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Operational Efficiency and Firm Performance: Developing Propositions in the Air Transportation Sector

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Abstract:

The relationship between operational efficiency and firm performance measures of firms in the airline sector has not been thoroughly examined in the past. This study aims to develop a framework on the relationship between performance and operational efficiency in the airline sector. The pertinent literature on the relationship between operational efficiency and firm performance for the period 2010-2024 has been gathered, and the PRISMA approach has been used to synthesize it. The study reveals that various operational efficiency measures and firm performance are tentatively related. Furthermore, the number of passengers carried, departures, cargo carried, and leasing charges are expected to moderate this relationship. The suggested framework of this research should assist managers in conceptualizing and tentatively optimizing the relationship between operational efficiency and firm performance. The study develops a conceptual framework that adds value to existing principles and processes for operational efficiency and firm performance in the transportation industry.

Keywords: Air transport, Operational efficiency, Firm performance, Passengers, Systematic

1. Introduction

Airline companies worldwide are facing volatile and vulnerable economic conditions and intense competition (Merkert & Hensher, 2011; Zuidberg, 2014; Saranga & Nagpal, 2016; Singh et al., 2019). The aviation sector has become one of the most difficult to operate in. To cope with changing conditions and intense competition, airlines must analyze the factors driving these problems and find effective ways to overcome them (Kaya et al., 2023). This raises questions about the relationship between operational efficiency and airlines' corporate performance.

The operational efficiency of airlines is measured in technical, cost, allocation, and scale, inter alia (Barros et al., 2013; Lee & Worthington, 2014; Li et al., 2015; Yu et al., 2017; Lin & Hong, 2020). The performance of airlines is measured by operating revenues, operating profit, profit margins, passenger kilometers, load factors, yields, ton-kilometers, and market share, among other measures (Merkert & Morrell, 2012; Jain & Natarajan, 2015; Saranga & Nagpal, 2016; Merkert & Swidan, 2019; Maung et al., 2022). Several studies on the relationship between operational effectiveness and corporate performance of airlines in the past were conducted, notably Scheraga (2004), Merkert & Morrell (2012), Jenatabadi & Ismail (2014), Seufert et al. (2017), Swidan & Merkert (2019), Nguyen et al. (2021), and Peng & Bai (2022).

Few researchers have examined the impact of passengers on the operational efficiency and performance of airlines (Joo & Fowler, 2014; Merkert & Pearson, 2015; Zou et al., 2015; Saranga & Nagpal, 2016; Merkert & Swidan, 2022). Some studies reveal the impact of departures on the relationship between operational efficiency and firms' performance in the airline sector (Jenatabadi & Jenatabadi, 2014; Granja et al., 2024). Sakthidharan and Sivaraman (2018) examined the impact of rental charges (for aircraft, engines, and equipment) on airline companies' operational efficiency and profitability. Past studies covering the impact of cargo carried on the operational efficiency and corporate performance of airlines are limited (Hong & Zhang, 2010; Sakthidharan & Sivaram, 2018).

The objective of the present study is to review operational efficiency versus firm performance relationship studies of airline firms published in top journals during the period 2010 to 2024, and also the effect of passengers carried,

departures, cargo carried, and leasing charges on this relationship. The study conducts a systematic domain-based literature review aiming for framework development (Bansal & Agarwal, 2020; Paul & Mas, 2020; Shukla et al., 2022). The literature review reveals a research gap on the relationship between operational efficiency and firm performance of airline companies, and also on the effect of passengers carried, departures, cargo carried, and leasing charges on this relationship. In order to fill this research gap, we develop a framework with five testable propositions for managers to better appreciate this relationship.

2. Background

Operational Efficiency

The air transport industry plays a key role in transporting passengers and cargo across the globe (Arjomandi et al., 2018). One of the ways to sustain competitive pricing is by maximizing operational efficiency (Jain & Natarajan, 2015; Sakthidharan & Sivaraman, 2018). Technical efficiency is a situation depicting the inability of a company to generate a greater outcome with similar inputs (Merkert & Morrell, 2012; Barros et al., 2013; Lee & Worthington, 2014; Jain & Natarajan, 2015; Saranga & Nagpal, 2016; Sakthidharan & Sivaraman, 2018). Cost efficiency is a situation depicting the production of the highest possible output with optimal choices of inputs given their prices (Saranga & Nagpal, 2016; Lin & Hong, 2020). Allocative efficiency is the production of a service or good to a point where the service or good produced last gives consumers a slight benefit that matches the marginal production cost (Saranga & Nagpal, 2016). Scale efficiency is the productivity gain that a firm achieves from optimal size (Merkert & Morrell, 2012).

Firm Performance

Few airline companies have consistently reported profits, since they operate in an extremely competitive and volatile market (Saranga & Nagpal, 2016). Therefore, airline companies continuously seek avenues to reduce operating costs and to maximize operating revenues (Zuidberg, 2014; Bitzan & Peoples, 2016; Yu et al., 2017; Lin & Hong, 2020). Operating revenues, operating profit, profit margin, revenue passenger kilometers, load factor, yield, revenue ton kilometers, market share, among others, are measures to assess the performance of airline firms (Joo & Fowler, 2014; Zou et al., 2015; Merkert & Pearson, 2015; Hazel, 2018; Swidan & Merkert, 2019; Nguyen et al., 2022). Financial hedging (interest rate, foreign exchange, and fuel) helps in improving financial performance (Merkert & Swidan, 2019). Operational hedging (aeroengine commonality) in combination with financial derivatives helps in increasing profitability (Swidan & Merkert, 2019).

