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US Airline Stock Market Performance and Change in Investor Behavior over the Great Recession of 2008

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Abstract: We study the relationship of West Texas Intermediate (WTI) crude oil returns and the stock market returns with the US airline stocks before, during and after the 2008 financial crisis. We confirm the positive relationship of the airline stock returns with the overall market and the negative relationship with WTI. However, we find that the crisis led to a structural change in this relationship. Our results differ for low-cost airlines which absorb the oil price shock better as compared to legacy airlines. We also find that there is a difference in the relationship between the airline stock returns and WTI returns when asymmetric WTI returns are considered. Investors punish airline stocks more when there are asymmetric negative WTI returns as compared to asymmetric positive returns. While our results are in line with the existing literature on the overall stock markets, this study is unique because it provides a context for the behavior of airline stocks.

Keywords: US airlines, airline stock returns, crude oil prices, financial crisis

JEL Codes: L62, G14, G01

Biographical Notes:

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1. Introduction

The Great Recession of 2008 was a period that saw turbulent times. The dip in real GDP, rise in unemployment accompanied by tightening credit conditions and volatile crude oil prices and equity returns changed the behavior of consumers, firms and investors around the world. There is evidence that these behavioral changes have altered the relationship between stocks across different industries and stock market indices. The research of Mollick and Assefa (2013) indicates that US stock returns are negatively correlated with the returns from crude oil prior to the financial crisis, but positively correlated during the financial crisis spanning the time period between 2008 and 2009. Sadorsky (2014) finds a structural change in the relationship between emerging market stock prices and commodity prices. Several other studies also note this change.[1]

Due to the changing economic conditions, the financial crisis also hurt the consumer sentiment. Rising uncertainty caused agents to adjust their consumption and saving pattern. The travel and tourism industry shrank by 18% in the United States (Ritchie et al., 2010). This also had an effect on air-travel as agents altered their behavior by seeking alternative forms of transportation. Consequently the passenger revenues for the 12 major airlines[2] shrank by almost 15% in the US in 2009 over 2008, and the passenger yield dropped by almost 14% over the same period. Net profit margin declined from 3.4% of total revenues in 2007 to negative 22% in 2008 and negative 3% in 2009 before bouncing back to 2.2% in 2010 (Greenslet, 2015). The reduction of profit margins led to a negative impact on stock returns.

Furthermore, with the growing importance of low-cost carriers and razor thin operating margins, cost factors have become increasingly important in the passenger air travel industry. Fuel and labor costs are the two most significant expenses for airlines. While fuel expenses

ranged from 23-34% of total expenses in 2015, wages and benefits ranged from 15-39% of total expenses (Syth et al., 2015). The Great Recession of 2008-09 had an effect on both these factors.

There are two unique contributions of this study. First, using a two-factor market model, we characterize the change in relationship of airline stock returns over the period of the Great Recession. Second, we also aim to capture the heterogeneity between legacy carriers and low-cost carriers to investigate whether the significance of the cost structure is captured by the nature of an airline or its profit margin. We also characterize the asymmetric effects of oil price changes on airline stocks. The rest of this paper is organized as follows: Section II covers the relevant literature and the background of this study. Section III discusses the data, theoretical and empirical model. Section IV discusses robustness checks and empirical results and Section V concludes.

2. Oil, Economy and Airlines

Oil prices significantly influence the overall economy and stock markets. Hamilton (1983) shows that oil prices are partially responsible for all recessions (except one) after World War II. However, the stock markets respond to oil price shocks in different ways depending on the underlying cause of the shocks: that is, whether the shocks are driven by demand or supply (Kilian and Park, 2009). Oil prices had a larger effect on inflation and the US economy before 1981 (Hooker, 2002). Kilian (2008) finds that oil supply shortfalls do not explain asymmetric price rises. However, supply shocks do cause a sharp drop in the US real GDP growth. Oil prices are pro-cyclical and lead consumer prices, but lag industrial production (Ewing and Thompson, 2007).

Several studies have also been conducted to determine the effects of oil price on stock returns. Guidi, Russell and Tarbert (2006) study the effect of oil price on stock markets in the US and UK as a result of OPEC policy decisions. They find that the US stock markets anticipate the policy decisions better than the UK stock markets. Oil prices have a negative effect on overall stock markets (Driesprong, et al., 2008; Jones and Kaul, 1996). Chen, Roll and Ross (1986) and Huang, Masulis and Stoll (1996) find that changes in oil prices do not have an explanatory effect on stock prices. Ewing and Malik (2010) find that oil prices have a strong initial negative impact on equity returns but die out quickly.

Changes in oil prices have varying effects depending on the country or the industry under examination. According to the research by Basher & Sardorsky (2009), oil is a fundamental driver of economic activity because it is a significant factor for production and it has no substitutes. Therefore, countries that are net importers of oil are negatively affected by price increases (Bhar & Nikolova, 2009). Shocks in oil prices have a significant impact on total economic output (Mork, 1989), but each industry may be impacted differently depending on its sensitivity and dependency on oil as a factor of production (Fama & French, 1997).

A number of studies document that an oil price increase has a stronger (negative) effect than a decrease. This phenomenon has been tested across several developed countries (Mork, 1989; Mork, Olsen, Mysen, 1994; Jones, Leiby and Paik, 2004). Olson, Vivian and Wohar (2014) examine the relation between energy and equity markets and find that low S&P 500 returns cause an increase in volatility of the energy index while energy shocks cause a weak response from the stock markets. An investigation of changes in oil prices on the stock markets of eight different countries finds that effects on the markets are small in magnitude (Apergis and Miller, 2009). Another study finds that the negative oil price shocks have an immediate negative

effect on the industrial production and employment in Greece (Papapetrou, 2001). Several studies have investigated the effect of oil prices on different industries in the United States and other developed countries. In addition to industries intensely related to the creation of different products from crude oil, the industries that depend on oil as a primary factor for operations (such as airlines) and others are also impacted by oil price shocks (Gogineni, 2010; Nandha and Faff, 2008; Faff and Brailsford, 1999). The effect of oil price risk on stock returns in China and other emerging markets is also well documented (Basher and Sadorsky, 2006; Cong, Wei, Jiao and Fan, 2008). The relationship between oil prices and stock prices of the oil and gas sector are significant and positively related (El-Sharif, Brown, Burton, Nixon and Russell, 2005; Elyasiani, Mansur and Odusami, 2011; Faff and Brailsford, 1999 and 2000; Sadorsky, 2001). El Hedi Arouri and Nguyen (2010) use data in various countries of Europe and find that stocks in various sectors of the industry respond differently to a change in oil prices.

