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EFFECT OF FUEL PRICE VOLATILITY ON REAL ACTIVITIES EARNINGS MANAGEMENT IN AIRLINES RELATED TO FUEL PRICE HEDGING

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Abstract

In the search for efficient fuel cost reduction measures, many airlines have implemented hedging strategies to cope up with fuel price volatility because high and volatile fuel prices can substantially affect profit margins or losses in the airline industry. Earnings management encompasses the methods used by business executives to manipulate earnings. Therefore, we collected airline data for the period from 2007 to 2015 and examined the association between fuel price volatility and earnings management to determine whether airline executives perform fuel hedging.

The results indicate that fuel price volatility is not significantly related to real earnings management (cash flow from operations, production costs, and discretionary expenditures), regardless of whether airlines conduct fuel hedging. However, fuel price volatility (i.e., the standard deviation of fuel price changes) is significantly positively related to manipulating cash flow from operations.

Keywords: *fuel price; real activities; earnings management; airlines; fuel price hedging*
JEL Codes: *E3, F3, F4*

1. Introduction

The airline industry is split between air freight and passenger air transportation. In the past, most airline companies were government-owned; nowadays, although some are still state-owned, new private airlines have been introduced into the market in several countries, creating more competition. To continue developing business or to remain competitive, most air carrier companies had to merge, becoming acquired within the industry, to improve their operational and financial efficiency. They may also enter into an

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alliance with one of the three large airline alliances—One World, Star Alliance, or Sky Team—to ensure their operation (Kristjanpoller & Concha,2016).

Due to its global range, the airline industry is sensitive to economic growth, political events, international trade, and terrorism. The International Air Transport Association (IATA) proclaimed that the industry safely transported 3.3 billion passengers and 50 million metric tons of cargo across a network of almost 50000 routes in 2013; however, the industry could not generate enough revenue to compensate for the cost of operations until 2015. Treanor et al. (2014) described that, according to a 2009 IATA report, fuel costs accounted for more than 35% of passenger airlines' total operating costs during the third quarter of 2008.

Quinn (1996) considered that one of the most critical sources of volatility in airline earnings is fuel prices, because airlines' exposure to this risk is greater than their exposures to either the interest rate or foreign exchange risk. Ndung'u and Mouni (2016) indicated that because the airline industry is fuel-intensive, high and volatile fuel prices can have a significant impact on airlines' bottom lines; if fuel costs are not actively managed, they can result in lower profit margins or losses for the airline company. This motivates airlines to search for efficient fuel cost reduction measures. Hedging strategies are the most effective option to cope with the fuel price increase (Turner & Lim, 2015; Zarb,2016) and to prevent large swings in operating expenses and bottom line profitability (Ndung & Mouni,2016).

Earnings management encompasses the methods used by business executives to manipulate earnings through the flexibility of accounting rules or by structuring transactions (Healy & Wahlen, 1999). The tools of earnings management, such as discretionary accrual items, are a component of accounting accruals or involve altering the timing and scale of operating decisions (i.e., sales, cost of goods for sale, and expenses). According to these references, airlines executives may use fuel price hedging to cover their fuel costs given fuel price volatility; thus, a significant relationship between fuel price volatility and earnings management is not likely in the airline industry. Although fuel costs make up a substantial part of total operating costs and airlines have no control over them, this method gives airlines more control over their fuel expenditure and makes them less dependent on the volatile fuel price.

Based on our research, this study is the first to examine the association between fuel price volatility and earnings management in the airline industry and whether airlines conduct fuel price hedging to cover their fuel costs. We adopted real earnings management (REM) activities to measure earnings management and the Platts index to measure fuel price volatility.

By investigating whether fuel price volatility influences airlines' earnings management from the perspective of investors, this study provides third-party investors with a method for analyzing the true value of an airline given fuel price volatility. The remainder of the paper is organized as follows. Section 2 presents a brief review of the related literature. Section 3 provides details of the research design and sample selection procedure and develops our model. Section 4 presents our empirical findings. Section 5 contains a summary and conclusions.

2. Literature review

2.1. Real activities Earnings Management

Real activities earnings management involves adjusting timing records and the scale of operating decisions to distort earnings through measures such as sales manipulation, overproduction, and discretionary expenses (Gunny, 2010; Cohen et al., 2008; Roychowdhury, 2006). According to the literature, motivations underlying real activities earnings management include the disclosure environment or corporate governance structure (Kang & Kim,2012; Cheng et al., 2016; Visvanathan,2008; Malik et al.,2015; Ge & Kim,2014; Goh et al.,2013), growth firms (Nabar & Son,2017), internal controls (Ja¨rvinen & Myllyma¨ki,2016), the International Financial Reporting Standards (Hastuti et al.,2016; Dewi & Ahmar,2015), the Sarbanes-Oxley Act of 2002 (SOX) (Hsieh et al.,2014), CEO compensation (Fabrizi & Parbonetti,2016), leverage (Vakilfard & Mortazavi,2016), IPOs (Alhadab et al.,2016), political connections (Braam et al.,2015), market power (Mitra et al., 2013), bond issuers (Pae & Quinn,2011), and performance (Badertscher,2011).