Passengers Carried

Passenger load factor (PLF) and passenger yield are both derivatives of passengers carried (Merkert & Pearson, 2015; Zou et al., 2015; Saranga & Nagpal, 2016; Merkert & Swidan, 2019; Maung et al., 2022). Sale of passenger tickets contributes to more than 90 percent of revenue for airlines (Saranga & Nagpal, 2016). An increase in passengers carried at higher costs is detrimental to airlines achieving higher levels of operating efficiency (Joo & Fowler, 2014). According to Schefczyk (1993), high PLF leads to high profitability. A higher PLF reduces the operating cost for each aircraft movement (Zuidberg, 2014). Passenger yield indicates an airline's market pricing power. Higher passenger yield persuades airline companies to achieve better technical efficiency, which in turn leads to higher yield in the future (Saranga & Nagpal, 2016).

Departures

Higher passenger convenience and satisfaction is achieved through a higher number of aircraft movements (departures). Market attractiveness of an airline increases through more departures (Ismail & Jenatabadi, 2014; Jenatabadi & Ismail, 2014). According to Lee & Worthington (2014), the number of aircraft movements hurt efficiency. Average stage length (ASL) is a derivative of departures. Improved financial performance for an airline can be achieved through longer average stage length (Jenatabadi & Ismail, 2014). Zuidberg (2014) found that a higher number of departures without an increase in the size of the network results in lower operating expenses for an aircraft departure.

Cargo Carried

Cargo carried by passenger airlines includes freight and mail (Arjomandi & Seufert, 2014; Sakthidharan & Sivaraman, 2018). Li et al. (2015) found that although cargo carried by airlines decreased from 2008 to 2009, the total efficiency of most of the 22 international airlines increased during this period. According to Hong and Zhang (2010), in several regions, up to 50-60 percent of air freight is carried as belly cargo in passenger aircraft. They found that mixed (passenger/cargo) airlines with a high cargo share in overall operations exhibit better efficiency compared to mixed airlines with a low cargo share in overall operations. As per Kottas & Madas (2018), passenger airlines realize 40 per cent of freight traffic globally.

Leasing Charges

Empirical results of Sakthidharan and Sivaraman (2018) reveal that the aircraft leasing model, instead of the aircraft owning model, is a better operational efficiency strategy for Indian airlines. Ownership cost per available seat kilometer (ASK) measures aircraft rentals, lease rentals, among others (Sakthidharan & Sivaraman, 2018). Leasing charges comprise aircraft, engine, and equipment rentals (Sakthidharan & Sivaraman, 2018). Results of Zuidberg (2014) indicate that ownership costs (leasing and depreciation costs) of newly inducted aircraft outweigh old aircraft maintenance costs.

As brought out in the introduction and background section, operational efficiency affects firm performance, while passengers carried, departures, cargo carried, and leasing charges affect the relationship between operational efficiency and firm performance. Therefore, the study will conduct a detailed review of the potential relationship between operational efficiency and firm performance and the effect of passengers carried, departures, cargo carried and leasing charges on this relationship based on prior studies, to develop a conceptual framework with testable propositions and also as a conceptual lens for future research.

3. Research Design

The purpose of the research is to review air transport industry literature on the potential relationship between operational efficiency and performance of airline companies and to understand the effect of passengers carried, departures, cargo carried, and leasing charges on this relationship. The study follows systematic literature review guidelines proposed in Snyder (2019) and Paul and Criado (2020), which include: design, conduct, analysis, and structuring and writing the review. Over the years, airlines across the world have been reporting losses in spite of growth in capacity and demand (growth in passenger traffic, cargo traffic, and departures). This is the motivation for the review. Year-on-year losses to individual airline firms of a nation result in losses to the industry, which in turn affect the GDP and economy of the nation. This is the need for review.

The scope of the literature review includes business, management, accounting, strategy, operations, transportation, economics, finance, and logistics. The research questions this review addresses is: the potential relationship between operational efficiency and firm performance of airline firms, and whether passengers carried, departures, cargo carried, and leasing charges moderate the operational efficiency versus firm performance relationship of airline companies. The potential audience of the review includes: the research community, academia, industry analysts, airline companies, airline regulatory agencies, the Ministry of Civil Aviation of governments, and the respective governments. Inclusion criteria determined to filter the literature include journal articles, English language, and published during the years 2010 to 2024. Exclusion criteria determined to filter the literature include book chapters, conference papers, and other publications.

We searched the article title, abstract, and keywords using keywords in different combinations in the online database Scopus. We read the abstracts of all the air transport industry literature from the results of the search and shortlisted airline operational efficiency literature. Ali et al. (2021) carried out a bibliometric analysis on airline efficiency and productivity literature for the period 1979 to 2020. They identified 17 journals out of 111 Scopus-indexed journals as the most influential journals on airline efficiency and productivity literature for the period 2010 to 2020. We read the abstracts of all the air transport industry literature published in these 17 journals year-wise for the period 2010 to 2024 and short-listed literature on airline operational efficiency studies.

The articles are selected by two reviewers to ensure protocol quality and reliability. After shortlisting the airline operational efficiency literature, different approaches are followed for the selection of the articles. Rejection of operational efficiency studies related to COVID-19 is the first criterion. The publication credibility based on Scimago Journal Rank (SJR), Australian Business Deans Council (ABDC) rating, and Scopus indexing is the second criterion. This resulted in the shortlisting of __ airline operational efficiency studies. We then perused these __ articles in totality to find out the appropriateness of the article to answer the research question. This resulted in the identification of 31 articles to answer the research question.

