**"The Effect of Fuel Price Fluctuation on Airline Operations"**

# Literature Review

## The relationship between Fuel Prices and Airline Profitability

The relationship between fuel prices and airline profitability is a crucial aspect of the aviation industry. Fuel costs are one of the largest expenses for airlines and fluctuations in fuel prices can have a significant impact on their financial performance. In this section, we will explore the literature on the relationship between fuel prices and airline profitability and augment the answer with an industry example. Several authenticated pieces of the literature suggest that the effect of raise in fuel prices on airline profitability is negative. A book published by Cronrath (2017) established a strong connection between the increasing fuel prices in the international market fuel prices and decreased profitability of the airlines. Similarly, a study conducted by Sgouridis, Bonnefoy, and Hansman (2011) analyzed the financial data of several airlines and found that a 10% increase in fuel prices reduces airline profitability by 1.5%.

Maung, Douglas, and Tan (2022) performed a study in which they used a dynamic panel GMM model for shaping a relationship between growth and profitability model in airlines; they highlighted through the findings of their study that the carriers with low consumption of fuel are one of the greatest contributors of increased profitability of any airline. This could be underpinned in the light of the study performed by Maung, Douglas, and Tan (2022) that the cost of fuel has a direct and measurable impact on the profit financial performance of any airline.

The relationship between fuel prices and airline profitability can also be illustrated through an industry example. In 2014, global oil prices fell sharply, leading to a decrease in fuel costs for airlines. This resulted in an increase in profitability for several airlines (Koopmans & Lieshout, 2016). For example, American Airlines reported a record profit of $4.2 billion in 2014, up from $2.9 billion in the previous year (Frank, 2015). Similarly, Delta Air Lines reported a profit of $3.8 billion in 2014, up from $2.7 billion in the previous year (Vasigh, 2014).

However, the industry example also highlights the complexity of the relationship between fuel prices and airline profitability. While lower fuel prices may increase profitability in the short term, they can also lead to increased competition and lower fares (Acar & Karabulak, 2015). This can ultimately result in lower profitability for airlines. For example, in 2015, Ryanair, a low-cost airline, reduced its fares by 6% due to lower fuel costs (Acar and Karabulak, 2015). This led to increased competition and pressure on other airlines to reduce their fares as well (Acar and Karabulak, 2015).

In conclusion, the literature and industry example suggest that fuel prices have a significant impact on airline profitability. While lower fuel costs may increase profitability in the short term, airlines need to consider long-term strategies to manage fuel costs and maintain profitability in a competitive market. These strategies may include hedging fuel prices, investing in fuel-efficient technologies, and optimizing operational efficiencies.

## The Impact of Fuel Prices on Airline Routes and Schedules

The effect of fuel costs on aircraft courses and timetables is huge, as fuel costs address one of the biggest costs for carriers. Airlines must consider the impact on profitability and operational efficiency of rising fuel prices, which may necessitate adjustments to schedules and routes. According to McConnachie, Wollersheim, and Hansman (2013), the price of fuel is one of the main causes which affect airline routes and schedules. Merkert and Swidan (2019)mentioned in their work related to financial hedging that the operating cost of a flight goes up when fuel prices go up, which can hurt airlines' profit margins or even cause them to lose money. In response, airlines may alter their schedules or routes to reduce operating costs and maximize fuel efficiency (Merkert & Swidan, 2019). For instance, airlines during COVID and in the post-COVID scenario decide to use smaller planes, reduce the number of flights on particular routes, or switch to planes that use less fuel (Vinod, 2022). Another very significant aspect was highlighted by Csereklyei and Stern (2020) that the range of aircraft that airlines are able to operate can also be affected by fuel prices. The scope of a not entirely set in stone by how much fuel it can convey, which thus influences the number of objections that carriers can serve. At the point when fuel costs are high, carriers might have to diminish the scope of their airplane to beneficially work. This could mean that airlines use aircraft with shorter ranges or fly nonstop on shorter routes (Vinod, 2022.

Demand for passengers is another factor that can be affected by fuel prices. The demand for passengers may decrease as ticket prices rise in tandem with fuel prices (Guzman, Gomez & Moncada, 2020). In response, if a route is no longer financially viable, airlines may have to reduce the number of flights on it or even stop flying it altogether. Flight duration and efficiency can also be affected by fuel prices. Airlines may have to operate at lower speeds or altitudes in order to save fuel when fuel prices are high. The efficiency of flights may suffer as a result of this (Guzman, Gomez & Moncada, 2020). As a result, airlines may need to alter their schedules in order to continue operating flights on time. In conclusion, fuel prices can have a significant effect on airline schedules and routes. When airlines plan their schedules and routes, they should take into account the cost of fuel because it has a direct impact on profitability and efficiency. Airlines may use a variety of tactics to lessen the impact of rising fuel prices on their operations, such as altering flight schedules, flying more fuel-efficient aircraft, and reducing the number of flights they operate. As airlines try to stay profitable and competitive in a market that is always changing, fuel prices will always be a major factor (Guzman, Gomez & Moncada, 2020).