Kang and Kim (2012) demonstrated that real activities earnings management decreases if the size of the board is larger or if a greater proportion of external directors sit on the board. Cheng et al. (2016) found that the extent of REM decreases with the number of years to retirement of the board members and their compensation relative to the CEO's compensation, because through internal governance, these characteristics of executives provide checks and balances in the organization and affect corporate decisions. Visvanathan (2008) examined board characteristics and audit committee characteristics in the context of REM and found that having a higher proportion of independent directors on the board or committee may limit this type of earnings management; this result should be of interest to investors and regulators who rely on governance mechanisms to oversee the integrity of corporate financial reporting. Malik et al. (2015) revealed that real activities earnings management is less prevalent for firms that have larger institutional investors; however, no evidence has indicated the role of the board in preventing REM. Ge and Kim

(2014) reported that the level of REM is higher when a firm is faced with tough board monitoring, and that takeover protection may reduce managerial incentives for REM. Goh et al. (2013) indicated that REM significantly decreases in the upward earnings management incentive bracket as the majority shareholder ownership increases, because majority shareholders are more sensitive to upward REM, which has a negative effect on future performance.

Nabar and Son (2017) found that growth firms are less likely to utilize REM (discretionary expenditures) than nongrowth firms, because trimming these expenditures is prohibitively costly for growth firms. Järvinen and Myllymäki (2016) reported that companies with existing material weaknesses in their internal controls engage in more manipulation of real activities, particularly inventory overproduction, because the management's weak commitment to provide an effective internal control system and high-quality financial information relate to a tendency to use REM methods. Hastuti et al. (2016) examined the effect of adopting the International Financial Reporting Standards (IFRS) on the REM moderated by the internal control structure. They found that adopting the IFRS-based accounting standard had a positive effect on the REM. Dewi and Ahmar (2015) measured cash flow from operations and found no difference in REM before and after the implementation of IFRS.

Hsieh et al. (2014) demonstrated that before SOX, companies with overconfident CEOs are more likely than other CEOs to manage earnings by accelerating the timing of cash flow from operations, thereby achieving analyst forecast benchmarks. After SOX, overconfident CEOs are more likely to engage in real activities earnings management through abnormally high cash flows and were more likely to have abnormally low discretionary expenses. Fabrizi and Parbonetti (2016) showed that CEOs with high risk incentives (e.g., option compensation) engage less in real activity manipulations that encompass cutting discretionary expenditures than do executives with low incentives, because CEOs incentivized by risk avoid engaging in real management activities that can decrease a firm's future risk profile. Vakilfard and Mortazavi (2016) indicated that managers tend to engage more in REM once their leverage increases. Alhadab et al. (2016) showed that IPO firms listed on the lightly regulated Alternative Investment Market in the United Kingdom have higher (or lower) levels of sales-based (discretionary expenses-based) earnings management around the IPO than do firms listed on the heavily regulated Main Market in the United Kingdom. Braam et al. (2015) showed that politically connected firms are more likely to conduct REM strategies than nonconnected firms because of higher secrecy and the potential to mask political favors; furthermore, when public monitoring and therefore the risk of detection increases, politically connected firms are more likely to

resort to less detectable REM strategies. Mitra et al. (2013) indicated that although firms manage real activities to varying degrees, firms with greater product market power and the ability to differentiate their products to earn additional revenue are less inclined to engage in real activates earnings management in suspect economic situations than firms with lower market power. Pae and Quinn (2011) found that bond issuers engage in REM. According to Badertscher (2011), the duration of firm overvaluation is an important determinant of managements' choice of alternative earnings management mechanisms; the longer the firm is overvalued, the greater is its total earnings management.

