheduled revenue flight. Scheduled revenue flights are economic flights from big companies. Other flight types, such as charter flights usually do not transport that many passengers and are done by small companies, so these are not part of the study.

The second criterium is that the involved company has to be registered on the stock market when the aeroplane crash occurred. At first, the aim was to only consider European companies, but since not all of these companies were listed in the past and companies from the United States were more often listed, the American companies will be used too.

The third criterium is that the crash has to have a minimum number of fatalities, because of the media coverage. Crashes with no or less fatalities get not as much media coverage compared to crashes with for instance more than hundred fatalities. The minimum number of fatalities used for the crashes in this study is 35 fatalities.

For the list of crashes caused by an external factor the same criteria as mentioned above had to be taken in account. External factors included bombs on board, a plane that was shot down and crashes caused due to weather conditions, in cases the crew was not to blame.

The study of Chance and Ferris (1987) and the study of Bosch et al. (1998) use only American listed companies in their research. In this study American and European companies were considered. This creates the possibility to determine whether there is a difference in abnormal returns between European companies and American companies after a crash.

Table 1 and 2 show the aeroplane crashes which fulfil these criteria and which are used for this project. The crash code mentioned is an unique code for each crash. This makes it easier to find information about a specific disaster.

| COMPANY | DATE OF CRASH | FATALITIES | CRASH CODE |
|---|---|---|---|
| TURKISH AIRLINES (TURKEY) | 8-1-2003 | 75 | TC-THG |
| SAS (SWEDEN) | 8-10-2001 | 114 | SE-DMA |
| AEROFLOT (RUSSIA) | 5-5-2019 | 41 | RA-89098 |
| AEROFLOT (NORD) (RUSSIA) | 14-9-2008 | 88 | VP-BKO |
| ALITALIA (ITAY) | 14-11-1990 | 46 | I-ATJA |
| AIRFRANCE (FRANCE) | 1-6-2009 | 228 | F-GZCP |
| KLM AIRLINES (NETHERLANDS) | 27-3-1977 | 248 | PH-BUF |
| GERMANWINGS/LUFTHANSA (GERMANY) | 24-3-2015 | 150 | D-AIPX |
| LUFTHANSA (GERMANY) | 20-11-1974 | 59 | D-ABYB |
| LAUDA AIR (AUSTRIA) | 26-5-1991 | 223 | OE-LAV |

*Table 1: The European sample of crashes, with the date of the crash, number of fatalities and the crash code*

| COMPANY | DATE OF CRASH | FATALITIES | CRASH CODE |
|---|---|---|---|
| AMERICAN AIRLINES | 20-12-1995 | 159 | N651AA |
| TRANS WORLD AIRLINES | 17-7-1996 | 220 | N93119 |
| ALASKA AIRLINES | 31-1-2000 | 88 | N963AS |
| DELTA AIRLINES | 2-8-1985 | 135 | N726DA |
| DELTA AIRLINES | 31-7-1973 | 88 | N975NE |
| COMAIR (DELTA AIRLINES) | 26-8-2006 | 49 | N431CA |
| UNITED AIRLINES | 19-7-1989 | 111 | N1819U |
| US AIRWAYS | 2-7-1994 | 37 | N954VJ |

*Table 2: The American sample of crashes, with the date of the crash, number of fatalities and the crash code*

The list shown in Table 1 and 2 concern crashes, which are caused by an internal factor. Many crashes could not been considered, since they did not meet the inclusion criteria.

At the time of crash a large number of European companies were not listed at the stock markets. Another reason for the exclusion of crashes is that the estimation window, which the expected returns are based on, may be biased. This happens when another crash oc-

curred for the same company. For example the US Airways crash on 8-9-1994 is excluded because of another US Airways disaster in the estimation window happened.