4. Findings

The relationships that can be derived from the literature review include the operational efficiency versus firm performance relationship and passengers carried, departures, cargo carried, and leasing charges on the relationship between operational efficiency and firm performance of airline firms. The following section will address these five relationships.

Operational Efficiency Versus Firm Performance

The summary of the findings of past studies on the relationship between operational efficiency and firm performance is shown in Table 1. Results of Perez-Granja et al. (2024) show that: (1) the likelihood of an accident is lower for airline companies with higher profitability levels; (2) when an air transport accident occurs, the expected number of accidents is higher for higher profitability airlines; and (3) accident severity has a negative relationship with profitability. Maung et al. (2022) found that: (1) low-cost airlines can follow both growth-focused strategies and improvements in profitability simultaneously; and (2) full-service airlines are unable to follow both growth in capacity and improvements in profitability simultaneously.

Results of Kaya et al. (2023) indicate that: (1) efficiency scores (customer, internal process, learning & growth, finance, and environmental dimensions of sustainability balanced scorecard) were highest for Icelandair and Aeromexico among 35 airlines; (2) an increase in wide-body aircraft number and return on assets negatively impact efficiency; (3) low-cost airlines are less efficient than network carriers; and (4) non-alliance airlines are more efficient than alliance airlines. Findings of Sakthidharan and Sivaraman (2018) suggest that the capacity of the Indian domestic airline industry can be increased without efficiency loss. Evidence from Saranga and Nagpal (2016) shows that Indian airlines that are low-cost have achieved significant efficiencies. They also found that better performance in the Indian market in the form of yield (total operating revenue/revenue passenger kilometers) is achieved through technical efficiency.

Khezrimotlagh et al. (2022) found that the merger resulted in an improvement in the overall efficiency of merged U.S. airline companies. Empirical analysis by Jain and Natarajan (2015) established that: (1) most of the low-cost airlines are efficient; (2) airlines under the public sector (smaller and larger) and airlines under the private sector (smaller) are efficient; and (3) even though the airlines under the public sector are suffering losses, these airlines are flying at the most productive scale. Lozano and Gutierrez (2014) concluded that, out of the sample of sixteen European airlines, six are efficient, six are efficient in either the production process or sales process, and four are inefficient in both production process and sales process.

As per Yen & Li (2022), since airline companies have performance characteristics based on air routes, it is imperative to evaluate the firm's performance from the perspective of air routes. Merkert & Hensher (2011) have shown econometrically that fleet mix and strategic management decisions like aircraft size, airline size, among others, impact airline efficiency. Bruggen & Klose (2010) suggest: (1) a positive association between fleet commonality and operating performance, and fleet size moderating this relationship; and (2) route length variation not interacting with fleet commonality and not influencing operating performance.

Empirical results of Yu & Chen (2023) show that efficiency improvement is the main origin of the gains in productivity of the complete system of airlines. Analysis by Barros and Couto (2013) shows that, between 2001 and 2011, in the aftermath of the twin tower attacks in the USA on September 11th, 2001, the majority of the airlines of Europe did not experience productivity gains. According to Lu et al. (2012), compared to the dispersion in relative marketing efficiency of thirty airline firms operating in the US, the dispersion in relative production

efficiency is not much. Results of Chow (2010) indicate that the performance of private Chinese airlines is better than that of state-owned Chinese airlines.

Hazel (2018) identified that, after controlling for fuel price and economic strength, a strong negative correlation exists between total US domestic airline capacity and average US domestic airline industry revenue per seat mile available. Joo and Fowler (2014) indicate that operating revenues and operating expenses are significant in explaining airlines' operational efficiency scores. Merkert and Morrell (2012) reveal that the optimal capacity for an airline is between 34 and 52 billion ASK, and greater than 200 billion ASK is excessively large for efficient operation. Hong & Zhang (2010) found that mixed airlines with a high cargo share in operations are more operationally efficient than mixed airlines with a low cargo business share.

Findings of Jenatabadi and Ismail (2014) indicate that the internal operations of airline companies is significantly affected by the situation of the country's economy. The impact that the situation of the economy has on the internal operation of airline companies is greater than the impact that the situation of the economy has on airline companies' performance. Ismail and Jenatabadi (2014) suggest that the performance of airlines is positively and significantly related to the airline's internal operation.

Samunderu et al. (2023) report on the limited effect of fuel hedging on airline firm performance. Merkert and Swidan (2019) indicate that volatility in earnings before interest and tax (EBIT) margin is significantly decreased through financial hedging in prices of aviation turbine fuel, whereas the cost of operations and profitability are not significantly affected. Outcomes of Swidan and Merkert (2019) show that the use of operational hedging (aeroengine commonality) and financial hedging (prices of aviation turbine fuel) in combination is much more effective than using them in isolation.

Nguyen et al. (2022) reveal that: (1) revenue efficiency significantly varied across full-service airlines, low-cost airlines, and airlines that are ultra-low- cost; (2) revenue efficiency is found to be lowest for ultra-low-cost due to constraints in technology; and (3) revenue performance of airfare, service quality and size of operations. Zou et al. (2015) establish that standardization of fleet results in a reduction of unit costs. Their results also indicate that aircraft family-level standardization leads to profitability improvements and aircraft model-level standardization results in reduced profits.