Multiple studies have examined several effects originating from real activities earnings management, including audit fees (Ghanbari et al.,2014 Greiner et al.,2017), earnings thresholds (Irani & Oesch,2016), performance (Machdar et al.,2017; Leggett et al., 2016,Tabassum et al.,2013 Hashemi & Rabiee,2011), and the cost of capital (Meini & Siregar,2014). Ghanbari et al. (2014) confirmed that REM through increased production costs and decreased discretionary expenditures positively influences audit fees; however, REM through increased sales does not influence audit fees. Greiner et al. (2017) found that with the exception of abnormal reductions in SG&A, aggressive income-increasing REM is positively associated with both current and future audit fees because managers pursue REM activities to influence reported earnings. As a consequence, altered cash flows, sacrificed firm value, and REM are considered in auditors' assessments of engagement risk related to the client's economic condition and result in higher audit fees. Irani and Oesch (2016) found that managers respond to the coverage loss by decreasing REM while increasing accrual manipulation. These effects are significantly stronger among firms with less coverage and for firms close to the zero-earnings threshold; they also suggest that managers use REM to enhance short-term performance in response to analyst pressure.

Machdar et al. (2017) suggested that REM negatively affects company performance, and information asymmetry exacerbates this effect. Leggett et al. (2016) found that REM is negatively related to subsequent period returns on assets and cash flows from operations. Tabassum et al. (2013) reported that the impact of REM (proxied by abnormal discretionary expenses, abnormal production costs, and abnormal operating cash flows) on financial performance (proxied by return on assets, return on equity, earnings per share, and the price to earnings ratio) is negative. Hashemi and Rabiee (2011) found that the relations between REM activities (proxied by abnormal production and operating costs) are sequential, and managers use earnings management to ensure a smooth income. Meini and Siregar (2014) found that earnings management through real activity manipulation has a negative effect on the cost of equity because investors are still not aware of the negative impact of earnings management through real activity manipulation.

2.2. Effect of fuel price on airline stock returns

Carter et al. (2003) found that in the absence of hedging, airline stocks are negatively affected when the oil price increases because the airline industry provides a homogenous environment where all airline firms experience similar risk exposure or because the airline industry is so sensitive to changes in expected cash flows due to a decrease in the available cash flows, which directly results from increasing jet fuel prices; thus, airline stock returns provide a sufficient variable to test against oil returns. Kristjanpoller and Concha (2016) mailto:diego.concha@alumnos.usm.clanalyzed the impact of changes in fuel price on the equity returns of airlines associated with IATA, as listed on the stock market, and forecasted price returns and the price variations of West Texas Intermediate crude oil and jet fuel by using GARCH models. They demonstrated a strong positive effect of fuel price fluctuation on stock prices because of the paradigm that oil price increases reflect improved economic growth (i.e., market inertia theory). Yashodha et al. (2016) indicated that fuel price fluctuations have a relatively significant negative effect in the short term. Because high and volatile jet fuel prices can have significant adverse effects on airline stock price, government intervention is required to reduce volatility. To cope with international jet fuel price upsurges and supply shortages, governments should consider oil-saving measures such as policies to improve energy efficiency, as well as promoting energy conservation and the use of alternative jet fuels (i.e., renewable energy). The airline industry faces substantial financial risk exposure that affects the vulnerability of stock returns, which increases the volatility of fuel price movements.

2.3. Effect of fuel price on airlines' operating decisions

Lozano and Gutiérrez (2011) showed that reducing fuel costs has been the major impetus for designing new, more efficient aircraft. Jet fuel costs are a growing part of airline expenditures, and the jet fuel price fluctuates considerably; airlines executives may adopt strategic flight planning (i.e., the optimal offered flights) to minimize jet fuel costs and counteract fuel price uncertainty because this highly determines the jet fuel consumption of an airline (Naumann & Suhl, 2013). According to Hsu and Eie (2013), commercial airline networks must enhance their designs in response to jet fuel price uncertainty; not only do routes with low load factors show a low probability that the proposed flight frequencies will operate in at least break-even conditions under future fuel price fluctuations, but also long-distance routes with high load factors exhibit similar situations during periods with high fuel prices. Adrangi et al. (2014) showed that the positive shocks to fuel prices trigger a substantially higher reaction on revenue passenger miles. Zou et al. (2014) described that to ease the financial burden of rising fuel prices, airlines should

improve fuel efficiency in their flight operations by implementing measures such as grounding; retire older, less fuel-efficient aircraft; upgrade their fleets with more fuel-efficient models; and adjust operating practices (i.e., using single-engine taxi procedures to reduce fuel consumption). Zarb (2016) found that as fuel prices declined, airlines trimmed their expenses and used the opportunity to add new flights and expand their networks.