Studies reveal that the relationship of the stock returns and crude oil returns before the financial crisis, during the crisis and after the crisis have changed. Tsai (2015) studies stock returns from different sectors of the US industry to conclude that the reaction of stocks to oil prices changed over the Great Recession. Mollick and Assefa (2013) find that prior to the financial crisis, the US stock returns were negatively affected by increased oil returns. However, after the crisis, the relationship between the stock returns and oil returns is positive and significant. The direct relation between oil and stock returns has been ascribed to an improving economy. Al-Mudhaf & Goodwin (1993) also create a structural break in their study of the oil shocks in the 1970s on equity returns. Other studies have examined the effects of other major events, such as terrorist attacks. Drakos (2004) found that the conditional systematic risk for

airlines more than doubled after the 9/11 period. Kim and Gu (2004) also found that systematic and total risk for airlines increased significantly after 9/11.

Aggarwal, Akhigbe and Mohanty (2012) study the impact of oil prices on the transportation sector and find evidence of negative and asymmetric effects of oil prices. Nandha and Brooks (2009) find that the negative effect of oil prices is persistent whether symmetric or asymmetric effects due to oil prices are considered. They examine the role of oil prices in explaining the equity returns of the transportation sector in 38 countries between 1983 and 2006 and find that there is a negative correlation between oil prices and stock indices of net oil importers. On the other hand, they find there is a positive correlation with the stock index of net exporters. This has also been observed by Park and Ratti (2008) and O'Neill et al. (2008). Hammoudeh and Li (2005) find that investors place more importance to systematic risk than risk due to oil prices. However, the US transportation sector has higher risk (beta) in markets showing negative returns.

The effect of crude oil returns is dependent upon the time period, country, and the sector of the economy. Since jet fuel costs play a prominent role in the airline cost structure, it is important to look at the relationship of crude oil returns and airline stock returns more closely. The airline industry is characterized by a high degree of price competition between carriers. There is an increasing importance being placed upon leisure travelers who are price sensitive. The other class of travelers, business travelers, are less price sensitive and are more concerned with aspects related to the quality of air travel such as flight schedule, frequent flier programs, first class and business class seats, and airport facilities. The price elasticity of demand for business travelers is low, whereas that of leisure travelers is high. People traveling for vacation have a greater flexibility and can schedule many months in advance to purchase a lower priced

ticket. To meet with the elastic demand, airlines need to keep prices low even if operating costs increase in the short run (Vasigh, Flemming, and Tacker, 2013). Thus volatile oil prices may have a direct impact on the financial performance of airlines. This may lead the airlines to create fuel hedging strategies. Carter, Rogers and Simkins (2006) find that the hedging of jet fuel led to a positive change in the airline firm value during the period 1992 to 2003. On the other hand, Turner and Lim (2015) find that jet fuel price risk for airlines cannot be effectively hedged by using any of the four proxies: West Texas Intermediate (WTI) crude oil, North Sea Brent oil, heating oil or gasoil. Lim and Hong (2014) find the statistical effect of fuel hedging on airline operating costs is not significant. Similarly, Nandha, Brooks and Faff (2013) find that oil prices and oil volatility have slight impact on airline stocks. Lee, Seo and Sharma (2013) use the method of Tobin's Q and find that high oil prices have a slight negative effect on the firm performance in the airline sector.

The airline industry is highly sensitive to changes in oil prices because jet fuel is a derivative of oil. As a result, large price increases will likely have a negative impact on airline stock returns. Jet fuel prices are highly correlated with crude oil prices, and large changes in jet fuel prices can negatively impact the cash flow for airlines as fuel is one of the most significant costs for carriers. Oil prices not only increase direct costs to the airlines, but high oil prices also reduce consumer income, thereby making air-travel less attractive to cheaper alternative forms of transportation. Mohanty et al. (2014) demonstrate the negative impact that oil price increases have on the Travel and Leisure industry, while Edelstein and Kilian (2009) demonstrate a decline in air travel as purchasing power decreases.

Another aspect affecting airline returns is the oligopolistic nature of the industry. Consequently, the actions of one firm are likely to affect the actions of the others (Gong et al.,

2008). Many airlines freely exchange passenger information through code-sharing agreements. These agreements affect airline stock performance; as explained by Song et al. (2007). Nanda et al. (2013) point out, several other factors that can contribute to airline stock returns are unforeseen events, differences in business model, regulations, and consumer sentiment.

The airline industry is characterized by two main forms of business models: legacy carriers and low-cost carriers (LCCs). Legacy carriers typically operate a hub-and-spoke network to capitalize on economies of scale and density. They also focus on product differentiation and cater to the business travelers. LCCs focus on being price leaders, operate point-to-point networks, utilize a uniform aircraft fleet, and minimize costs by eliminating extra services (Vasigh, Fleming, & Tacker, 2013). Our study includes both types of airlines in order to examine if there is a difference in the way stock returns are determined based on the business model followed by the airline. Flouris and Walker (2007) compared the performance of Canadian airlines operating under different business models and showed that the low-cost carrier was less affected by catastrophic events. The LCCs also demonstrated better performance in terms of risk and return. In this study we also look at the nature of the relationship of each airline with overall markets and crude oil returns to examine if the relationship is affected by the airline cost structure.

3. Empirical Model

Our empirical model is based upon the efficient market hypothesis, which states that any new information about a company with publicly traded stock will change the investors' perception of expected future cash flows thereby changing the price of its stock. This price fully captures all available information to investors at a point in time (Fama et al., 1969; Ball & Brown, 1968).

In this study, we examine the relationship given by the two factor model. This includes the West Texas Intermediate (WTI) crude oil spot price returns and stock market returns represented by the Standard and Poor 500 Index (S&P 500) returns as the explanatory variables and the US airline stock returns as the explained variable and is similar to the model used by Khudoykulov (2016).[3] We consider the effects before and after the Great Recession.[4] In keeping with the past research, this study detects and imposes a structural break during the time of increased volatility in stock markets and crude oil prices to determine the effects of these variables on airline returns.[5]

Brent crude oil and jet fuel returns were also considered as explanatory variables, but they were highly correlated with WTI returns and removed from the model because of multicollinearity.[6] Other characteristics of the airlines were also considered, such as the use of fuel hedging and cost structure (low-cost carrier or legacy carrier) but these characteristics do not change for each individual airline and often resulted in a singular matrix; the effects of these characteristics would be captured by the parameter estimates and can be factored in the second stage regressions. For this reason, these variables were excluded from the primary OLS model and were used in a secondary model to test if the coefficients of the explanatory variables were significantly different before and after the structural break and if cost structure also determined the parameter estimates for the airline stock returns. Fuel hedging was tested in the second stage regression but was found to be insignificant.