Empirical results of Yu et al. (2016) show that more than half of the sample of thirteen airlines that are low-cost of US and Europe need to improve their utilization of capacity, and all thirteen airlines that are low-cost need to improve their efficiency in the market as well as reduce high costs. Merkert and Pearson (2015) affirm that the impact of customer service on airline profitability is limited. Steven et al. (2012) found that, when the market concentration is lower, customer satisfaction has a stronger impact on the performance of US airline firms and vice versa.

Seufert et al. (2017) demonstrate that airlines in Europe are relatively better performers in pollution-adjusted efficiency in operations and pollution-adjusted productivity. Airlines in the Middle East are found to be making gains in growth of output but perform poorly in pollution-adjusted productivity, an indication that emission trading schemes may result in greener airlines. Arjomandi and Seufert (2014) show that technically efficient airlines are more from North Asia and China, and airlines that are environmentally efficient are more from Europe.

Table 1. Operational Efficiency Versus Firm Performance Studies

Reference	Purpose	Sample	Study Period	Methodology
Granja et al. (2024)	Explore the air transport safety versus profitability relationship.	94 US domestic passenger airlines.	1991 - 2018	Zero-inflated negative binomial (ZINB) model.

Kaya et al. (2023)	Performance evaluation of airline firms from different dimensions.	35 international airlines.	2019	Two-stage sustainability balanced scorecard (SBSC)-Data envelopment analysis (DEA) model & Simar-Wilson analysis.
Samunderu et al. (2023)	Conceptualize a model on the effect of fuel hedging on an airline's firm value.	3 European and 5 American airlines.	9 years	Panel regression approaches.
Yu & Chen (2023)	Assess the productivity change of global airlines.	17 international airlines.	2009 - 2018	Network DEA-based global Malmquist productivity index (NGMPI)
Yen & Li (2022)	Evaluation of airline performance on the basis of air routes.	2 Taiwanese airlines	2019	Meta-analysis, DEA & Cluster analysis.
Khezrimotlagh et al. (2022)	Study the firm performance of U.S. airline companies & the effect of mergers on airlines' efficiency.	12 U.S. airlines	2005 - 2018	Two-stage variable returns to scale (VRS) network DEA.
Maung et al. (2022)	Examine the effect of the business model of airlines on the growth versus profits relationship.	64 major international airlines.	2010 - 2017	Generalized method of moments (GMM) model.
Nguyen et al. (2022)	Investigate the difference in revenue efficiency of airlines that are full service, airlines that are low cost, and airlines that are ultra-low-cost.	Major airlines in the US.	2015 - 2019	Two-stage DEA (stage1 – bootstrap non-convex meta-frontier approach & stage 2 – bootstrap truncated regression).
Merkert & Swidan (2019)	Investigate whether operating profits can be enhanced through financial hedging in the form of fuel, interest rates, and foreign exchange.	100 global airlines.	Six consecutive fiscal years.	Generalized least squares (GLS), Swamy-Arora estimator, and maximum likelihood random effects.
Swidan & Merkert (2019)	Evaluate the operational hedging versus financial hedging relationship and the effect of hedging in operations on operational efficiency and airline profitability.	80 global airlines.	2010/2011 to 2013/2014	Random effects panel regression analysis estimated by GLS for models 1, 3 & 4. Random effects logistic regression for model 2.

Hazel (2018)	Examines growth in capacity of US domestic airline industry and its effect on operating revenue.	U.S. domestic market.	1995 - 2016	Ordinary least squares (OLS) regression.
Sakthidharan & Sivaraman (2018)	Determine how efficiency is affected by operating cost and its components.	Indian domestic airlines.	2013 - 14	Input minimization DEA to estimate efficiencies of airlines. Constant returns to scale (CRS) model initially & extends to VRS model subsequently. Input efficiency profiling (IEP) is also attempted.
Seufert et al. (2017)	Assess efficiency and productivity at the operations stage.	World's major airlines.	2007 - 2013	DEA by-product models.
Yu et al. (2016)	Evaluate utilization of capacity.	13 low-cost airlines across the world that are low-cost.	2010	DEA
Saranga & Nagpal (2016)	Investigate the relation between drivers of performance, technical & cost efficiency and performance in the market.	All public & private airlines in operation in India.	2005 - 2012	Analysis in two stages. Estimation of technical efficiency & cost efficiency in stage 1 using DEA and determining drivers of performance in stage 2 using GLS & Tobit regressions.
Jain & Natarajan (2015)	Investigate the scale efficiency and technical efficiency of all scheduled airlines (small, large, public, private, full service & budget) across ownership, size & cost, providing domestic & international services.	All airlines operating in India.	2006 - 2010	VRS model of DEA and IEP model of DEA.
Merkert & Pearson (2015)	Investigate whether profitability is impacted by service provided to customers.	World's top 150 airlines.	2011 - 2012	DEA in first stage and truncated regressions in second stage.
Zou et al. (2015)	Estimate the impact of standardization of fleet on unit operating cost and airline profitability.	16 US airlines.	1999 - 2009	Regression analysis