2.4. Effect of fuel price volatility on airlines' earnings management

The airline industry is fuel-intensive; fuel costs account for the majority of airlines' operating costs, and earnings volatility rises in response to fuel prices. Hedging is a common risk management practice, in which the future cash flows required to purchase fuel are locked in at the present time (Berk and DeMarzo,2007). Fuel hedging is thus a risk management tool that is used by the airline industry (Lim & Hong,2014) to maintain operating costs despite oil price volatility (Turner & Lim,2015;Zarb,2016). By hedging the cost of fuel, air carriers can reduce financial costs (Froot et al.,1993) and operating costs (Lim & Hong,2014) and prevent large swings in operating expenses and bottom line profitability (Ndung& Mouni,2016) can thus successfully and effectively control the fuel price risk (Carter et al.,2006).

Earnings management encompasses the methods used by business executives to manipulate earnings through flexible accounting rules or by structuring transactions(Healy &Wahlen, 1999). It involves adjusting the timing record and scale of operating decisions to distort earnings through measures such as sales manipulation, overproduction, and discretionary expenses(Gunny, 2010; Cohen et al., 2008; Roychowdhury, 2006). However, to survive in the highly competitive market place, air carriers may hedge fuel costs to cope with the impact of fuel price volatility, thereby remaining profitable despite increased fuel prices. Therefore, a significant relationship may not exist between fuel price volatility and earnings management.

Nevertheless, if airlines executives do not perform fuel hedging, they may be motivated to manipulate earnings to cope with the effect of fuel price volatility on profitability, resulting in a significant relationship between fuel price volatility and earnings management. Therefore, we propose the following hypotheses:

H1: Fuel price volatility is not significantly related to manipulating cash flow from operations when fuel hedging is conducted.

H2: Fuel price volatility is significantly related to manipulating cash flow from operations in the absence of fuel hedging.

H3: Fuel price volatility is not significantly related to manipulating product costs when fuel hedging is conducted.

H4: Fuel price volatility is significantly related to manipulating product costs when fuel hedging is conducted.

H5: Fuel price volatility is not significantly related to manipulating discretionary expenses when fuel hedging is conducted.

H6: Fuel price volatility is significantly related to manipulating discretionary expenses in the absence of fuel hedging.

Methodology

In this study, we collected data for the period from 2007 to 2015 from the COMPUSTAT database. A regression model was adopted to analyze the data. The sample was separated based on whether airlines conduct fuel price hedging to reflect fuel price volatility. Furthermore, data of hedging by airlines were derived from their financial statements.

3.1 Dependent variables: real activities earnings management

Roychowdhury (2006) demonstrated that real activities earnings management can be measured by cash flows from operations, production costs, and discretionary expenses and developed the following regression models to estimate the typical levels of real business activities. The absolute value of ε originates from the following model that measures real activities earnings management (i.e., the abnormal level). In addition, we used the absolute value of ε multiplied by the assets for the year $t-1$ to reflect the real numbers.

$$\frac{CFO_{it}}{TA_{it-1}} = \alpha_1 + \alpha_2 \frac{1}{TA_{it-1}} + \alpha_3 \frac{SALES_{it}}{TA_{it-1}} + \alpha_4 \frac{\Delta SALES_t}{TA_{it-1}} + \varepsilon_{it} \qquad (1)$$

$$\frac{PRDO_{it}}{TA_{it-1}} = \alpha_1 + \alpha_2 \frac{1}{TA_{it-1}} + \alpha_3 \frac{SALES_{it}}{TA_{it-1}} + \alpha_4 \frac{\Delta SALES_{it}}{TA_{it-1}} + \alpha_5 \frac{\Delta SALES_{it-1}}{TA_{it-1}} + \varepsilon_{it} \qquad (2)$$

$$\frac{DISP_{it}}{TA_{it-1}} = \alpha_1 + \alpha_2 \frac{1}{TA_{it-1}} + \alpha_3 \frac{SALES_{it-1}}{TA_{it-1}} + \varepsilon_{it} \qquad (3)$$

where CFO_{it} is the cash flow form operations for year t; $PRDO_{it}$ is the sum of the cost of goods for sales and the change in inventory for year t; $DISP_{it}$ represents discretionary expenses according to the sum of advertising, R&D , general and administrative expenses for year t; $SALES_{it}$ is the sales for year t ; $\Delta SALES_t$ is the change in sales for year t ; $\Delta SALES_{it-1}$ is the change in sales for year t-1; TA_{it-1} is the assets for year t-1

3.2 Independent variables: fuel price volatility

Mohanty and Nandha (2011) demonstrated that fuel price shocks are measurements constructed using spot prices. However, many fuel price standards are available worldwide. In this study, we used the Platts index for the fuel price (measured by ton in USD) as an appropriate proxy for the cost of fuel. We also followed Treanor et al. (2014) to indicate the change in the fuel price, and the standard deviation of fuel price changes accurately captures airlines' exposure to fuel price volatility.