The two-factor regression model to can be expressed as follows[7]:

$$E(R_{it}) = C_{1i} + C_{2i}R_{mt} + C_{3i}R_{WTIt} \quad (1)$$

Where:

R_{it} is the stock return for airline *i* and day *t,*

R_{mt} is the S&P500 Index return on day *t,*

R_{WTIt} is the WTI spot price return on day *t.*

This model is based on the premise that the expected value of the airline stock returns on day 't' (R_{it}) is related to the overall market returns (R_{mt}) and the returns from oil (R_{WTIt}). Per efficient market hypothesis (EMH), it is expected that the overall market returns would be positively correlated with the airline stock returns (Gokhale and Raghavan, forthcoming) and negatively correlated with crude oil returns, the latter being a factor in the variable cost of the airlines. This model was appropriately modified to accommodate the asymmetric effects of oil prices. To consider the effect of asymmetric positive effects, only those observations were considered, in which oil returns were positive and similarly for asymmetric negative effects, only those observations were considered, when the oil returns were negative.

The regression model used to determine the effects of the 2008-09 financial crisis and the decline in the profitability of airlines and the airline cost structure on each of the coefficients in equation 1 is

$$C_{ji} = \beta_1 + \beta_2 Cost_i + \beta_3 Pre2008_i \quad (2)$$

Where

C_{ji} is coefficient *j* of airline *i,*[8]

$$j = \begin{cases} 1: intercept \\ 2: estimate\ of\ Standard\ and\ Poor\ 500\ returns \\ 3: estimate\ of\ crude\ oil\ returns \end{cases}$$

$Cost_i$ is a dummy variable for the cost structure of airline *i,* assuming a value of 1 for low-cost carriers and 0 otherwise,

$Pre2008_i$ is a dummy variable with a value of 1 when the coefficient C_{ij} is for the period prior to the 2008 financial crisis and zero otherwise.

In this model, we study the effect of the characteristic of the airline (legacy vs low-cost) and of the nature of the time period (whether the time period under consideration is before the crisis or after). The hypotheses are that the coefficients derived from the stage one model are dependent on the nature of the airline (whether the legacy airlines' stock returns are more responsive to market returns vis-à-vis low-cost airlines), and also on the time period (whether the relationship between airlines stock returns and overall market/ oil returns changed after the crisis).

3.1 Variables and Identification

The dependent variable in the first stage (equation 1) is the stock return of each airline. It is assumed that a positive change in the economic activity will have a positive effect on demand for transportation for work and leisure, thus stimulating the demand for air travel and increasing airline stock returns. Thus, the overall markets (represented by the S&P stock returns) are expected to have a direct relationship with the airline stock returns. As discussed earlier, jet fuel is a significant cost factor for airlines and its price is highly correlated with WTI spot price. It is assumed that a positive return in WTI will have a negative impact on airline returns. It is expected that each airline will have a positive correlation with the S&P 500 Index returns.

The dependent variable in the second stage (equation 2) is the coefficient of the S&P 500 Index returns from equation 1. Our objective is to determine if airline cost structure and the pre-

recession effect had a relationship with the parameter estimate for the relationship of the airline stock returns with the market returns. Therefore, the independent variables are the cost structure of the airline and the period of the observation (pre or post-recession). The cost structure is considered because stock returns of the low-cost carriers may be less sensitive to the changes in the returns from the overall market as compared to legacy carriers. The time period is considered because the period after the financial crisis may have impacted the relation of airline returns with the overall market returns as noted by Mollick and Assefa (2013), Tsai (2015) and Al-Mudhaf and Goodwin (1993). For instance, the volatility of the period may have caused airlines to increase fuel hedging practices and result in a decrease in the correlation between airline stock returns and stock market returns for the period after the crisis.

3.2 Hypothesis

H1 C_2: A rise in stock market returns leads to a rise in airline stocks and vice versa, $C_{2i} > 0$.

H2 C_3: As WTI returns increase, the airline returns decrease and $C_{3i} < 0$.

H3 β_2: If the cost structure of the airline has an impact on the coefficient then $\beta_2 < 0$.[9]

H4 β_3: If the 2008 financial crisis has an impact on the coefficient then $\beta_3 < 0$.[10]

4. Data and Summary Statistics

For this study, the data needed are stock returns for airlines, the returns from the overall markets, and crude oil returns. The return for day 't' was derived from the stock prices (P_t on day 't' and P_{t-1} for the previous trading day) and dividends paid out on day 't' (D_t), if any, using the relation $R_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$. The airline stock prices were obtained from the Center for Research in Security Prices (CRSP) database for the period between January 1, 2007 and December 31,

2013. The price of the Standard and Poor's 500 Index (called as S&P 500 Index) was used to calculate the market returns for the study. This index is the weighted average of the stock prices of the stocks of 500 leading companies in different industries of the United States. The data were analyzed as pre and post 2008 financial crisis covering the date ranges from January 1, 2007 to November 30, 2007 and July 1, 2009 to December 31, 2013.[11] This therefore covered 251 observations pre-crisis, and between 316 to 1134 observations post crisis depending on the airline under consideration. There is a difference in the number of observations for different airlines because of bankruptcy proceedings (American), listing on stock exchange (Spirit) and merger (United).

We obtained WTI crude oil spot prices from the US Energy Information Administration database. The means of all returns, both before and after the 2008 financial crisis, were approximately zero (See tables 2 and 3). The sample size for all but Delta (DAL) pre-crisis and American (AAL) post-crisis was greater than 250 observations. This helps us assume the asymptotic properties of the distribution of the error term in the regression models.

5. Results

Regression 1

The results of the first stage model pre-2008 recession are shown in table 4. The data showed evidence of heteroscedasticity; hence, we corrected the standard errors with White's correction and used robust standard errors. Table 4 suggests that the intercept term in case of all airlines is not significant at the 5% level. However, all airline stock returns are sensitive to changes in the S&P 500 returns. The three most sensitive stocks being American, Alaska and Skywest. The stocks also showed a negative correlation with crude oil returns. American, US Airways and United Airlines showed the most sensitivity to changes in crude oil returns and

Allegiant Airlines showed the least sensitivity to changes in crude oil returns. Since this provides us the evidence that low-cost airlines may have lower dependence on the shocks due to oil prices, we decided to do the second stage regressions. This regression also confirms the hypothesis H1 for the significance of the dependence of all airlines on stock markets at a level of 0.1%. It also confirms H2 for all airlines at a level of at least 5% significance (with the exception of Allegiant Airlines).