Lozano & Gutierrez (2014)	Analysis of efficiency.	Sixteen European airlines.	2007	Slacks-based network DEA.
Arjomandi & Seufert (2014)	Examine technical efficiency and environmental efficiency.	48 major airlines (full service & low cost) from six different regions.	2007 - 2010	Bootstrapped DEA models under VRS.
Jenatabadi & Ismail (2014)	Estimating non-financial and financial performance.	209 airline companies.	2014	Structural equation modelling (SEM).
Joo & Fowler (2014)	Measure and compare operational efficiencies.	30 largest airlines each of North America, Europe and Asia in terms of annual revenues.	2010	DEA to measure relative efficiency and Tobit regression to identify efficiency determinants.
Ismail & Jenatabadi (2014)	Investigate the moderating effects of firm age on performance outcomes.	30 airlines from Asia Pacific region.	2006 - 2011	SEM
Barros & Couto (2013)	Evaluate the productivity changes by combining both financial and operational variables.	23 airlines of Europe.	2000 - 2011	Productivity changes evaluated using the Luenberger productivity indicator. Malmquist index is estimated for comparative purposes.
Steven et al. (2012)	Investigate the link between service provided to customers, satisfaction gained by customers, and performance of airline firms.	US airline industry.	2003 - 2009	Two-stage least squares (2SLS).
Merkert & Morrell (2012)	Analyze whether economies of scale through mergers and acquisitions produce optimal efficiency.	66 largest passenger airlines.	2007 - 2009	Efficiency analysis using DEA.
Lu et al. (2012)	Evaluate marketing efficiency & production efficiency and explore whether the performance of the airlines is affected by corporate governance characteristics.	30 airline firms operating in the US.	2006	Two-stage DEA and truncated regression.

Merkert & Hensher (2011)	Investigate the impact of strategic management decisions on airline firms' efficiency.	58 passenger airlines	2007 – 2009	Two-stage DEA with Tobit regressions in stage 2.
Hong & Zhang (2010)	Investigate the operational effect of high cargo business by mixed airlines.	29 mixed airlines	1998 – 2002	DEA & non-parametric statistical tests.
Bruggen & Klose (2010)	Investigate the effect of commonality of fleet on the performance of airlines that are low-cost.	28 airlines	2007	Linear Regression
Chow (2010)	Measuring the changes in productivity of Chinese airlines after the entry of non-state-owned airlines.	16 airlines (11 state-owned, 1 international joint venture & 4 privately owned).	2003 - 2007	Malmquist indices

Source: The authors

Passengers Carried Versus Operational Efficiency - Firm Performance Relationship

The studies on the moderating effect of passengers carried on the relationship between operational efficiency and firm performance is summarized in Table 2. As per Maung et al. (2022), airline profit is positively affected by passenger capacity utilization and yield from passengers carried. Merkert and Swidan (2019) report that airline operating costs are significantly reduced by passenger capacity utilization, and passenger capacity utilization also has a very significant positive effect on airline profit margins. In estimating the impacts of standardization of fleet on operating profit margin and unit operating cost, Zou et al. (2015) concluded that both passenger yield and passenger load factor have a significant positive effect on the operating profit margin of airlines.

According to Saranga and Nagpal (2016), in India, airlines that are low-cost are more operationally efficient than their counterpart airlines that are full service. Airlines that are low-cost are making optimum use of their aircraft by fitting more seats and thereby flying more passengers with less fixed costs. International revenue passenger kilometers or international revenue passenger miles are found to have a significant and positive interaction with cost efficiency and technical efficiency. Load factor is found to have a significant and positive interaction with cost efficiency and technical efficiency.

Evidence from Merkert and Pearson (2015) shows that both yields and load factors have a significant impact on profit margins of airlines. Joo and Fowler (2014) establish that passengers are not significant in explaining airlines' operational efficiency scores. According to them, airlines cannot achieve higher levels of operating efficiency with an increase in passengers at higher costs. They concluded that airlines should support an increase in passengers while containing costs.

Table 2. Studies on the Moderating Effect of Passengers Carried on the Operational Efficiency Versus Firm Performance Relationship

Reference	Purpose	Sample	Study Period	Methodology
Maung et al. (2022)	Examine the effect of business model of airline on growth versus profits relationship.	64 major international airlines	2010 - 2017	GMM model.

Merkert & Swidan (2019)	Investigate whether operating profits can be enhanced through financial hedging in the form of fuel, interest rates, and foreign exchange.	100 international airlines.	Six consecutive fiscal years.	Regression methodologies: GLS random effects, Swamy-Arora estimator and maximum likelihood random effects.
Saranga & Nagpal (2016)	Investigate the relation between drivers of performance, technical & cost efficiency, and performance in the market.	All public & private airlines in operation in India.	2005 - 2012	Analysis in two stages. Estimation of technical & cost efficiency in stage 1 using DEA and determining drivers of performance in stage 2 using GLS & Tobit regressions.
Merkert & Pearson (2015)	Investigate whether profitability of the world's top 150 airlines is impacted by service provided to customers.	World's top 150 airlines.	2011 - 2012	DEA in the first stage and truncated regressions in the second stage.
Zou et al. (2015)	Estimate the impact of standardization of fleet on unit operating cost and airline profitability.	16 US airlines.	1999 - 2009	Regression analysis
Joo & Fowler (2014)	Measure and compare operational efficiencies.	30 largest airlines in North America, Europe and Asia in terms of annual revenues.	2010	DEA to measure relative efficiency and Tobit regression to identify efficiency determinants.