3.3 Control variables

Ge and Kim (2014) revealed that among firms, growth firms are less likely to engage in sales manipulation and overproduction. Franz et al. (2014) also indicated that these firms are less likely to engage in the manipulation of discretionary expenses. Furthermore, Dhole et al. (2016) reported that larger firms are less likely to manipulate cash flow for operating and discretionary expenses in response to greater regulatory/political scrutiny. According to Ge and Kim (2014), larger firms are generally less likely to manipulate product costs. Finally, Zamri et al. (2013) showed that leverage is negatively associated with the manipulation of cash flow for operating; their results are consistent with the control hypothesis for debt creation, because debt can be used to reduce agency costs when managers control a firm's cash flow at their own discretion. The control role begins when managers have an obligation to make interest and principal payments that, if left unpaid, may send the firm to bankruptcy court. Dhole et al. (2016) indicated that high leverage is indicative of a firm that is closer to debt covenant restrictions; however, to avoid possible covenant violations, managers are not likely to manipulate product costs and discretionary expenses. Following Ge and Kim (2014), we used the market-to-book ratio to measure firm growth; following Zamri et al. (2013), we used the logarithm of assets to measure the firm size and the total debts scaled by total assets to measure firm leverage.

3.4. Empirical model

$$ABCFO_{it} = \alpha_0 + \alpha_1 CFP_{it} + \alpha_2 MB_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \varepsilon_{it} \quad (4)$$

$$ABCFO_{it} = \alpha_0 + \alpha_1 SCFP_{it} + \alpha_2 MB_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \varepsilon_{it} \quad (5)$$

$$ABPC_{it} = \alpha_0 + \alpha_1 CFP_{it} + \alpha_2 MB_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \varepsilon_{it} \quad (6)$$

$$ABPC_{it} = \alpha_0 + \alpha_1 SCFP_{it} + \alpha_2 MB_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \varepsilon_{it} \quad (7)$$

$$ABDE_{it} = \alpha_0 + \alpha_1 CFP_{it} + \alpha_2 MB_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \varepsilon_{it} \quad (8)$$

$$ABDE_{it} = \alpha_0 + \alpha_1 SCFP_{it} + \alpha_2 MB_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \varepsilon_{it} \quad (9)$$

$ABCFO_{it}$ represents the abnormal level of cash flow from operations for year t (model 1); $ABPC_{it}$ denotes the abnormal level of production costs for year *t* (model 2); $ABDE_{it}$ is the abnormal level of discretionary expenditures for year t (model 3); CFP_{it} is the change in the fuel price for year *t* (the value is 1 if the fuel price for year *t* is above that for year $t-1$, or 0 otherwise); $SCFP_{it}$ is the standard deviation of fuel price changes for year *t*; MB_{it} is the market-to-book ratio for year *t*; $SIZE_{it}$ denotes the logarithm of assets for year *t*; and LEV_{it} represents debts divided by assets for year *t*.

4. Results

4.1 Descriptive statistics

According to the descriptive statistics in Table 1, the mean real activities earnings management (i.e., the abnormal levels of cash flow from operations, production costs, and discretionary expenditures) are positive. This finding indicates that airlines have adopted real activities for managing earnings and increasing their adjusted income. Furthermore, because the market-to-book ratio exceeds 100%, it is likely that airlines are growth firms; however, outside investor overvaluation is possible. Moreover, the debt ratio of 57.47% (debt divided by assets) indicates that airlines may be less financially conservative.

Table no. 1 - Descriptive statistics (all samples)

	Max	Min	Avg
$ABCFO_{it}$ (million / US dollars)	29.62	0.93	16.71
$ABPC_{it}$ (million / US dollars)	35.71	7.40	12.43
$ABDE_{it}$ (million / US dollars)	20.66	15.65	17.59
MB_{it} (%)	14.79	1.71	7.22
$SIZE_{it}$	19.07	12.26	15.62
LEV_{it} (%)	62.54%	45.62%	57.47%
Sample	155		

$ABCFO_{it}$ represents the abnormal level of cash flow from operations for year t (model 1); $ABPC_{it}$ denotes the abnormal level of production costs for year *t* (model 2); $ABDE_{it}$ is the abnormal level of discretionary expenditures for year t (model 3); CFP_{it} is the change in the fuel price for year t, if the fuel price for year t above year t-1, the value is

1 or 0 otherwise; $SCFP_{it}$ is the standard deviation of fuel price changes for year *t*; MB_{it} is the market-to-book ratio for year t; $SIZE_{it}$ denotes the logarithm of assets for year t; LEV_{it} represents debts divided into assets for year t.