The results of the first stage model post-2008 recession are shown in table 5. The standard errors of these regressions were corrected with White's correction. Table 5 also suggests that the intercept term in case of all airlines except United is not significantly different from zero at 5% level. However, all airline stock returns remain sensitive to the changes in the S&P 500 returns post crisis. The three most sensitive stocks being American, United and US Airways. It seemed that the sensitivity of these stocks with market returns post-recession had increased as seen from the increase in the coefficient of 'R_{mt}'. This is what will be checked in the second stage regressions. The stocks also showed a negative correlation with crude oil returns, but the absolute value of the negative coefficients seemed to decrease for all except Allegiant Airlines. American, US Airways and United Airlines continued to show the most sensitivity to changes in crude oil returns even after the recession. On the other hand, the sensitivity of Republic Airlines to WTI returns increased but the sensitivity was not significant at 5% level. This could be due to the acquisition of Midwest (the operating brand of Republic airlines) by Frontier airlines. This regression also confirms H1 for all airlines at a level of 0.1% (except American). It also confirms H2 for all airlines at 0.1% significance (with the exception of American, United and Republic Airlines).

We examined another version of this model in which instead of considering the symmetric effects of crude oil returns, we just considered the asymmetric effects of positive and negative oil returns. In the pre-crisis period, considering the negative asymmetric effects (table 6) two of the three most affected airlines (American and US Airways) are also positively rewarded. United, the third airline is also rewarded with positive returns, but the effect is not as high as with symmetric effects. The parameter estimates of oil returns are significant at 5% for all but three airlines in our sample. Moreover, the parameter estimates decreased for all other airlines suggesting possibly that markets viewed negative change in oil prices optimistically for airline stocks.

When we consider the asymmetric effect of positive crude oil returns during the pre-crisis period, we find that the effect on parameter estimates is mixed (table 7). American, US Airways and United are punished by the investors with greater than normal negative returns than in the symmetric oil return situation. Delta, another legacy carrier, also gets punished more severely than expected. Other airlines such as Alaska, Allegiant, Skywest and Hawaiian do not witness as great negative returns as expected from regression with symmetric oil returns. Overall, the pre-crisis parameter estimates for crude oil for airlines are more negative when oil returns are positive than when they are negative, meaning that before the Financial Crisis of 2008, stock investors differentiated between the type of airline (legacy vs low-cost) more when oil returns were positive than when they were negative.

This trend continues to be observed even after the financial crisis. When crude oil returns are negative, the markets do not reward all airline stocks as expected when we consider the symmetric effects which is seen from greater parameter estimates of the crude oil returns if negative WTI returns are considered from table 9. The biggest beneficiaries of the negative crude

oil returns after the financial crisis are United, American and the erstwhile US Airways (which has since merged with American to amplify these effects).

When crude oil returns are (asymmetric) positive, it is expected that the stock returns of airlines will be negative. The worst affected are the four (now three) legacy carriers (American, Delta, United and US Airways) as seen from their coefficients which are more negative than others, as seen from table 8. Consistent with the observation in table 5, Allegiant has a more negative coefficient after the Crisis. However, it is notable that the coefficients of two low-cost carriers Spirit and Southwest airlines increased marginally. The parameter estimates suggest that asymmetric positive crude oil returns do not hurt the returns of these two airlines. The estimates, although negative are not significantly different from zero even at a 5% significance level. This evidence suggests that even after the financial crisis, investors seem to place more importance on the cost structure of the airlines.

Finally, we look at the relationship of airline stock returns with S&P 500 returns and WTI returns during the financial crisis. These parameter estimates are as in table 10 below. As seen in the table and comparing with table 4, one can observe that the sensitivity of stock returns with respect to S&P 500 returns increased from the pre-2008 levels (seen in the parameter estimates of market returns), perhaps indicating that the investors believed that volatile markets meant decreasing profitability for airline stocks and vice versa. This high volatility remained after the recession was over. The other parameter estimate – that of WTI returns actually increased (became less negative) implying slight breakdown in the negative correlation of the oil returns with the stock returns. This implies that even though investors felt that the airline stocks were more risky during the recession, they believed that the airlines would be able to respond better to

the volatility in oil returns than before the recession. The three airlines with the most negative parameter estimates were respectively United, US Airways and American.

When we consider asymmetric negative oil returns (table 11), the parameter estimates for Delta and Southwest airlines were less negative, implying that the positive benefits of decreasing oil prices were not passed on to positive stock returns as compared to the expected value of the parameter estimate when symmetric oil prices were considered. This could possibly be due to the loss on the hedges placed by these companies in a situation of falling oil prices. However, when positive WTI returns were considered (table 12), we failed to reject the hypothesis that the expected returns of airlines were different from zero, implying insensitivity of airline stocks to positive changes in WTI prices. This relation returned to negative both before and after the crisis.[12]

Regression 2

Table 13 (a) shows the results of regression of the parameter estimates for S&P 500 returns obtained for airlines from the first stage (for pre and post-recession periods in tables 4 and 5) on the low-cost dummy and pre2008 dummy variables. Table 13 (b) shows the results with the regressand being the parameter estimated for S & P 500 returns for each year (2007, 2009, 2010, 2011, 2012 and 2013). We also included the parameter estimates for the market index from the first stage during the recession and ran the same regression model. The results of this regression model are in table 13 (c). We find that both low-cost and pre-recession coefficients are negative and significant at 1% level. This confirms both H3 and H4. Confirmation of H3 implies that for low-cost carriers, the impact of the S&P 500 Index returns is less than the impact for legacy carriers. This could be due to the fact that low-cost carriers need to be more sensitive to customer needs, cut costs and focus on profitability at all times. The low-

cost carriers such as Spirit Airlines and Allegiant Airlines are highly profitable. The confirmation of H4 implies that the assumption of structural break over the Great Recession is justified. The stock markets and overall economy had a lesser effect on airline stocks prior to the Great Recession and after the recession this effect has increased. Adding the parameter estimates for the recession allowed us to have a dummy for both pre-recession and post-recession. These results are consistent with those from tables 13 (a) and 13 (b). The low-cost term is negative and significant at 0.1%. The pre-recession term is negative and significant at 1%. The post-recession term is negative but not significant at 5%.[13]

6. Conclusion and Policy Implications

The objective of this paper is to examine the relationship between airline stocks and S&P 500 Index returns, and WTI crude oil returns both before and after the 2008 financial crisis. Our first stage regression model allows us to derive this relationship for stocks of different airlines. A second stage model has been used to incorporate the fixed effects of the airline cost structure and the period of Great Recession to measure the effects on the sensitivity of airline stocks to the overall markets. The results show a positive correlation between S&P 500 Index returns and most airline stock returns significant at the 0.1% level. These results hold regardless of the period (pre, during, or post crisis). This suggests that usually the airline stocks on an average increase (decrease) by a little more than the increase (decrease) in the overall markets. This also confirms the procyclical nature of airline stocks.