Table 3 shows the descriptive statistics for the European sample as well as the American sample.

| | EUROPEAN SAMPLE | AMERICAN SAMPLE |
|---|---|---|
| CRASHES | 10 | 8 |
| COMPANIES | 8 | 6 |
| MINIMUM FATALITIES | 41 | 37 |
| MAXIMUM FATALITIES | 248 | 220 |
| MEAN FATALITIES | 127,2 | 110,875 |

*Table 3: Descriptive statistics of the sample, including European and American crashes.*

For each crash of an involved company, the stock market returns in the same period for non-involved companies were also taken in account to construct a control sample. The abnormal returns of non-involved companies were calculated on basis of the same estimation window. The list of the crashes and the corresponding number of control companies are shown in Appendix Table A.1 for the European sample and Table A.2 for the American sample.

For the selection of the control companies, the data had to be available in the period of the crash and the control company must have not been involved in a crash and no other factors which may have influenced the returns should be present during the estimation window of [-165, -3].

Some crashes happened around the same time. Like the crashes of Alitalia and Lauda Air. In that case, different control companies were assigned to each crash.

## Formulas

The data of the closing price, market value of the stocks and indices in this study are obtained from DataStream.

The first event period is [0,1], the second event period is [0,7] and the third event period is [0,15]. The event period starts on the day of the crash, since it is unlikely there is an information leak prior to the crash. Therefore, the returns on the day of the crash and the returns on the first day after the crash, the first seven days, and the first fifteen after the crash of the involved company are investigated. The analysis will be done in SPSS, which is a software application used to analyse data and statistics.

The expected return will be estimated according to the market model of MacKinlay (1997)

$$E(R_{it}) = \alpha + \beta * Rm$$

Where $\alpha$ is a performance measure compared to a corresponding index. This is calculated as the Excel function INTERCEPT(known_y;known_x) and β as the risk measure for the stock and $E(\mathrm{R}_{mt})$ as the expected return of the market portfolio. This is calculated by SLOPE(known_y;known_x).

Both the α and β are based on the estimation window of [-165, -3] from the event date. Where the y is the daily return of the stock and x the daily return of the index. Returns are calculated as:

> *''return of today = (closing price of today – closing price of yesterday)/ closing price of yesterday''*

Afterwards, the abnormal returns are calculated. The abnormal return (AR) can be calculated with the following formula:

$$AR_{it} = R_{it} - E(R_{it})$$

Where R is the actual return of the stocks and E(R) is the expected return of the stocks of company i on time t.

Next, the cumulative abnormal returns (CAR) for the first days after the crash are calculated, which is a sum of the abnormal returns starting from the event date. A distinction has been made between the first day after the crash, the first seven days and the first fifteen days after the crash. This is calculated with the following formula:

$$CAR_i = \sum_{t=1}^{T} AR_{it}$$

I compare the reaction of the airline companies involved in the crash to comparable non-involved companies.

The stock market returns after American crashes will be compared to the returns for European crashes, using the same event period and estimation window [-165,-3].

To investigate the possible connection between the number of fatalities in a crash and the negative return, a new variable *new_fatalities* will be created. This is calculated as the variable *fatalites / 100*. This is to have a better understanding of the result. A regression will be made in SPSS with the curve estimation.

## Data

The stock price data for the airline companies, as well as the corresponding index prices are from DataStream and are analysed in SPSS. Table A.3 and A.4 in the Appendix show the calculated α and β for both the European and American companies. Table 4 shows the corresponding index for each involved company for the European sample and Table 5 shows this for the American Sample.

| EUROPEAN COMPANY | CORRESPONDING INDEX |
|---|---|
| TURKISH AIRLINES | MSCI TURKEY |
| SAS | MSCI Sweden |
| AEROFLOT | MSCI Russian |
| AEROFLOT | MSCI Russian |
| KLM | AEX |
| AIR FRANCE-KLM | France MSCI index |
| ALITALIA | MSCI ITALY - PRICE INDEX |
| DEUTSCHE LUFTHANSA | DAX |
| DEUTSCHE LUFTHANSA | DAX |
| LAUDA AIR | ATX - Austria Index |

*Table 4: Crashed companies in the European sample and the corresponding indices*

