6-2015

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Scholarly Commons Citation

Gokhale, J., & Raghavan, S. (2015). Effect of Weather Delays on Shareholder Value: Evidence from the Airline Industry. *Journal of International Finance and Economics, 15*(2). https://doi.org/10.18374/JIFE-15-2.7

EFFECT OF WEATHER DELAYS ON SHAREHOLDER VALUE: EVIDENCE FROM THE AIRLINE INDUSTRY

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ABSTRACT

Airlines measure service quality based on different factors such as on-time performance, delays and cancellations, mishandled baggage and denied boardings. Among the above factors, recent studies show that long delays and cancellations have a major impact on airlines bottom line not only in terms of current costs but also in terms of loss of future revenue. Finance literature tells us that stock prices reflect the present value of future cash flows. In this paper we use event study methodology to examine how weather delay and cancellations affect current stock market returns for our sample airlines. We find some evidence that airline stocks are adversely affected by weather delays only when the delays are significant and widespread or persistent over a longer period. However the results are not significant and show that currently the stock market is not penalizing airlines for delays and there is no significant loss in the value for these firms.

Keywords: *Airline Service Quality, Event Study, Airline Industry, Stock Returns.*

1. INTRODUCTION

The impact of the different dimensions of airline service quality, such as percentage of on time arrival, passengers denied boarding, mishandled baggage and customer complaints on customer satisfaction has been extensively researched. (Baker, 2013) concludes that for the period 2007-2011 low cost carriers performed better than traditional legacy carriers in terms of the four service quality measures outlined above. Park et al. (2004) examine the air passenger's decision making process based on data from Korean international passengers. Their study concludes that service value, passenger satisfaction and airline image have a direct effect on air passengers' decision making process.

There are also specific indexes such as the American Customer Satisfaction Index (ACSI) and the Airline Quality rating (AQR) which ranks airlines based on specific attributes. The ACSI for example uses twelve airline attributes namely on- time arrival, baggage handling and seat comfort etc. Unlike the ACSI which is survey based, the AQR is based on published data and is a multi-factor weighted approach developed by Bowen and Headley (2015). Some of the factors used in the AQR are on-time arrivals, denied boarding and customer complaints. However neither the ASCI nor the AQR specifically deal with delays, cancellations or diversions due to weather related issues.

Further the literature is scant on study of airline service quality variables on airline stocks. The study by Li et al. (2011) was the first to explicitly model investor's expectations of operational performance along the different dimensions of airline service quality. The paper examines the effect of unexpected operational performance on current stock price movements in the industry. The study concludes that unanticipated long delays and cancellations are by far the greatest source of negative abnormal returns and other factors such as mishandled baggage and denied boardings are weak and statistically insignificant. They eschew the use of event studies as they feel that their methodology helps them examine the effect of multiple operational variables on current stock prices.

Given their conclusion that unanticipated long weather delays and cancellations have the largest significant effect on stock prices and as the literature does not specifically address flight cancellations, we use event study methodology to specifically test if unanticipated weather delays did have a significant impact on airline stock returns during the weather delays in the winter of 2014.

2. EVENT STUDY METHODOLOGY

The event study method was developed by Ball and Brown (1968) and Fama, Fisher Jensen and Roll (1969). This method has been widely reviewed and a number of methods have been developed for testing the significance of abnormal performance of stock returns. For more recent reviews of this method, see Thomson (1985), Armitage (1995), MacKinlay (1997), Bhagat and Romano (2002a, 2002b) and Corrado (2011). This method has been widely used to study the effect of adverse events on shareholder returns. Several studies have investigated the relationship between stock returns of companies and catastrophic events such as airline crashes (Barrett et al. 1987; Davidson et al. 1987) and the September 11 terrorist attacks (Carter and Simkins, 2004) and more recently on the Boeing Dreamliner groundings (Gokhale et al., 2014). The measure of a change in company's shareholders' wealth is measured by the percentage change in stock returns. It is hypothesized that stock returns of a company are proportional to the returns from the markets. This is called the market model. The specificity, accuracy and sensitivity of percentage change in stock returns in response to unexpected events makes it attractive for researchers to use the market model. This model is based on Efficient Markets Hypothesis (EMH), according to which any new information related to a stock is captured by change in stock returns. Assuming that there are no arbitrage opportunities and that agents behave rationally, the EMH in its strong form assumes that the price of a security reflects the fundamental value of the firm, which is assumed to be the present value of future profits attributed to the firm's operations. Any new information either changes the expected value of profits or changes the discounting rate and hence affects stock returns. The market model thus assumes a stable linear relationship between stock returns for a company 'i' at time 't' (R_{it}) and market returns (R_{mt}) at time 't', described as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \quad (1)$$

$$\varepsilon_{it} \sim N(0, \sigma^2), \quad (2)$$

where the error term ε_{it} is white noise and follows a random walk.