Source: The authors

Departures Versus Operational Efficiency - Firm Performance Relationship

The studies on the moderating effect of departures on the relationship between operational efficiency and firm performance are summarized in Table 3. Granja et al. (2024) conclude that the probability of air transport accidents is higher with an increase in the number of departures, and the profitability of airline companies is linked to a lower likelihood of air transport accidents. According to Jenatabadi and Ismail (2014), airline performance is affected by the state of the nation's economy through internal airline operations (departures, average stage length, and advertising). The study indicates that both departures and average stage length (total distance flown / number of departures) play a significant mediating role between the state of the economy and airline performance. Ismail and Jenatabadi (2014) determined that the performance of airlines is positively and significantly related to airlines' internal operations, which include the measures: departures, average stage length, and advertising expenses. Average stage length can contribute to the company's superior financial performance.

Table 3. Studies on the Moderating Effect of Departures on Operational Efficiency Versus Firm Performance Relationship

Reference	Purpose	Sample	Study Period	Methodology
Granja et al. (2024)	Explore the air transport safety versus profitability relationship.	94 US domestic passenger airlines.	1991 - 2018	ZINB model.
Jenatabadi & Ismail (2014)	Estimating non-financial and financial performance.	209 airline companies.	2014	SEM
Ismail & Jenatabadi (2014)	Investigate the moderating effects of firm age on performance outcomes.	30 airlines from the Asia Pacific region.	2006 - 2011	SEM

Source: The authors

Cargo Carried Versus Operational Efficiency - Firm Performance Relationship

The studies on the moderating effect of cargo carried on the relationship between operational efficiency and firm performance are summarized in Table 4. Empirical results of Sakthidharan and Sivaraman (2018) reveal that, due to factors like less cargo, less catering, and a single type of fleet, employee productivity is higher for airlines that are low-cost. Hong & Zhang (2010) determined that mixed airlines with a high cargo business share in overall operations are significantly more operationally efficient than mixed airlines with a low cargo business share.

Table 4. Studies on the Moderating Effect of Cargo Carried on the Operational Efficiency Versus Firm Performance Relationship

Reference	Purpose	Sample	Study Period	Methodology
Sakthidharan & Sivaraman (2018)	Determine the effect of operating cost & its components on efficiency.	Indian domestic airlines.	2013 - 14	Input minimization DEA to estimate efficiencies of airlines. CRS model initially & extends to VRS model subsequently. IEP is also attempted.
Hong & Zhang (2010)	Investigate the operational effect of high cargo business by mixed airlines	29 mixed airlines	1998 – 2002	DEA & non-parametric statistical tests.

Source: The authors

Leasing Charges Versus Operational Efficiency - Firm Performance Relationship

The studies on the moderating effect of leasing charges on the relationship between operational efficiency and firm performance are summarized in Table 5. Sakthidharan and Sivaraman (2018) assert that the aircraft leasing model, instead of the aircraft owning model, is a more viable strategy for Indian domestic airlines' operational efficiency.

Table 5. Studies on the Moderating Effect of Leasing Charges on Operational Efficiency Versus Firm Performance Relationship

Reference	Purpose	Sample	Study Period	Methodology
Sakthidharan & Sivaraman (2018)	To determine how efficiency is affected by operating cost and its components.	Indian domestic airlines.	2013 - 14	Input minimization DEA to estimate efficiencies of airlines. CRS model initially & extends to VRS model subsequently. IEP is also attempted.

Source: The authors

5. Discussion and Further Research

On the basis of the literature review, as illustrated in Figure 1, a conceptual framework is arrived at. The six research areas: operational efficiency, firm performance, passengers carried, departures, cargo carried, and leasing charges are described in the conceptual framework. Based on the conceptual framework, five propositions are developed that can enrich future research.

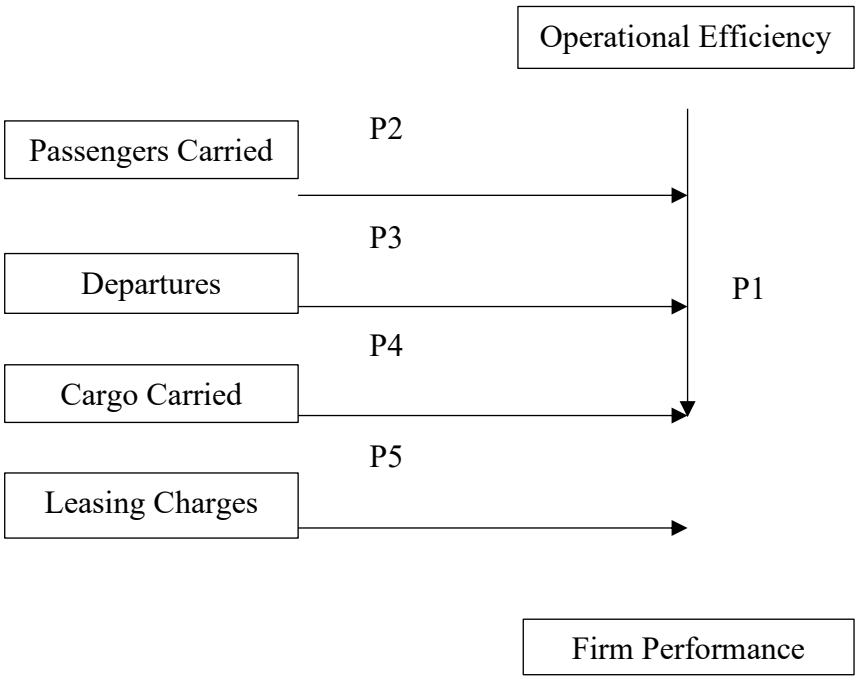


Figure 1. Potential Relation Between Operational Efficiency & Performance of Airline Firms and Moderating Effects of: Passengers Carried, Departures, Cargo Carried and Leasing Charges on the Operational Efficiency Versus Firm Performance Relationship