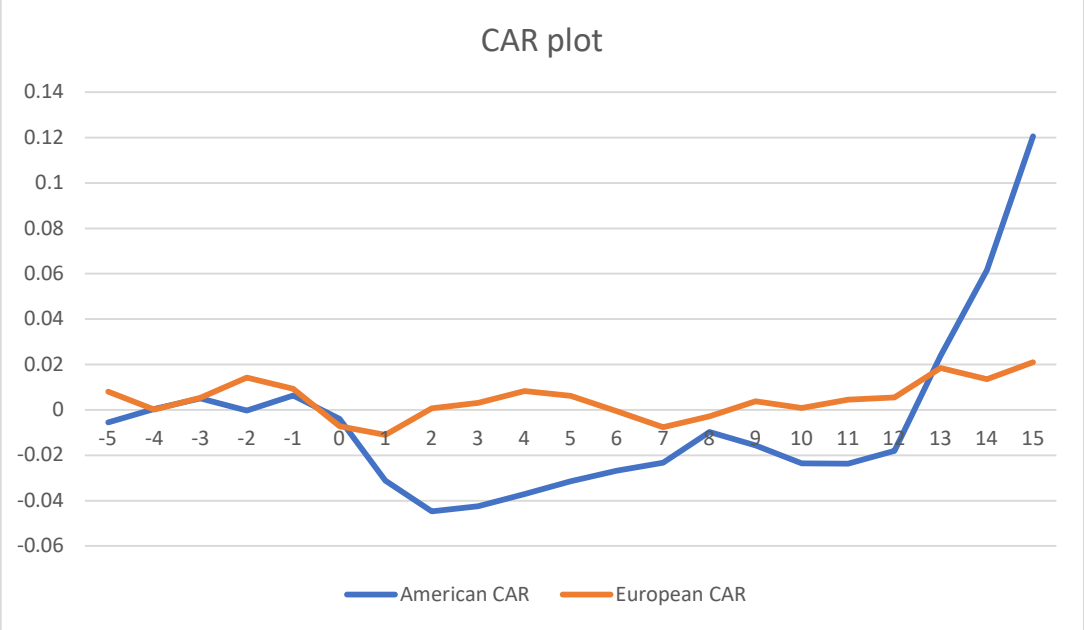
| AMERICAN COMPANY | CORRESPONDING INDEX |
|---|---|
| AMERICAN AIRLINES | DOW JONES |
| US AIRWAYS | DOW JONES |
| UNITED AIRLINES | DOW JONES |
| TRANSWORLD AIRLINE | DOW JONES |
| ALASKA AIR GROUP | DOW JONES |
| DELTA AIRLINES | DOW JONES |
| DELTA AIRLINES | DOW JONES |
| DELTA AIRLINES | DOW JONES |

*Table 5: Crashed companies in the American sample and the corresponding indices*

# Results

## Negative return

To answer the first sub-question *''Does the involved aviation company experience a negative stock return after the crash?'',* the CAR for each day is plotted in graph 1. The period [-5 to 0] is to see if there is a run-up.




*Graph 1: running Cumulative abnormal return from -5 to 15 for European and American companies*

As we can see in graph 1 there is a slightly positive CAR for both the European and the American companies in the period before the crash. This turns into a negative CAR on the event day and the first trading day after the crash for the European companies.

For the American companies there is a more negative CAR and this stays negative until the thirteenth day after the crash. After that day the CAR of the American companies goes sky high, while the CAR of the European companies stays around zero until the tenth day. However, these results are not significant.

| EVENT PERIOD | EUROPEAN | AMERICAN |
|---|---|---|
| CAR[-5,15] | 0,0021 | 0,1206 |
| CAR[0,1] | -0,0202 | -0,0374* |
| CAR[0,7] | -0,0168 | -0,0296 |
| CAR[0,15] | 0,0112 | 0,1136 |

*Table 6: the CAR for European and American companies for each event period. *significant at 95% confidence interval*

Appendix Table B.1 shows the results of the average abnormal returns per trading for the European sample and Appendix Table B.2 shows these results for the American sample. Table 6 shows the CAR for different event periods. A significant negative CAR[0,1] was found for the American companies who suffered a negative return of 3,74% on the event day and the day following the crash. The Appendix Table B.3 shows the significance of this result.