4.2 Empirical test

The empirical results in Table 2 indicate that fuel price volatility (defined as the change in the fuel price) is not significantly related to the abnormal level of cash flow from operations when airlines conduct fuel hedging. It is consistent with H1 and indicates that airlines do not manipulate earnings through cash flow from operations when they conduct fuel hedging, because fuel hedging activities must efficiently control cash flow from operations to reflect the effect of changing fuel prices on operating costs. However, fuel price volatility (i.e., the standard deviation of fuel price changes) is significantly positively related to the abnormal level of cash flow from operations. It is inconsistent with H1. It is likely that when the standard deviation of fuel price changes is higher, airlines conduct fuel hedging to avoid higher fuel price volatility and to maintain profitability. However, to compensate for their investment risks, outside investors are more concerned about the effect of fuel price volatility on cash flow from operations; therefore, airline executives manipulate cash flow from operations to satisfy these investors and generate a favorable business image. Consequently, investors may be willing to provide additional funds to enterprises. In addition, fuel price volatility (including the change in the fuel price and the standard deviation of fuel price changes) is not significantly related to the abnormal level of cash flow from operations when airlines do not conduct fuel hedging. This is inconsistent with H2 and indicates that when they do not conduct fuel hedging, airlines do not manipulate earnings through operations cash flow to reflect the effect of fuel price volatility on operating costs. Outside investors may not focus on the effect of fuel price volatility on operations cash flow when airlines do not conduct fuel hedging, or airlines may adopt other methods to lower the effect of fuel price volatility on operating costs when they do not conduct fuel hedging.

The empirical results in Table 3 indicate that fuel price volatility (including the change in the fuel price and the standard deviation of fuel price changes) is not significantly related to the abnormal level of production costs, regardless of whether airlines conduct fuel hedging. This is consistent with H3, but not H4, revealing that airlines may not manipulate earnings through production costs whether or not they conduct fuel hedging. Fuel hedging activities likely involve efficiently controlling funds distribution, in line with airline operating strategies such as calculating the cost of goods or perfecting inventory policy. Thus, by compensating for the effect of fuel price volatility on operating costs,

airlines do not focus on manipulate earnings through production costs; moreover, outside investors may not focus on the effect of fuel price volatility on product costs when airlines do not conduct fuel hedging.

The empirical results in Table 4 reveal that fuel price volatility (including fuel price change and the standard deviation of fuel price changes) is not significantly (negatively) related to the abnormal level of discretionary expenditures, regardless of whether airlines conduct fuel hedging. This is consistent with H5, but not H6, and indicates that airlines may not manipulate earnings through discretionary expenditures, regardless of whether they conduct fuel hedging. It is likely that fuel hedging activities efficiently control a firm's fuel expenditure; thus, they may have a lower motivation to manipulate discretionary expenses to compensate for the effect of fuel price volatility on operating costs, or they may compensate for the effect by manipulating earnings other than discretionary expenses (e.g., advertising, R&D, and general and administrative expenses) when not conducting fuel hedge. Outside investors may also not focus on the effect of fuel price effect volatility on discretionary expenses when airlines do not conduct fuel hedging.

Concerning the control variables, the market-to-book ratio is not significantly related to REM in terms of cash flow from operations (see Table 2), production costs (see Table 3), or discretionary expenditures (see Table 4) when airlines conduct fuel hedging. This result suggests that fuel price volatility has little effect on operating costs, and that the higher market-to-book ratio represents that investors think airlines have lower operating risks in these situations, and the investors have a favorable image of airline businesses; therefore, airline executives are less motivated to manipulate earnings through real activities. However, in the absence of fuel hedging, the market-to-book ratio has a significant positive relationship with the abnormal cash flow from operations (see Table 2), a nonsignificant relationship with abnormal production costs (see Table 3), and a significant negative relationship with abnormal discretionary expenditures (see Table 4). This suggests that fuel price volatility has a considerable effect on operating costs; in this scenario, the higher market-to-book ratio represents that investors think that airlines have higher operating risks, but are willing to tolerate them and continue to invest funds in them. Airline executives who want to generate a favorable image for their businesses may have increased motivation to manipulate earnings through cash flow from operations, but not discretionary expenditures, because this can be detected by investors and result in an unfavorable image of the business, making investors unwilling to invest more funds in their businesses.

Size also has a significant positive relationship with REM such as cash flow from operations (see Table 2), production costs (see Table 3), and discretionary expenditures

(see Table 4), regardless of whether airlines conduct fuel hedging. Under normal circumstances, the airline industry is regulated; thus, larger airlines may manipulate earnings through cash flow from operations, production costs, and discretionary expenditures in response to greater regulatory or political scrutiny, regardless of whether they conduct fuel hedging. Furthermore, leverage (the debt ratio) is not significantly related to REM such as cash flow from operations (see Table 2), production costs (see Table 3), or discretionary expenditures (see Table 4). Airlines may control cash flow from operations, production costs, and discretionary expenditures at their own discretion, because managers that have higher leverage are obligated to make interest and principal payments or else risk bringing the firm into bankruptcy court, regardless of whether airlines conduct fuel hedging.