Source: The authors

P1. Potential Relation Between Operational Efficiency and Firm Performance

Financial performance of airline companies is positively related to airline operational efficiency (Joo and Fowler, 2014; Ismail and Jenatabadi, 2014; Zou et al., 2015; Merkert and Pearson, 2015; Saranga and Nagpal, 2016; Swidan and Merkert, 2019; Nguyen et al., 2022). Different operational efficiency measures of airline firms affect

different firm performance measures of airline firms, individually and in combination (Lu et al., 2012; Merkert and Morrell, 2012; Steven et al., 2012; Seufert et al., 2017; Hazel, 2018; Merkert and Swidan, 2019). In the case of the sea transport industry, Peng and Bai (2022) found that LSCs adopt different operational strategies to improve profitability.

The proposition raises several queries that require further investigation: (1) The individual and combination effect of different measures of operational efficiency on the different individual and combination measures of firm performance (existing measures not already investigated); and (2) The effect of existing and new operational efficiency measures on the existing and new firm performance measures like accidents, fatalities, incidents, flight delays, air route, on-time performance (OTP), carbon emissions, etc., in an individual capacity and in combination.

P2. Passengers Carried Moderate Operational Efficiency Versus Firm Performance Relationship

Airline profit is positively affected by passenger capacity utilization and yield from passengers carried (Merkert and Pearson, 2015; Zou et al., 2015; Merkert and Swidan, 2019; Maung et al., 2022). Prior research has shown that an increase in passengers carried has a stronger relationship with operational efficiency and firm performance, and vice versa. Previous research has focused more on the moderating effects of passengers carried on the relationship between operational efficiency and the performance of an airline firm in terms of the profit of airline companies. Therefore, it is necessary to investigate the moderating effect of passengers carried on the relationship between operational efficiency and firm performance in terms of existing and new operational efficiency and firm performance measures (accidents, fatalities, incidents, flight delays, air route, OTP, carbon emissions, and so on), not already investigated, in an individual capacity and in combination.

P3. Departures Moderate Operational Efficiency Versus Firm Performance Relationship

A greater average stage length can lead to improved financial gains for airline firms (Jenatabadi and Ismail, 2014). Airline firm performance is positively and significantly related to the airline's internal operations, which include the measures of departures and average stage length (Ismail and Jenatabadi, 2014; Jenatabadi and Ismail, 2014). The focus of previous research on the effect of departures on the relationship between operational efficiency and firm performance is mostly on the financial performance of airline companies. This raises the need to investigate the moderating effect of departures on operational efficiency and performance of airline firms in terms of existing and new operational efficiency and firm performance measures (accidents, fatalities, incidents, flight delays, air route, OTP, carbon emissions, and so on), not yet investigated individually and in combination. This can guide airline firms to determine the optimum number of departures that can result in the strongest relationship between operational efficiency and firm performance.

P4. Cargo Carried Moderate Operational Efficiency Versus Firm Performance Relationship

Employee productivity is high for airline firms with a low-cost business model, due to less cargo being carried (Sakthidharan and Sivaraman, 2018). Prior research on the moderating effect of cargo carried out on the relationship between operational efficiency and firm performance is scarce. Therefore, it is interesting to investigate the moderating effect of cargo carried on the relationship between operational efficiency and performance of airline firms in terms of existing and new operational efficiency and firm performance measures (accidents, fatalities, incidents, flight delays, air route, OTP, carbon emissions, and so on) not already investigated, in an individual capacity and in combination. Since passenger airlines with high cargo share in overall operations exhibit better efficiency vis-à-vis passenger airlines with low cargo share in overall operations (Hong and Zhang, 2010), future research can help passenger airline companies to decide on optimum cargo to be carried in each flight to maximize the relationship between operational efficiency and firm performance.

P5. Leasing Charges Moderate Operational Efficiency Versus Firm Performance Relationship

An aircraft leasing model, instead of an aircraft ownership model, is a more fruitful strategy for Indian domestic airlines' operational efficiency (Sakthidharan and Sivaraman, 2018). Prior research on the moderating effect of leasing charges on the relationship between operational efficiency and firm performance is scarce. Previous research has given more attention to the effect of leasing charges on operational efficiency. Therefore, it is

imperative to investigate the moderating effect of leasing charges on operational efficiency and performance of airline firms in terms of existing and new operational efficiency and firm performance measures (accidents, fatalities, incidents, flight delays, air route, OTP, carbon emissions, and so on) not already investigated, individually and in combination. This can help the airline companies to decide on the more viable strategy (aircraft leasing model versus aircraft owning model), which can result in the optimum relationship between operational efficiency and firm performance.

6. Conclusion

The study carries out a systematic domain-based literature review of the potential relationship between operational efficiency and firm performance of airline companies and the effect of passengers carried, departures, cargo carried, and leasing charges on this relationship. A conceptual framework with five propositions is developed on the basis of the literature review. The potential relationship between operational efficiency and firm performance of airline firms is the first proposition. The moderating effect of passengers carried, departures, cargo carried, and leasing charges on the operational efficiency versus firm performance relationship constitutes the second, third, fourth, and fifth propositions, respectively.