The mean CAR[0,7] was still slightly negative for both the American companies and the European companies. Then the mean CAR[0,15] was positive for the European companies as well for the American companies. However, these results are not significant.

*Hypothesis 1*: If the accident is caused by an internal factor, involved aviation companies will experience a negative stock return for a couple of days after the crash, consistent with the results of Bosch et al. (1998).

For American companies a reaction of -3,74% is found for the day of the crash and the day after the crash. For the other event periods and for the European companies the results were insignificant. This may be caused by the relative small sample size or the crash just did not have enough impact on the stockholders. So, this hypothesis is not rejected for the American sample. On the other hand, for the European sample the hypothesis is rejected.

## Non-involved companies

The next sub-question was *'Do other (non-involved) aviation companies experience a negative stock return after the crash?'*. Involved companies are being compared to a number

of non-involved companies to see if non-involved companies also experienced a negative reaction, and if indeed so, for how long. Table 7 shows the abnormal returns for the different event periods for crashed and non-involved companies in Europe.

| EUROPEAN SAMPLE | CRASHED COMPANIES | NON-INVOLVED COMPANIES |
|---|---|---|
| CAR[0,1] | -0,0202 | 0,0106 |
| CAR[0,7] | -0,0168 | -0,0064 |
| CAR[0,15 | 0,0112 | -0,0064 |

*Table 7: the CAR for European companies which suffered a disaster and non-involved companies for the given event periods*

In Europe non-involved companies experienced a mean positive result of 1,06%, while the crashed company suffered a mean negative result of 2,02%. Over the first seven days after the crash the entire aviation industry in Europe suffered a mean negative return. However, on the first fifteen days following a crash the non-involved companies being negatively affected while the company involved with the crash experienced a positive return. These results are insignificant.

In addition, Table 8 shows the results of the same tests performed on the American sample.

| AMERICAN SAMPLE | CRASHED COMPANIES | NON-INVOLVED COMPANIES |
|---|---|---|
| CAR[0,1] | -0,0374* | -0,0012 |
| CAR[0,7] | -0,0296 | -0,0088 |
| CAR[0,15 | 0,1136 | -0,0048 |

*Table 8: the CAR for American companies which suffered a disaster and non-involved companies for the given event periods. *significant at 95% confidence interval*

A significant negative result of 3,74% for the CAR[0,1] was found for crashed American companies.

The non-involved companies suffer also from a crash with a slightly negative CAR. Companies still showing a negative CAR for the first fifteen days after the crash, while the company involved with the crash experienced a mean positive result of no less than 11,36%. These results are considered to be insignificant.

*Hypothesis 2*: Other (non-involved) aviation companies experience a negative stock return after the crash. After a big crash it is expected that the entire aviation industry will experiences a negative stock return.

A significant negative result of 3,74% for the CAR[0,1] is found for American companies involved in a crash. However, the non-involved companies do not experience a significant abnormal return.

The other results of the tests are insignificant. This is probably due to the relative small sample size. Another explanation may be that the non-involved companies simply do not suffer when another airline company crashes. This could mean that the majority of the people do not avoid travelling by other companies after a crash. This is inconsistent with the study of Borenstein and Zimmerman (1988). This hypothesis is rejected.

## European versus American abnormal returns

''Is there a difference between returns for European companies and American companies which suffered from a disaster?'' Table 9 shows the results of the involved European companies compared to the involved American companies.

| EVENT PERIOD | EUROPEAN | AMERICAN |
|---|---|---|
| CAR[0,1] | -0,0202 | -0,0374* |
| CAR[0,7] | -0,0168 | -0,0296 |
| CAR[0,15] | 0,0112 | 0,1136 |

*Table 9: The CAR for companies from Europe and the United States which experienced a disaster for the given event periods. *significant at 95% confidence interval*

*Hypothesis 3*: There is no significant difference between the financial returns of American and European airline companies after a crash occurred.