As discussed in the literature section, our results confirm the negative relation between WTI returns and airline stock returns. However, after the crisis the sensitivity of airline stocks to WTI returns is not as high as it was before the crisis. This suggests changes in demand and cost structure when crises occur in energy/ financial markets and need to be monitored closely by the

policymakers. The sensitivity of the fluctuations in the WTI returns to the crisis period also makes a strong case for the study of asymmetric fluctuations in oil price returns.

When we study the asymmetric effects of oil price returns, we find that investors differentiate between the airlines based on their cost structure. On an average, legacy airlines' stock returns were more sensitive to asymmetric negative shocks before the crisis and remained more sensitive to the asymmetric negative oil price shock even after the crisis. The policy implications of these are for both regulators of stock markets and energy markets that the behavior of the low-cost airlines is different from the legacy carriers in driving the energy demand in the industry, which in turn influences energy prices. The evidence of this can be witnessed from a recent news reported in Reuters (Ngai, 2016) that new hedge creation by airlines fuels a rally in oil futures[14]. The response of legacy airline stocks to oil price changes is more extreme than low-cost airlines, especially when oil returns are positive. This implies that during the regime of increasing oil prices, policy makers must pay close attention to the stress on the cost structure of legacy airlines.

The results of our second regression model which accounts for the cost structure fixed effects and pre-recession fixed effects show a negative relationship of the parameter estimate of the S&P 500 Index returns with low-cost airline stock returns (significant at the 1% level), implying that a dramatic rise in the level of overall economic activity (hence S&P 500 index returns) will have a greater impact on the returns of the legacy carriers. This shows that the legacy carriers are more sensitive to the cyclical effects than low cost airlines. This result is not surprising as we observe the same investor behavior when asymmetric oil price effects are considered on legacy vs low-cost carriers. Legacy carriers are more sensitive to asymmetric oil price shocks given both positive and negative shocks. The one exception to this is Allegiant

airlines which is likely due to the airline's decision to not participate in fuel hedging during the period under consideration. However, the overall lower sensitivity of the low-cost airlines can be explained by the fact that most low-cost carriers in the sample are under tremendous pressure to cater to the extremely price conscious customer.

Our results also demonstrate that the coefficient for S&P 500 Index returns is negatively correlated with the pre-2008 financial crisis period, which suggests that a change in overall economic activity (hence overall markets) before the crisis was likely to have a greater effect on the airline stock returns' sensitivity as compared to the post-financial crisis period. In future research, it might be beneficial to increase the sample size by expanding the period of study and extending the sample to global airlines. These policy implications may also be verified for other industries in the transportation sector.

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Table 1: Correlation matrix of WTI Crude oil return, jet fuel returns and brent crude oil returns for the entire period (1a) Pre 2008 (1b) and Post 2008 (1c)

1a. Correlation between West Texas Intermediate (WTI) Crude oil, Brent crude oil and Jet Fuel between 2007 - 2013

	WTI	BRENT	JET
WTI	1.00	0.57	0.60
BRENT	0.57	1.00	0.53
JET	0.60	0.53	1.00

1b. Correlation between West Texas Intermediate (WTI) Crude oil, Brent crude oil and Jet Fuel Pre 2008

	WTI	BRENT	JET
WTI	1.00	0.44	0.80
BRENT	0.44	1.00	0.48
JET	0.80	0.48	1.00

1c. Correlation between West Texas Intermediate (WTI) Crude oil, Brent crude oil and Jet Fuel Post 2008

	WTI	BRENT	JET
WTI	1.00	0.58	0.73
BRENT	0.58	1.00	0.64
JET	0.73	0.64	1.00

Table 2: Pre 2008 Financial Crisis Airline, Stock Market and WTI Return Summary Statistics

Variable	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t	rmt	Rwti
Symbol	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SKYW	UAUA	S&P500	WTI
N	251	251	251	168	251	251	251	251	251	251	251	251	251
Mean	0.001	-0.001	-0.003	-0.002	0.001	-0.003	-0.005	-0.001	0.001	0.000	0.000	0.000	0.002
Std. Dev.	0.027	0.026	0.032	0.030	0.038	0.025	0.034	0.016	0.021	0.020	0.028	0.010	0.019
Min	-0.072	-0.104	-0.144	-0.087	-0.210	-0.089	-0.130	-0.044	-0.078	-0.063	-0.085	-0.035	-0.046
Max	0.124	0.092	0.088	0.101	0.198	0.144	0.082	0.085	0.082	0.075	0.074	0.029	0.057

(Expansion of symbols: ALGT: Allegiant Travel Company, ALK: Alaska Air Group, AMR: American, AAL: American Airlines Group, DAL: Delta Airlines, HA: Hawaiian Holdings, JBLU: JetBlue Airways, LCC: US Airways, RJET: Republic Airlines, SKYW: Skywest, LUV: Southwest Airlines, SAVE: Spirit Airlines, UAUA: UAL Corp., UAL: United Continental Holdings)

Table 3: Post 2008 Financial Crisis Airline, Stock Market and WTI Return Summary Statistics

Variable	r1t	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r11t	r12t	r13t	r14t	rmt	rwti
Symbol	AAL	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SAVE	SKYW	UAL	UAUA	SP500	WTI
N	16	1134	1134	634	1134	1134	1134	1118	1134	1134	654	1134	818	316	1134	1134
Mean	0.002	0.001	0.002	-0.001	0.002	0.001	0.001	0.003	0.001	0.001	0.002	0.001	0.001	0.007	0.001	0.000
Std. Dev.	0.021	0.020	0.023	0.067	0.028	0.026	0.026	0.038	0.019	0.038	0.027	0.025	0.027	0.045	0.011	0.018
Min	-0.046	-0.116	-0.107	-0.840	-0.116	-0.130	-0.147	-0.158	-0.086	-0.162	-0.157	-0.164	-0.117	-0.215	-0.067	-0.082
Max	0.045	0.093	0.134	0.670	0.139	0.155	0.103	0.213	0.087	0.613	0.148	0.221	0.111	0.188	0.047	0.104