In this study, we test the null hypothesis that adverse events such as delays and cancellations due to adverse weather have no effect on an airline stocks' abnormal returns. Normal or Expected Returns are defined as returns predicted by the market model conditional on the existing information about the stock market. An abnormal return is defined as the actual ex post return minus the expected return. The abnormal return for firm i at event date τ is:

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|R_{m\tau}), \quad (3)$$

where $E(R_{i\tau}|R_{m\tau})$ is the expected return and $R_{m\tau}$ is the conditioning information available before the event which assumes the normal relationship between stock returns $R_{i\tau}$ and the market returns $R_{m\tau}$. In other words, $R_{m\tau}$ is the information that is used to predict the expected return assuming that the pre-event relationship still exists between the stock returns and market returns. The difference between the actual returns and the predicted returns then determined the extent to which the event caused a shock in stock returns.

To successfully measure and analyze abnormal returns, we first need sufficient stock price (and dividend) data before and after the event date. Let $\tau = 0$ be the event date and W_{pre} be the pre-event time period or estimation window. Let T_{pre} be the number of observations (number of days) in W_{pre}. The event window (W_{event}) identifies the time it takes for the event information to affect stock returns. In a perfectly efficient financial market, this will be a very short length of time and would include just one time period (Brooks et al., 2003). With real world imperfections, however, there may be information leaks before the event and lags in response to the event. With information leaks, W_{event} starts before $\tau = 0$; if it takes time for investors to evaluate the economic consequences of an event, then W_{event} extends into several periods after $\tau = 0$.

The next step in evaluating the financial effect of an event is to accurately estimate expected normal returns. This requires estimation of the market model in equation 1. Under the conditions of the model, the parameters can be estimated with data from W_{pre} using ordinary least squares (OLS). Parameter estimates ($\hat{\alpha}_i$ and $\hat{\beta}_i$) and market data from W_{event} are used to forecast normal returns during the event window, $(R_{i\tau}|R_{m\tau})$. Thus, the abnormal return at time τ is:

$$AR_{i\tau} = R_{i\tau} - E(\hat{R}_{i\tau}|R_{m\tau}) \tag{4}$$

For the classic market model,

$$AR_{i\tau} = R_{i\tau} - (\hat{\alpha}_i + \hat{\beta}_i R_{m\tau})$$

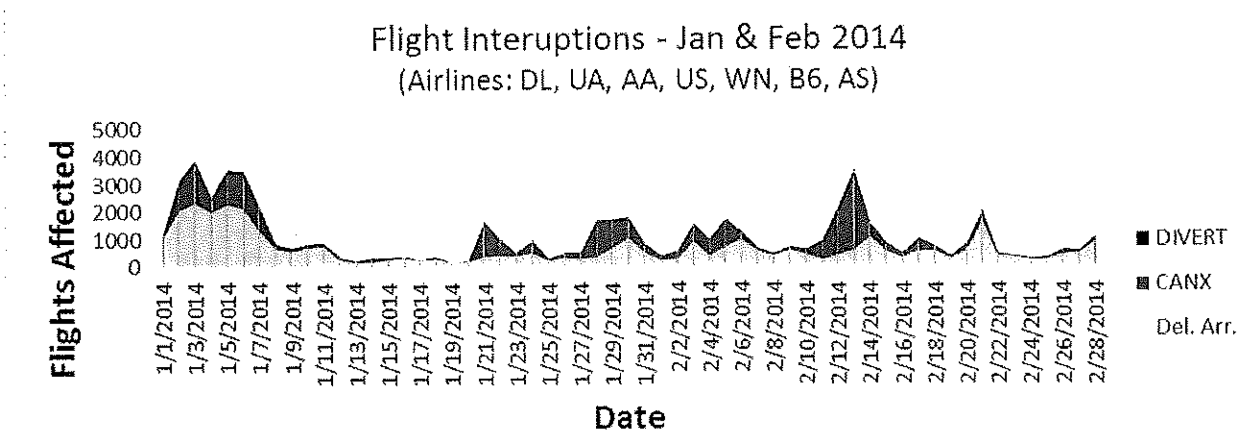
$E(R_{i\tau}|R_{m\tau})$ Is the expected return and $R_{m\tau}$ is the market return (which is the conditioning information). In other words, $R_{m\tau}$ is the information that is used to predict expected returns assuming no abnormal event. In the event study method, the relation between $R_{i\tau}$ and $R_{m\tau}$ is measured in the estimation window. This allows us to estimate the sample value of $\hat{\alpha}_i$ and $\hat{\beta}_i$. Let W_{pre} be the length of the estimation window and T_{pre} be the number of observations in the estimation window. The value of T_{pre} needs to be sufficiently long and yet should not include any other abnormal events, which may cause instability in the estimation of $\hat{\alpha}_i$ and $\hat{\beta}_i$. Let W_{event} be the length of the event window, which starts at τ=0. This is before the official start of the event if there are fears of information leakage. The length of W_{event} is > 1 if there are inefficiencies in transmission of information to investors, or if the event studied is a complex series of smaller events. In such a case, τ extends through several trading days.

Using the estimated values of $\hat{\alpha}_i$ and $\hat{\beta}_i$ from W_{pre}, we can estimate abnormal returns and cumulative abnormal returns (CARs). CARs aggregate abnormal returns over the event window. If an event does not have an impact on returns, then ARs (and hence CARs) would not be statistically significant. A negative (positive) event would produce negative (positive) ARs and CARs. If W_{event} ranges from τ_1 to τ_2, then:

$$CAR_{i\tau} = \sum_{t=\tau_1}^{\tau_2} AR_{i\tau}. \tag{5}$$

3. RESULTS AND ANALYSIS

Figure 1: flight interuptions for the period January-February 2014



Data for six major carriers for delays were obtained from the OAG data base of airlines' schedules. List of airlines and their stock returns are available with the Center for Research in Security Prices (CRSP). The market model is executed using the program STATA provided by STATA Corp. We analyze delays

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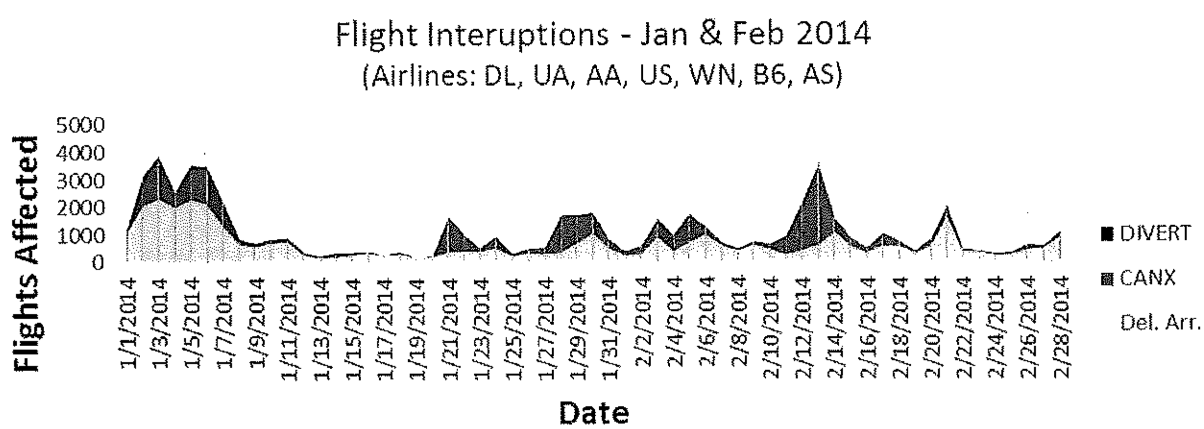

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 ISSN: 1555-6336

and stock price effects on six major carriers namely Alaska Airlines, American Airlines and U.S. Airways, Jet Blue Airways, Southwest Airlines and United Airlines for the period January 1, 2014 to 14th February 2014. We look at five event windows where there were major cancellations involving cumulative flight delays of 2000 or more for a five day period.