In this study no significant difference between European and American companies is found. This can also be explained by the size of the sample, which is relatively small. Another explanation for this result could be that there simply is no difference between the stock market returns of the companies from Europe and the United States. So, this hypothesis is not rejected.

## Fatalities

In order to determine whether there is a correlation between the number of fatalities and the negative return, curve estimates are carried out on the CAR[0,1], CAR[0,7] and CAR[0,15] of the companies involved with crashes and their number of fatalities.

For better understanding of these regression a new variable, *new_fatalities* was computed. This new variable was calculated as the variable *fatalities* / 100. In Table 10 are the results of these regressions.

| EVENT PERIOD | EUROPEAN | AMERICAN |
|---|---|---|
| CAR[0,1] | -0,006898 | -0,050589* |
| CAR[0,7] | -0,040509 | -0,068380 |
| CAR[0,15] | -0,076747 | -0,195850 |

*Table 10: regression table with the relation between the number of deaths and the CAR of the event periods.*
**significant at 95% confidence interval*

A significant small negative relation between the number of fatalities and the return after a aviation disaster for American companies on the CAR[0,1] is shown. The significance of this result can be seen in Appendix Table B.4. The other negative mean relations are insignificant.

*Hypothesis* 4: After a crash with a high number of fatalities the company will experience a more negative return.

So, is there a relation between the number of deaths and the abnormal returns after a crash? A significant result is found for the CAR[0,1] for the American companies. This means that the number of deaths has an impact on the short term stock market reactions of companies from the United States. This is consistent with Ho et al. (2013). However, the other results are insignificant. One explanation for this is the relative small sample size. Another explanation may be that on the longer term, the number of deaths do not have an impact on the abnormal returns. So, this hypothesis is not rejected for the American sample. On the other hand, for the European sample the hypothesis is rejected

# Conclusion

The research question of this thesis was: ''*What is the effect of airline disasters on the stock market?*'' This research question will be answered on the basis of the several sub-questions.

The majority of articles about the effect of airline disasters on the stock market values are focused on American companies only. However, this thesis also researches European companies and investigates the difference between American and European stock response.

After a disaster the airline company could face some financial problems, for instance, the loss of an airplane by the company, the financial compensation for families of the deceased and the loss of income from future customers who will avoid this particular company.[11]

Therefore, this thesis answered the following research question ''*What is the effect of airline disasters on the stock market?*''.

American airlines which suffer from an aviation disaster, experience a negative stock return on the event day and the day after of the crash of 3,74%. In the first seven days and fifteen days following a crash no significant result is found. For the returns of the European companies no significant result is found after the crash. One possible explanation for this result could be that stockholders are not impressed enough by the crash.

There is no significant difference found between the returns of the involved companies and the non-involved companies. This also applies for the returns of companies from Europe and the United States. This also may be due to the relative small sample size or may be due to the low impact on the stockholders.

The number of deaths has a small negative impact on the returns of an American company after a crash for the event period [0,1]. While companies from Europe do not experience a more negative return when the number of deaths is higher. The number of fatalities also does not have a significant impact on the abnormal return for the first seven and fifteen days following the crash for both the European and American companies.

[11] Choice (2019, April 17). After boeing crash more people want help, taming fear of flying Choice.npr https://choice.npr.org/index.html?origin=https://www.npr.org/2019/04/17/711820160/after-boeing-crashes-more-people-want-help-taming-fear-of-flying?t=1612439178057

## Recommendations

This thesis has some limitations. Firstly, the sample size is relatively small, which would explain why the majority of the results are not significant.

Secondly, the investigation of the sub-question concerning the difference of stock reactions between crashes caused by an internal factors and external factors could not be carried out because the number of crashes caused by an external factor are relatively low. Only one crash in Europe and one crash in the United States met the criteria for crashes by external factors. However, Chalk (1987), Krieger and Chen (2005) and Walker et al. (2005) stated that the stock market returns after a crash depends on the cause of a crash. Therefore, it is recommended to investigate this dependence in future research.

Since most of the studies are focused on American companies, another recommendation is to do research on the returns of European companies which suffered from a crash. Is there a difference between the returns of European and American companies? And if so, why would that be?