(Expansion of symbols: ALGT: Allegiant Travel Company, ALK: Alaska Air Group, AMR: American, AAL: American Airlines Group, DAL: Delta Airlines, HA: Hawaiian Holdings, JBLU: JetBlue Airways, LCC: US Airways, RJET: Republic Airlines, SKYW: Skywest, LUV: Southwest Airlines, SAVE: Spirit Airlines, UAUA: UAL Corp., UAL: United Continental Holdings)

Table 4: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}), WTI returns (r_{WTI}) Pre-2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t
Symbol	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SKYW	UAUA
Intercept	0.001	-0.001	-0.001	0.000	0.001	-0.003	-0.003	-0.001	0.001	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
r_{mt}	0.858***	1.319***	1.526***	0.923***	1.003***	0.947***	1.236***	0.681***	1.024***	1.256***	1.112***
	(0.148)	(0.168)	(0.151)	(0.183)	(0.202)	(0.141)	(0.198)	(0.093)	(0.121)	(0.123)	(0.152)
r_{WTI}	-0.083	-0.323***	-0.760***	-0.522**	-0.292*	-0.422***	-0.696***	-0.218***	-0.153*	-0.211***	-0.609***
	(0.087)	(0.081)	(0.098)	(0.163)	(0.144)	(0.081)	(0.112)	(0.048)	(0.064)	(0.050)	(0.090)
N	251	251	251	168	251	251	251	251	251	251	251
R^2	0.102	0.299	0.411	0.208	0.088	0.239	0.274	0.253	0.248	0.432	0.325

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 5: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}), WTI returns (r_{WTI}) Post-2008 Crisis

	r1t	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r11t	r12t	r13t	r14t
Symbol	AAL	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SAVE	SKYW	UAL	UAUA
Inter-cept	0.002	0.001	0.001*	-0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.002	-0.001	0.001	0.006**
	(0.006)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
r_{mt}	0.050	1.023***	1.476***	2.005***	1.565***	1.386***	1.527***	1.972***	1.183***	1.440***	1.437***	1.283***	1.531***	2.139***
	(1.019)	(0.066)	(0.061)	(0.194)	(0.080)	(0.069)	(0.077)	(0.116)	(0.056)	(0.120)	(0.115)	(0.078)	(0.095)	(0.250)
r_{wti}	-0.925	-0.258***	-0.276***	-0.487***	-0.371***	-0.271***	-0.288***	-0.571***	-0.198***	-0.0783	-0.273***	-0.111**	-0.607***	-0.239
	(0.812)	(0.044)	(0.039)	(0.127)	(0.051)	(0.043)	(0.048)	(0.086)	(0.034)	(0.067)	(0.069)	(0.040)	(0.052)	(0.146)
N	16	1134	1134	634	1134	1134	1134	1118	1134	1134	654	1134	818	316
R^2	0.112	0.222	0.382	0.108	0.276	0.247	0.322	0.238	0.367	0.148	0.266	0.27	0.277	0.256

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 6: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and asymmetric negative WTI returns (r_{WTI}) Pre-2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t
	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SKYW	UAUA
Intercept	0.000	-0.001	-0.005	-0.007	-0.001	-0.004	-0.007	-0.003	-0.004	0.000	0.000
	(0.004)	(0.003)	(0.004)	(0.005)	(0.005)	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.003)
r_{MT}	1.054***	1.246***	1.288***	0.691**	0.942**	0.987***	0.920**	0.652***	1.100***	1.193***	0.833***
	(0.209)	(0.264)	(0.225)	(0.248)	(0.280)	(0.212)	(0.280)	(0.136)	(0.175)	(0.191)	(0.214)
r_{WTI}	-0.232	-0.372	-0.977***	-0.847	-0.564*	-0.450*	-0.793**	-0.307*	-0.420*	-0.302*	-0.560*
	(0.215)	(0.226)	(0.251)	(0.427)	(0.274)	(0.221)	(0.253)	(0.122)	(0.189)	(0.123)	(0.214)
N	118	118	118	77	118	118	118	118	118	118	118
R^2	0.163	0.281	0.319	0.175	0.13	0.204	0.198	0.247	0.284	0.406	0.224

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 7: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and asymmetric positive WTI returns (r_{WTI}) Pre-2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t
Symbol	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SKYW	UAUA
Intercept	-0.004	-0.004	0.000	0.007	-0.010*	0.000	0.004	0.001	0.002	-0.002	0.009*
	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)	(0.002)	(0.002)	(0.002)	(0.003)
r_{mt}	0.552**	1.390***	1.772***	1.158***	0.965**	0.904***	1.648***	0.692***	0.853***	1.284***	1.512***
	(0.204)	(0.187)	(0.181)	(0.227)	(0.297)	(0.189)	(0.275)	(0.134)	(0.150)	(0.134)	(0.166)
r_{wti}	0.198	-0.162	-0.822***	-0.857*	0.316	-0.531***	-1.070***	-0.299**	-0.160	-0.082	-1.043***
	(0.195)	(0.157)	(0.191)	(0.340)	(0.308)	(0.141)	(0.261)	(0.082)	(0.100)	(0.088)	(0.187)
N	130	130	130	91	130	130	130	130	130	130	130
R^2	0.057	0.285	0.427	0.262	0.064	0.218	0.301	0.244	0.225	0.452	0.377

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 8: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and asymmetric positive WTI returns (r_{WTI}) Post-2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r11t	r12t	r13t	r14t
	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SAVE	SKYW	UAL	UAUA
Intercept	0.001	0.000	0.001	0.003	0.000	-0.001	0.005	0.003	-0.007*	0.006	-0.001	0.001	0.007
	(0.002)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.003)	(0.002)	(0.003)	(0.005)
Rmt	1.084***	1.634***	2.165***	1.849***	1.441***	1.694***	2.534***	1.097***	1.418***	1.503***	1.403***	1.721***	2.552***
	(0.117)	(0.144)	(0.228)	(0.198)	(0.110)	(0.135)	(0.218)	(0.0853)	(0.166)	(0.235)	(0.105)	(0.185)	(0.339)
Rwti	-0.390***	-0.618***	-0.766***	-0.517**	-0.246*	-0.493***	-0.826***	-0.121	-0.497**	-0.0561	-0.339**	-0.666***	-0.833***
	(0.101)	(0.164)	(0.192)	(0.184)	(0.106)	(0.121)	(0.209)	(0.071)	(0.173)	(0.210)	(0.104)	(0.132)	(0.245)
N	555	555	493	555	555	555	555	555	555	132	555	207	348
R^2	0.199	0.391	0.26	0.32	0.331	0.399	0.326	0.411	0.226	0.366	0.415	0.353	0.29