## The Role of Government Policies in mitigating Fuel Price Volatility

Government policies play a crucial role in mitigating fuel price volatility, as fuel prices can have significant impacts on the economy, especially in industries such as aviation, transportation, and manufacturing (Jones & Cardinale, 2023). One of the most effective ways that governments can mitigate fuel price volatility is by implementing price stabilization policies (Boute & Zhang, 2019). According to Ari et al., (2022), price stabilization policies can include measures such as subsidies, price caps, or taxes that are designed to regulate fuel prices and stabilize the market. Similarly, Sgaravatti, Tagliapietra, and Zachmann (2022) emphasized in their work that in some countries, governments offer subsidies to fuel producers or consumers to help offset the impacts of price increases. These subsidies can help to stabilize prices and reduce volatility, providing a measure of stability for industries that rely on fuel, such as aviation.

Moreover, through the work of Yang et al., (2022) it could be understood that another way that governments can use to mitigate fuel price volatility is through strategic reserves. “Strategic reserves are stockpiles of fuel that are held by governments to ensure a stable supply in the event of market disruptions” (Feigenbaum & Hou, 2020).  So as Yang et al., (2022) suggested governments can release these reserves during times of high demand or price spikes to help stabilize prices and prevent volatility. For example, in the United States, the Strategic Petroleum Reserve holds over 727 million barrels of crude oil, which can be released during emergencies to help stabilize prices (Kilian & Zhou, 2020).

Xu and Xu (2022) highlighted another very significant aspect and that is governments can also use regulatory measures to help mitigate fuel price volatility. They further added that governments may set fuel efficiency standards for vehicles, which can help to reduce the overall demand for fuel and mitigate price volatility (Xu and Xu 2022). Additionally, governments can encourage the development and use of alternative fuels, such as biofuels or electric vehicles, which can reduce dependence on traditional fossil fuels and help to mitigate volatility in the fuel markets.

According to Hao et al., (2023), the fact could not be ignored that government policies can also play a role in mitigating fuel price volatility by promoting transparency and competition in the fuel markets. By promoting transparency, governments can ensure that fuel prices are based on market fundamentals rather than market manipulation or speculation (Hao et al., 2023). Governments can also promote competition in the fuel markets by encouraging new market entrants and breaking up monopolies or cartels that may be manipulating prices (Hao et al., 2023). Fuel price volatility can have significant impacts on the economy and various industries, including aviation. Governments can play a crucial role in mitigating fuel price volatility by implementing price stabilization policies, maintaining strategic reserves, regulating fuel efficiency standards, promoting alternative fuels, and promoting transparency and competition in the fuel markets. These policies can help to provide stability and predictability in the fuel markets, reducing the impacts of volatility on the economy and various industries.

# Data Collection Method

Following are the steps, which would be used to conduct a comprehensive and rigorous meta-analysis of the effect of fuel price fluctuations on airline operations. “Meta-analysis is a research methodology that involves systematically analyzing and synthesizing the results of multiple studies on a particular topic. It is a statistical technique that allows researchers to combine the findings from different studies to estimate the overall effect of a particular intervention or exposure” (King & He, 2005). Meta-analysis is the most suitable research methodology for the topic "The Effect of Fuel Price Fluctuation on Airline Operations" because it allows for the integration of findings from multiple studies, which can provide a more comprehensive and robust understanding of the effect of fuel price fluctuations on airline operations. “By pooling data from multiple studies, meta-analysis can provide a more precise estimate of the effect size, as well as identify potential sources of heterogeneity and bias that may not be apparent in a single study”. Furthermore, meta-analysis can help identify areas where further research is needed and provide insights for policy and decision-making with respect to regulating fuel pricing and providing subsidized fuel to the airlines. It is especially relevant in the context of the airline industry, where fuel prices are a significant factor in the operational costs and profitability of airlines. Following is the data collection method for meta-analysis considering the PRISMA technique.

**Define the research question**: It would be started by clearly identifying the question and that is "What is the effect of fuel price fluctuations on airline operations?" This will guide the search for relevant studies.

**Identify relevant databases**: The database/databases would be identified that are relevant to the research question, such as Google Scholar. This database is comprehensive and will give access to a wide range of studies.

**Search strategy**: A search strategy would be developed using keywords and “Boolean Operators” to narrow down the relevant studies. For example, keywords such as "fuel price," "airline operations," and "fluctuations" would be used. Using “Boolean Operators” such as "AND" and "OR" would help to combine these keywords.

**Study selection**: After that inclusion and exclusion criteria for the studies that have been retrieved from the search would be settled. Inclusion criteria would include publication date (nothing older than 10 years, study design (both qualitative and quantitative studies would be included), and the relevance of the study to the research question would be ensured (at least of the provided keywords must be included). Exclusion criteria included studies that are not peer-reviewed, studies that are not written in English, or studies that are not relevant to the research question; any study which is older than 10 years would not be included in the meta-analysis despite its relevance.

**Data extraction**: Data would be extracted from the studies that meet the provided inclusion criteria. This would include the study design, sample size, data analysis methods, and results.

**Quality assessment**: The quality of the studies which are being included in the meta-analysis would be inspected. This will include evaluating the study design, sample size, and potential sources of bias.

**Data synthesis**: Statistical techniques would be used to synthesize the data that have been extracted from the studies. This can include calculating effect sizes, conducting subgroup analyses, and assessing heterogeneity.

**Publication bias assessment**: Assess for publication bias by creating a funnel plot and conducting tests for asymmetry would also be performed.

**Reporting**: The findings of the meta-analysis would be reported in accordance with the PRISMA guidelines, which include a flow diagram of the study selection process, a description of the study characteristics, a synthesis of the results, and a discussion of the limitations of the study.

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