Table 1 and Figure 1 show our results. Figure 1 shows the breakdown of delayed arrival, cancellations and diversions for the six airlines in our study for different days in our sample.

It also shows the events where major cancellations occurred. Table 1 shows the breakdown of the five different event windows. For the first event (January 2-7, 2014) we see that that on January 6th and 7th that all the airlines witnessed negative abnormal returns but only the abnormal return for delta was significant at the 10% level.

Similarly, for event 2, only Southwest Airlines showed negative abnormal returns, and these were not significant at 10% level.

Event 3 was longer and all airlines had negative abnormal returns, but none of these was significant. During event 3, only Alaska and Delta reported negative abnormal returns for all three days, but these were not significant at 10%. Only Southwest showed significance at a level of 5%.

For event 4, Alaska, Southwest, US Airways and Delta airlines all showed negative abnormal returns, but only US Airways showed significance at 5% level. Finally, for event 5. All airlines reported negative abnormal returns but those that were significant were only Southwest (at 5%), Jetblue (10%) and United (10%).

The abnormal returns were negative for all five days for Delta but not significant. In conclusion we find some evidence that airlines stock returns are adversely affected by weather delays only when the delays are either significantly widespread and sustain for a longer period of time.

Table 1 - The Breakdown Of The Five Different Event Windows

Event	From	ARALK	ARluv	ARjblu	ARual	ARlccaal	ARdal
Event 1: 2 Jan to 7 Jan 2014	2-Jan	0.009873	0.010148	0.01718	0.016122	-0.00815	0.019386
	3-Jan	0.018019	0.027534	0.052223	0.046283	0.056256	0.053667
	6-Jan	-0.00351	-0.01265	-0.04058	0.021285	-0.0181	0.003699
	7-Jan	-0.01032	0.011937	-0.00551	-0.01409	-0.01741	-0.02844*
Event 2: 21 Jan to 22 Jan 2014	21-Jan	0.014724	-0.00061	0.010701	0.016697	0.016328	0.026356
	22-Jan	0.021097	0.020031	0.031881	0.016088	0.024237	0.020784
Event 3: 27 Jan to 30 Jan 2014	27-Jan	-0.00412	-0.00726	-0.01947	-0.00108	-0.02278	-0.01158
	28-Jan	-0.00073	0.025995	0.003685	0.049615	0.016424	-0.00098
	29-Jan	-0.02064	-0.02339**	-0.01569	0.045578	-0.019	-0.01872
	30-Jan	-0.0026	0.016163	0.043592	0.00828	0.023405	0.00338
Event 4: 03 Feb to 05 Feb 2014	3-Feb	-0.02264	-0.0019	0.006408	0.043662	-0.05436**	-0.00856
	4-Feb	0.000496	0.0012	0.006623	-0.00883	0.003573	0.00573
	5-Feb	-0.00466	-0.0012	-0.01068	-0.0052	-0.01135	0.003604
Event 5: 10 Feb to 14 Feb 2014	10-Feb	-0.01724	-0.02223**	-0.02541*	-0.00545	-0.01137	-0.01828
	11-Feb	-0.00672	0.001057	-0.01263	-0.02894*	-0.02306	-0.01197
	12-Feb	0.008901	-0.00629	-0.00489	-0.01286	0.008346	-0.01058
	13-Feb	0.006211	-0.00809	-0.00158	0.000614	0.013234	-0.00356
	14-Feb	0.017521	-0.00183	-0.00276	-0.02491	-0.01412	-0.00947

However the results are not significant and show that currently the stock market is not penalizing airlines for delays and there is no significant loss in the value for these firms. Thus there is no significant loss in expected future profits and the markets do not penalize these airlines for delays or cancellations.

However, it is clear that if these delays are persistent or not handled by airlines to the best of their ability, it may harm their reputation and lead to significant negative abnormal returns.

Consequently, it is prudent to state that despite our results airlines should focus on reducing extreme delays and cancellations to improve their profitability within the Industry.

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ISSN: 1555-6336

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