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 9: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and asymmetric negative WTI returns (r_{WTI}) Post-2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r11t	r12t	r13t	r14t
	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SAVE	SKYW	UAL	UAUA
Intercept	-0.006***	-0.005**	-0.009*	-0.009***	-0.003	-0.006**	-0.012***	-0.003*	-0.001	0.000	-0.005***	-0.003	-0.016***
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.003)	(0.001)	(0.002)	(0.004)
r_{MT}	1.150***	1.415***	1.623***	1.585***	1.153***	1.532***	2.241***	1.000***	1.268***	1.444***	1.195***	1.500***	2.131***
	(0.121)	(0.131)	(0.167)	(0.146)	(0.124)	(0.125)	(0.131)	(0.078)	(0.138)	(0.209)	(0.109)	(0.138)	(0.203)
r_{WTI}	-0.004	-0.122	-0.289*	-0.080	0.056	-0.060	-0.191*	-0.094	-0.093	-0.191	-0.030	-0.443***	-0.085
	(0.054)	(0.073)	(0.127)	(0.084)	(0.088)	(0.089)	(0.094)	(0.054)	(0.086)	(0.153)	(0.059)	(0.126)	(0.117)
N	577	577	516	577	577	577	577	577	577	145	577	233	344
R^2	0.299	0.383	0.147	0.317	0.248	0.383	0.378	0.368	0.144	0.332	0.371	0.316	0.328

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 10: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and symmetric WTI returns (r_{WTI}) during the 2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t
Symbol	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	RJET	LUV	SKYW	UAUA
Intercept	0.003	0.002	0.001	0.002	0.003	0.002	0.002	0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.001)	(0.003)	(0.002)	(0.004)
r_{mt}	1.077***	1.426***	1.744***	1.676***	1.214***	1.552***	2.367***	0.969***	1.250***	1.262***	2.218***
	(0.118)	(0.134)	(0.170)	(0.162)	(0.116)	(0.125)	(0.171)	(0.073)	(0.129)	(0.098)	(0.223)
r_{wti}	-0.268***	-0.457***	-0.649***	-0.430***	-0.0529	-0.325***	-0.690***	-0.157***	-0.272**	-0.249***	-0.708***
	(0.062)	(0.087)	(0.103)	(0.099)	(0.068)	(0.076)	(0.114)	(0.042)	(0.091)	(0.056)	(0.129)
N	377	377	377	377	377	377	377	377	377	377	377
R^2	0.221	0.356	0.322	0.304	0.301	0.394	0.366	0.39	0.213	0.417	0.298

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 11: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and asymmetric negative WTI returns (r_{WTI}) during the 2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t
Symbol	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SKYW	UAUA
Intercept	0.009	0.005	0.016*	0.016*	0.004	0.003	0.014	0.005	-0.008	0.000	0.016
	(0.006)	(0.006)	(0.007)	(0.007)	(0.005)	(0.005)	(0.008)	(0.004)	(0.006)	(0.004)	(0.008)
r_{mt}	1.081***	1.622***	1.953***	1.849***	1.425***	1.719***	2.600***	1.025***	1.367***	1.470***	2.546***
	(0.155)	(0.196)	(0.278)	(0.268)	(0.150)	(0.182)	(0.298)	(0.114)	(0.220)	(0.131)	(0.386)
r_{WTI}	-0.286	-0.635**	-0.542*	-0.352	-0.167	-0.488**	-0.744*	-0.0810	-0.591*	-0.403**	-0.751**
	(0.147)	(0.241)	(0.251)	(0.261)	(0.150)	(0.177)	(0.296)	(0.109)	(0.248)	(0.144)	(0.283)
N	188	188	188	188	188	188	188	188	188	188	188
$\mathbf{R^2}$	0.183	0.387	0.318	0.319	0.354	0.416	0.334	0.406	0.246	0.476	0.286

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 12: Regression of Airline stock returns (r_{it}) with S&P 500 returns (r_{mt}) and asymmetric positive WTI returns (r_{WTI}) during the 2008 Crisis

	r2t	r3t	r4t	r5t	r6t	r7t	r8t	r9t	r10t	r12t	r14t
Symbol	ALGT	ALK	AMR	DAL	HA	JBLU	LCC	LUV	RJET	SKYW	UAUA
Intercept	-0.017***	-0.019***	-0.024***	-0.025***	-0.006	-0.013**	-0.032***	-0.005*	-0.006	-0.012***	-0.038***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)	(0.002)	(0.005)	(0.003)	(0.006)
r_{mt}	1.194***	1.393***	1.653***	1.637***	.079***	1.513***	2.338***	0.921***	1.243***	1.158***	2.120***
	(0.165)	(0.175)	(0.201)	(0.191)	(0.166)	(0.165)	(0.165)	(0.091)	(0.173)	(0.140)	(0.204)
r_{WTI}	0.176*	0.049	-0.116	0.139	0.168	0.055	0.054	-0.073	-0.071	0.054	0.149
	(0.070)	(0.100)	(0.146)	(0.117)	(0.118)	(0.123)	(0.118)	(0.069)	(0.109)	(0.080)	(0.128)
N	188	188	188	188	188	188	188	188	188	188	188
R-squared	0.357	0.386	0.340	0.360	0.267	0.424	0.489	0.393	0.205	0.412	0.399

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 13: Regression of the slope of S&P 500 returns (r_{mt}) obtained pre and post-recession (table 13a) and annually (table 13b and 13c) on lowcost, pre-recession and post-recession variables