An additional recommendation is to have a further investigation of the relation between the number of fatalities in an airplane disaster and the impact on the stock market.

# References


Blalock, G., Kadiyali, V., & Simon, D. H. (2007). The Impact of Post-9/11 Airport Security Measures on the Demand for Air Travel. The Journal of Law and Economics, 50(4), 731–755. https://doi.org/10.1086/519816

Borenstein, S., & Zimmerman, M. B. (1988). Market incentives for safe commercial airline operation. The American Economic Review, 913-935.

Bosch, J. -. C., Eckard, E. W., & Singal, V. (1998). The Competitive Impact of Air Crashes: Stock Market Evidence. The Journal of Law and Economics, 41(2), 503–519. https://doi.org/10.1086/467399

Chalk, A. J. (1987). Market Forces and Commercial Aircraft Safety. The Journal of Industrial Economics, 36(1), 61. https://doi.org/10.2307/2098597

Chance, D. M., & Ferris, S. P. (1987). The effect of aviation disasters on the air transport industry: a financial market perspective. Journal of Transport Economics and Policy, 151-165.

Ho, J. C., Qiu, M., & Tang, X. (2013). Do airlines always suffer from crashes? Economics Letters, 118(1), 113–117. https://doi.org/10.1016/j.econlet.2012.09.031

Krieger, K., & Chen, D. (2015). Post-accident stock returns of aircraft manufacturers based on potential fault. Journal of Air Transport Management, 43, 20–28. https://doi.org/10.1016/j.jairtraman.2015.01.002

MacKinlay, A. (1997). Event Studies in Economics and Finance. Journal of Economic Literature, 35(1), 13-39. Retrieved March 1, 2021, from http://www.jstor.org/stable/2729691

Vasterman, P., Yzermans, C. J., & Dirkzwager, A. J. E. (2005). The Role of the Media and Media Hypes in the Aftermath of Disasters. Epidemiologic Reviews, 27(1), 107–114. https://doi.org/10.1093/epirev/mxi002

Walker, T. J., Thiengtham, D. J., & Lin, M. Y. (2005). On the performance of airlines and airplane manufacturers following aviation disasters. Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration, 22(1), 21-34.

# Appendices

## Appendix A: Descriptives

| Company | Control Companies | First observation | Last observation |
|---|---|---|---|
| **Turkish airlines (Turkey)** | 7 | 20-5-2002 | 14-2-2003 |
| **SAS (Sweden)** | 7 | 17-2-2001 | 4-11-2001 |
| **Aeroflot (Russia)** | 6 | 25-1-2008 | 21-10-2008 |
| **Aeroflot (nord) (Russia)** | 6 | 14-9-2018 | 11-6-2019 |
| **KLM (Netherlands** | 1 | 6-8-1976 | 3-5-1977 |
| **Airfrance (France)** | 6 | 11-10-2008 | 8-7-2009 |
| **Alitalia (italy)** | 1 | 26-3-1990 | 21-12-1990 |
| **Germanwings/Lufthansa (Germany)** | 1 | 1-4-1974 | 27-12-1974 |
| **Lufthansa (Germany)** | 6 | 3-8-2014 | 30-4-2015 |
| **Lauda Air (Austria)** | 1 | 5-10-1990 | 2-7-1991 |

*Table A.1: number of control companies for the European sample*

| Company | Control Companies | First observation | Last observation |
|---|---|---|---|
| **American Airlines** | 2 | 1-5-1995 | 26-1-1996 |
| **Trans World Airlines** | 2 | 27-11-1995 | 23-8-1996 |
| **Alaska Airlines** | 5 | 12-6-1999 | 8-3-2000 |
| **Delta Airlines** | 4 | 10-12-1972 | 6-9-1973 |
| **Delta Airlines** | 5 | 12-12-1984 | 8-9-1985 |
| **Comair (Delta Airlines)** | 4 | 5-1-2006 | 2-10-2006 |
| **United Airlines** | 5 | 28-11-1988 | 25-8-1989 |
| **US Airways** | 4 | 11-11-1993 | 8-8-1994 |