Overall, the results from variance inflation factors explain 15 variables for correlation; the results lie between 1.007 and 1.236, indicating no correlation problems. To avoid possible bias from extreme values, those samples, only including all the sample data, were adopted as measures for a robustness test. Most of the results are consistent with Table 5. For example, fuel price volatility (including the fuel price change and the standard deviation of fuel price changes) is not significantly related to REM (including cash flow from operations, production costs, and discretionary expenditures), regardless of whether airlines conduct fuel hedging. Furthermore, if the market-to-book ratio is not significant, size and leverage are significantly positively related to REM.

Table no. 2 - Regressions of fuel price volatility with real activities earnings management (the abnormal level of cash flow from operations)

	Dependent variable: $ABCFO_{it}$			
	Hedge		Non- hedge	
intercept	226.604***	117.340	142.979	424.888***
CFP_{it}	-59.452		194.357	
$SCFP_{it}$		6.866*		-16.798
MB_{it}	-0.102	-0.087	0.389*	-0.444
$SIZE_{it}$	47.685**	60.007***	145.154***	162.794***
LEV_{it}	375.193	493.526**	1017.272***	1141.760***
R^2	0.086	0.094	0.167	0.198
F-value	3.898**	3.520**	3.549**	4.518***
sample	97		58	

$ABCFO_{it}$ represents the abnormal level of cash flow from operations for year t (model 1); CFP_{it} is the change in the fuel price for year t, if the fuel price for year t above year t-1, the value is 1 or 0 otherwise; $SCFP_{it}$ is the standard deviation of fuel price changes for year *t*; MB_{it} is the market-to-book ratio for year t; $SIZE_{it}$ denotes the logarithm of assets for year t; LEV_{it} represents debts divided into assets for year t. *:p<0.1、**: p<0.05、***: P<0.01

Table no.3 - Regressions of volatility of the fuel price with real activities earnings management (the abnormal level of production costs)

	Dependent variable: $ABPC_{it}$			
	hedge		Non-hedge	
intercept	1910.061	2485.205	3894.858**	5289.937**
CFP_{it}	-503.822		-362.227	
$SCFP_{it}$		-60.737		-150.917
MB_{it}	-1.921	-1.898	-5.152	-5.566
$SIZE_{it}$	1411.993***	1386.353***	2736.529***	2725.933***
LEV_{it}	-8662.745	8538.866*	18951.782***	18995.672***
R^2	0.138	0.153	0.256	0.271
F-value	4.412***	5.347***	5.380***	6.284***
sample	97		58	

$ABPC_{it}$ denotes the abnormal level of production costs for year *t* (model 2); CFP_{it} is the change in the fuel price for year t, if the fuel price for year t above year t-1, the value is 1 or 0 otherwise; $SCFP_{it}$ is the standard deviation of fuel price changes for year *t*; MB_{it} is the market-to-book ratio for year t; $SIZE_{it}$ denotes the logarithm of assets for year t; LEV_{it} represents debts divided into assets for year t. *:p<0.1、**: p<0.05、***: P<0.01

Table no. 4 - Regressions of volatility of the fuel price with real activities earnings management (the abnormal level of discretionary expenditures)

	Dependence variable: $ABDE_{it}$			
	Hedge		Non- hedge	
Intercept	172.461	193.146	745.559***	899.399***
CFP_{it}	-137.336		-119.819	
$SCFP_{it}$		-4.502		-18.333
MB_{it}	-0.254	-0.206	-0.710*	-0.794**
$SIZE_{it}$	217.758***	213.589***	315.542***	318.534***
LEV_{it}	1388.662**	1374.229**	2279.611***	2321.810***
R^2	0.251	0.241	0.283	0.289
F-value	8.124***	8.702***	6.026***	6.780***
sample	97		58	

$ABDE_{it}$ is the abnormal level of discretionary expenditures for year t (model 3); CFP_{it} is the change in the fuel price for year t, if the fuel price for year t above year t-1, the value is 1 or 0 otherwise; $SCFP_{it}$ is the standard deviation of fuel price changes for year *t*; MB_{it} is the market-to-book ratio for year t; $SIZE_{it}$ denotes the logarithm of assets for year t; LEV_{it} represents debts divided into assets for year t. *:p<0.1、**: p<0.05、***: P<0.01