Dependent variable → Independent variable ↓	slope of r_{mt} in first stage regression	Dependent variable → Independent variable ↓	slope of r_{mt} in first stage regression	Dependent variable → Independent variable ↓	slope of r_{mt} in first stage regression
Intercept	1.643***	**Intercept**	1.780***	**Intercept**	1.609***
	(0.092)		(0.170)		(0.123)
Lowcost	-0.349**	**Lowcost**	-0.287***	**Lowcost**	-0.315***
	(0.094)		(0.075)		(0.070)
Pre-recession	-0.468***	**Pre-recession**	-0.576**	**Pre-recession**	-0.443**
	(0.100)		(0.172)		(0.130)
		Time trend	-0.046	**Post-recession**	-0.050
			(0.041)		(0.129)
N	24	**N**	69	**N**	80
R-sq	0.597	**R-sq**	0.267	**R-sq**	0.245
prob > F	0.0001	**prob > F**	0.000	**prob > F**	0.000
Table 13(a)		**Table 13(b)**		**Table 13(c)**	

Robust Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Figure 1: Conditional Variance of WTI Returns generated by a GARCH (1, 1) Process

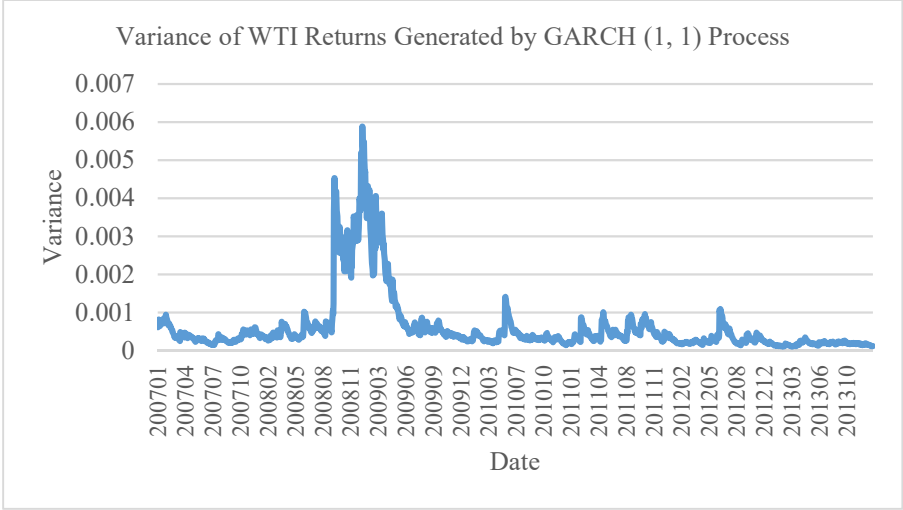
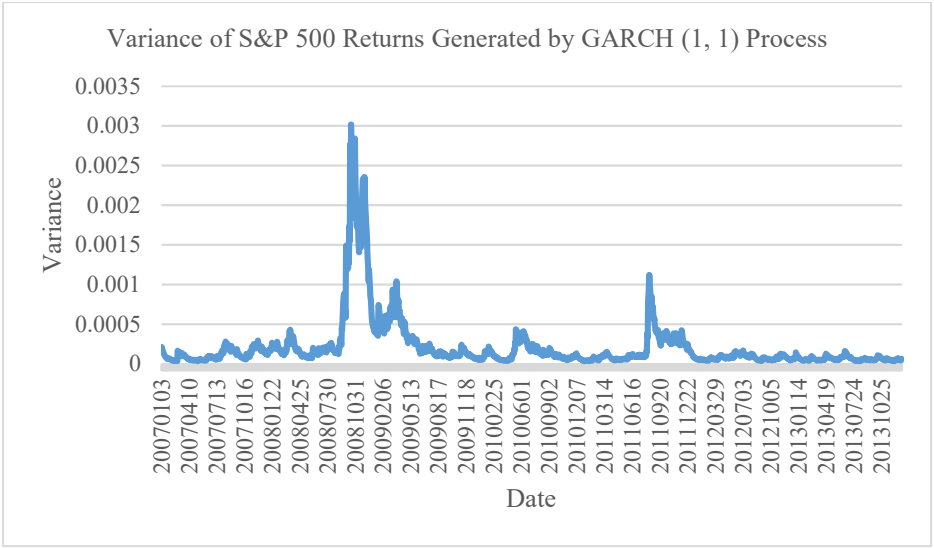


Figure 2: Conditional Variance of Standard and Poor 500 Index Returns generated by a GARCH (1, 1) Process



[1] For more evidence, see Filis et al. (2011), Du and He (2015) and Nazlioglu et al. (2015)
[2] These airlines are Alaska, American, Delta, ExpressJet, Frontier, Hawaiian, JetBlue, Skywest, Southwest, Spirit, United, Virgin America.
[3] We also consider lagged oil returns in the regression model as well as in an instrumental variable regression but find that the lagged oil returns do not play a significant role in either model.
[4] We impose a structural break during the Great Recession from December 1, 2007 through June 30, 2009 and use the Chow test to determine the difference in parameter estimates before and after this period.
[5] We find the variance of oil returns and S & P 500 returns using a GARCH(1, 1) process.
[6] See table 1 for correlations. Even though, WTI, Jet fuel and Brent Crude oil are not very highly correlated but removing both Jet and Brent made the significance of the WTI coefficient higher.
[7] There was some evidence of correlation between oil returns and S&P 500 returns before and after the Great Recession. R^2 before the Great Recession was 0.06 per cent but increased to 24 per cent post recession.
[8] We performed the second stage regression with the constant from the first stage and with the parameter of oil return for each airline as the dependent variable, but did not find significant effect of the explanatory variables.
[9] This is based on the assumption that LCC returns are less sensitive to S & P 500 returns due to their customer base. When the economy is weaker, customers would have to move away from more expensive legacy carriers.
[10] This is based on the assumption that airlines were less sensitive to S&P 500 returns before the financial crisis. After the crisis, customer spending would be more conservative, which would affect air travel.
[11] The US economy officially peaked in December 2007 and the recession began the month after that (January 2008) and ended in June 2009 according to the National Bureau of Economic Research.
[12] This implies that the investors believed that airlines would have hedged their fuel prices during the extreme volatility of the crisis; which is a reasonable assumption considering nine of the eleven airlines in this study participated in some form of fuel hedging during the period.
[13] In order to check if the oil return variable captures complete effect of oil price fluctuations, we added a dummy variable equal to 1 if the airline hedged during a given period and zero otherwise. We found that this variable did not affect the market return parameter in the second stage regression model.
[14] Reuters article- “Airline hedges fuel rally in later dated oil prices” by Catherine Ngai, dated April 6, 2016 reports that new hedge creation by airlines has sparked rally in oil futures. This article is available at http://www.reuters.com/article/us-usa-airlines-oil-idUSKCN0X31DV accessed on April 7, 2016.