*Table A.2: number of control companies for the American sample*

| Company | α | β |
|---|---|---|
| **Turk Hava Yollari (TL)** | 0,0015 | 1,120792099 |
| **SAS (Sk)** | -0,003189 | 0,07907432 |
| **Aeroflot (Ur)** | -0,001238 | 0,406053297 |
| **Aeroflot (Ur)** | -0,000561 | 0,221025521 |
| **KLM (EU)** | -0,000911 | 0,827426227 |
| **AirFrance-KLM (Eu)** | -0,000391 | 0,946531552 |
| **Alitalia (Eu)** | -0,002647 | 0,728253162 |
| **Lufthansa (Eu)** | -0,000692 | 0,069920724 |
| **Lufthansa (Eu)** | -0,00056 | 0,588455861 |
| **Lauda Air (Eu)** | -0,00043 | 0,089297035 |

*Table A.3: Alpha and Beta for European sample*

| Company | α | β |
|---|---|---|
| **AMR** | -0,000642 | 1,345729385 |
| **US Airways** | -0,004063 | 0,795843831 |
| **UAL** | 0,0020402 | 0,929153201 |
| **Transworld** | 0,0019372 | 0,638661218 |
| **Alaska Air group** | -0,000995 | 0,762641506 |
| **DELTA AIR LINES** | -0,000208 | 1,429165415 |
| **DELTA AIR LINES** | 0,0006788 | 1,025165387 |
| **DELTA AIR LINES** | 0,0002739 | 0,094202408 |

*Table A.4: Alpha and Beta for American sample*

## Appendix B: SPSS

**Descriptives**

AR_MM

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| -5 | 10 | ,0079 | ,01535 | ,00485 | -,0031 | ,0188 | -,02 | ,03 |
| -4 | 10 | -,0078 | ,01205 | ,00381 | -,0164 | ,0008 | -,03 | ,01 |
| -3 | 10 | ,0052 | ,02287 | ,00723 | -,0112 | ,0216 | -,05 | ,03 |
| -2 | 10 | ,0089 | ,01632 | ,00516 | -,0028 | ,0205 | -,02 | ,04 |
| -1 | 10 | -,0049 | ,02267 | ,00717 | -,0211 | ,0113 | -,05 | ,04 |
| 0 | 10 | -,0166 | ,02757 | ,00872 | -,0363 | ,0032 | -,05 | ,05 |
| 1 | 10 | -,0037 | ,03347 | ,01058 | -,0277 | ,0202 | -,09 | ,03 |
| 2 | 10 | ,0117 | ,04920 | ,01556 | -,0235 | ,0469 | -,05 | ,12 |
| 3 | 10 | ,0023 | ,02527 | ,00799 | -,0158 | ,0204 | -,04 | ,05 |
| 4 | 10 | ,0052 | ,02862 | ,00905 | -,0153 | ,0256 | -,03 | ,07 |
| 5 | 10 | -,0021 | ,01990 | ,00629 | -,0163 | ,0121 | -,02 | ,04 |
| 6 | 10 | -,0068 | ,02592 | ,00820 | -,0254 | ,0117 | -,06 | ,02 |
| 7 | 10 | -,0070 | ,01786 | ,00565 | -,0198 | ,0058 | -,04 | ,02 |
| 8 | 10 | ,0048 | ,01712 | ,00541 | -,0074 | ,0170 | -,03 | ,03 |
| 9 | 10 | ,0066 | ,00982 | ,00311 | -,0004 | ,0137 | -,01 | ,02 |
| 10 | 10 | -,0029 | ,01800 | ,00569 | -,0158 | ,0099 | -,02 | ,04 |
| 11 | 10 | ,0037 | ,03355 | ,01061 | -,0203 | ,0277 | -,03 | ,08 |
| 12 | 10 | ,0009 | ,01489 | ,00471 | -,0097 | ,0116 | -,03 | ,02 |
| 13 | 10 | ,0130 | ,02760 | ,00873 | -,0068 | ,0327 | ,00 | ,09 |
| 14 | 10 | -,0049 | ,02479 | ,00784 | -,0227 | ,0128 | -,06 | ,03 |
| 15 | 10 | ,0075 | ,02182 | ,00690 | -,0081 | ,0231 | -,01 | ,06 |
| Total | 210 | ,0010 | ,02455 | ,00169 | -,0023 | ,0043 | -,09 | ,12 |