Table no. 5 - Regressions of volatility of the fuel price with real activities earnings management (all samples)

Dependent variable	$ABCFO_{it}$		$ABPC_{it}$		$ABDE_{it}$	
intercept	242.990***	269.906***	3682.701***	4316.089***	557.373***	600.071***
CFP_{it}	-13.193		-1163.774		-231.286	
$SCFP_{it}$		-1.714		-109.960		-12.648
MB_{it}	-0.146	-0.191	-2.405	-2.778	-0.343	-0.388
$SIZE_{it}$	55.009***	70.303***	1572.144***	1636.729***	203.454***	212.663***
LEV_{it}	422.011***	542.912***	11006.709***	11523.039***	1462.577***	1542.214***
R^2	0.055	0.071	0.152	0.167	0.193	0.190
F-value	2.974**	3.930***	7.107***	8.715***	9.108***	10.028***
sample	155					

$ABCFO_{it}$ represents the abnormal level of cash flow from operations for year t (model 1); $ABPC_{it}$ denotes the abnormal level of production costs for year *t* (model 2); $ABDE_{it}$ is the abnormal level of discretionary expenditures for year t (model 3); CFP_{it} is the change in the fuel price for year t, if the fuel price for year t above year t-1, the value is 1 or 0 otherwise; $SCFP_{it}$ is the standard deviation of fuel price changes for year *t*; MB_{it} is the market-to-book ratio for year t; $SIZE_{it}$ denotes the logarithm of assets for year t; LEV_{it} represents debts divided into assets for year t. *:p<0.1、**: p<0.05、***: P<0.01

5. Solutions

The airline industry is fuel-intensive, and high and volatile fuel prices can significantly impact airline operations such as managing fuel expenditure or profit margins or losses. Most airlines searching for efficient fuel cost reduction measures may opt for hedging strategies to cope with fuel price volatility. We collected airline data for the period from 2007 to 2015 from the COMPUSTAT database to examine the association between fuel price volatility and earnings management and to determine whether airline executives hedge fuel prices.

The results indicate that fuel price volatility is not significantly related to REM (cash flow from operations, production costs, and discretionary expenditures), regardless of whether airlines conduct fuel hedging; however, fuel price volatility (i.e., the standard deviation of fuel price changes) is significantly positively related to manipulating cash flow from operations.

The results provide critical implications for managers, researchers, investors, and regulators. Airline managers should focus more on risk management related to fuel price volatility. For researchers, the empirical findings indicate the relationship between fuel price volatility and REM when airlines decide whether to fuel hedge or not, and investors can analyze the true value of enterprises, regardless of whether they have adopted earnings management or fuel hedging. Regulators (e.g., governments or international organizations such as the IASC) may attempt to harmonize accounting within an industry instead of formulating standards or subverting various national accounting practices away from the optimal ones for domestic purposes to improve comparability between companies for facilitating optimal allocation of resources across airlines worldwide.

However, this research has also limitations. Many mainline, established low-cost carriers have been created, which focus on maintaining lower operating costs; they may increase seating capacity, fly smaller aircraft, or increase the use of their regional jets, because a diverse fleet reduces exposure to fuel price volatility. However, most of these

firms are nonlisted; therefore, this study may not reflect airlines worldwide. Furthermore, this study only used the Platts index to measure the fuel price, which may not reflect overall fuel price volatility to measure the cost of airline fuel.

This study only examined the effect of fuel hedging, rather than the gains and losses from fuel hedging strategies. The accounting implications of fuel hedging on airline financial performance pose another empirical question that should be addressed in future research. Different hedging tools, such as futures and forward contracts, should be adopted to examine the effect of fuel price volatility on real activities earnings management.

However, this study's focus on fuel hedging relates to operational hedging strategies that are relevant across a wide variety of industries and should be considered a valuable component of a firm's overall risk management program. Airlines have different proxies for operational hedging, such as alliances, route networks, or flight procedures; operational hedges and financial hedges are both effective at reducing airlines' exposure to fuel price volatility. To maintain their profit margins despite high fuel price volatility, carriers have been forced to adopt strategies such as increasing ticket prices, diversifying revenue, and reducing the share of fixed costs by using part-time labor, outsourcing work, leasing aircraft, obtaining shorter-term leases for real estate, and adding fuel oil surcharges. Further research should examine the relationship between fuel price volatility and REM in the presence of these tools.

Finally, airlines operate in different countries with various strategies, financial situations, internal controls, governing practices, leader style, cultures, systems, and environments; hence, they cannot be considered equivalent. Further research should examine the relationship between fuel price volatility and REM given these differences.

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