*Table B.1: SPSS output for the average abnormal return per trading day for the European Sample*

**Descriptives**

AR_MM

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| -5 | 8 | ,0055 | ,03811 | ,01347 | -,0373 | ,0264 | -,05 | ,08 |
| -4 | 8 | ,0059 | ,01756 | ,00621 | -,0087 | ,0206 | -,01 | ,03 |
| -3 | 8 | ,0046 | ,02447 | ,00865 | -,0158 | ,0251 | -,01 | ,06 |
| -2 | 8 | -,0054 | ,02983 | ,01055 | -,0303 | ,0195 | -,04 | ,05 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -1 | 8 | ,0067 | ,03688 | ,01304 | -,0242 | ,0375 | -,07 | ,04 |
| 0 | 8 | -,0103 | ,02913 | ,01030 | -,0347 | ,0141 | -,04 | ,04 |
| 1 | 8 | -,0271 | ,03349 | ,01184 | -,0551 | ,0009 | -,10 | ,01 |
| 2 | 8 | -,0137 | ,02614 | ,00924 | -,0356 | ,0081 | -,07 | ,02 |
| 3 | 8 | ,0023 | ,02656 | ,00939 | -,0199 | ,0245 | -,02 | ,04 |
| 4 | 8 | ,0054 | ,03133 | ,01108 | -,0208 | ,0316 | -,06 | ,04 |
| 5 | 8 | ,0055 | ,02563 | ,00906 | -,0160 | ,0269 | -,03 | ,06 |
| 6 | 8 | ,0048 | ,02150 | ,00760 | -,0132 | ,0228 | -,02 | ,04 |
| 7 | 8 | ,0035 | ,02620 | ,00926 | -,0184 | ,0255 | -,03 | ,06 |
| 8 | 8 | ,0135 | ,03726 | ,01317 | -,0177 | ,0446 | -,01 | ,10 |
| 9 | 8 | -,0058 | ,00563 | ,00199 | -,0105 | -,0011 | -,01 | ,00 |
| 10 | 8 | -,0080 | ,03557 | ,01258 | -,0378 | ,0217 | -,07 | ,05 |
| 11 | 8 | -,0001 | ,02574 | ,00910 | -,0217 | ,0214 | -,04 | ,05 |
| 12 | 8 | ,0056 | ,04396 | ,01554 | -,0312 | ,0423 | -,05 | ,09 |
| 13 | 8 | ,0419 | ,09494 | ,03357 | -,0375 | ,1213 | -,02 | ,26 |
| 14 | 8 | ,0377 | ,07699 | ,02722 | -,0267 | ,1020 | -,01 | ,22 |
| 15 | 8 | ,0591 | ,12994 | ,04594 | -,0496 | ,1677 | -,02 | ,36 |
| Total | 168 | ,0057 | ,04867 | ,00375 | -,0017 | ,0132 | -,10 | ,36 |

*Table B.2: SPSS output for the average abnormal return per trading day for the American Sample*

**One-Sample Test**

| | Test Value = 0 | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | |
| | t | df | Sig. (2-tailed) | Mean Difference | Lower | Upper |
| AR_MM | -2,371 | 15 | ,032 | -,01869 | -,0355 | -,0019 |

*Table B.3: significance for the one sample test on the American sample on the event period [0,1]*

**Coefficients**

| | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | t | Sig. |
| new_fatalities | -,051 | ,015 | -,801 | -3,273 | ,017 |
| (Constant) | ,006 | ,017 | | ,336 | ,748 |

*Table B.4: significance for the curve estimate on the number of fatalities and abnormal return for American companies on [0,1]*