Different measures of operational efficiency affect different measures of firm performance individually and in combination. Literature on the moderating effect of passengers carried and departures on the relationship between operational efficiency and firm performance is limited. An increase in passengers carried and departures tends to make the relationship between operational efficiency and firm performance stronger, and vice versa. Literature on the moderating effect of cargo carried and leasing charges on the operational efficiency versus performance of airline firms' relationships is scarce. One study has shown that mixed airlines with a high cargo share in overall operations exhibit better efficiency and vice versa.

The main limitations of the review include: (1) overlooking studies not accessible through the search; and (2) missing out on unpublished studies. Future research on refining the framework can overcome these limitations. This review study contributes to the existing air transport industry literature by conceptualizing the moderating effect of passengers carried, departures, cargo carried, and leasing charges on the relationship between operational efficiency and firm performance of airline firms and also identifying existing and new operational efficiency and firm performance measures for future research.

The framework developed through the review study can be generalized by managers of airline firms to determine the quantum of the moderator variables (passengers carried, departures carried, cargo carried, and leasing charges), to maximize the relationship between operational efficiency and firm performance. Future researchers can use the framework to test the impact of the moderator variables on the relationship between operational efficiency and performance of airline companies with existing and new operational efficiency and firm performance measures like accidents, fatalities, incidents, air routes, OTP, flight delays, and carbon emissions, among others, both individually and in combination.

7. References

[1] Ali, N. S. Y., Yu, C., & See, K. F. (2021). Four decades of airline productivity and efficiency studies: A review and bibliometric analysis. Journal of Air Transport Management, 96, 102099.

[2] Arjomandi, A., Dakpo, K. H., & Seufert, J. H. (2018). Have Asian airlines caught up with European Airlines? A by-production efficiency analysis. Transportation Research Part A: Policy and Practice, 116, 389-403.

[3] Arjomandi, A., & Seufert, J. H. (2014). An evaluation of the world's major airlines' technical and environmental performance. Economic Modelling, 41, 133-144.

[4] Bansal, N., & Agarwal, U. A. (2020). Examining the relationships among work–life constructs: a review. Business Perspectives and Research, 8(2), 257-271.

[5] Barros, C. P., & Couto, E. (2013). Productivity analysis of European airlines, 2000–2011. Journal of Air Transport Management, 31, 11-13.

[6] Barros, C. P., Liang, Q. B., & Peypoch, N. (2013). The technical efficiency of US Airlines. Transportation Research Part A: Policy and Practice, 50, 139-148.

[7] Bitzan, J., & Peoples, J. (2016). A comparative analysis of cost change for low-cost, full-service, and other carriers in the US airline industry. Research in Transportation Economics, 56, 25-41.

[8] Brüggen, A., & Klose, L. (2010). How fleet commonality influences low-cost airline operating performance: Empirical evidence. Journal of Air Transport Management, 16(6), 299-303.

[9] Chow, C. K. W. (2010). Measuring the productivity changes of Chinese airlines: the impact of the entries of non-state-owned carriers. Journal of Air Transport Management, 16(6), 320-324.

[10] Hazel, R. (2018). Airline capacity discipline in the US domestic market. Journal of Air Transport Management, 66, 76-86.

[11] Hong, S., & Zhang, A. (2010). An efficiency study of airlines and air cargo/passenger divisions: a DEA approach. World Review of Intermodal Transportation Research, 3(1-2), 137-149.

[12] Ismail, N. A., & Jenatabadi, H. S. (2014). The influence of firm age on the relationships of airline performance, economic situation and internal operation. Transportation Research Part A: Policy and Practice, 67, 212-224.

[13] Jain, R. K., & Natarajan, R. (2015). A DEA study of airlines in India. Asia Pacific Management Review, 20(4), 285-292.

[14] Jenatabadi, H. S., & Ismail, N. A. (2014). Application of structural equation modelling for estimating airline performance. Journal of Air Transport Management, 40, 25-33.

[15] Joo, S. J., & L. Fowler, K. (2014). Exploring comparative efficiency and determinants of efficiency for major world airlines. Benchmarking: An International Journal, 21(4), 675-687.

[16] Kaya, G., Aydın, U., Ülengin, B., Karadayı, M. A., & Ülengin, F. (2023). How do airlines survive? An integrated efficiency analysis on the survival of airlines. Journal of Air Transport Management, 107, 102348.

[17] Khezrimotlagh, D., Kaffash, S., & Zhu, J. (2022). US airline mergers' performance and productivity change. Journal of Air Transport Management, 102, 102226.

[18] Kottas, A. T., & Madas, M. A. (2018). Comparative efficiency analysis of major international airlines using Data Envelopment Analysis: Exploring effects of alliance membership and other operational efficiency determinants. Journal of Air Transport Management, 70, 1-17.

[19] Lee, B. L., & Worthington, A. C. (2014). Technical efficiency of mainstream airlines and low-cost carriers: new evidence using bootstrap data envelopment analysis truncated regression. Journal of Air Transport Management, 38, 15-20.

[20] Lin, Y. H., & Hong, C. F. (2020). Efficiency and effectiveness of airline companies in Taiwan and Mainland China. Asia Pacific Management Review, 25(1), 13-22.

[21] Li, Y., Wang, Y. Z., & Cui, Q. (2015). Evaluating airline efficiency: an application of virtual frontier network SBM. Transportation Research Part E: Logistics and Transportation Review, 81, 1-17.

[22] Lozano, S., & Gutiérrez, E. (2014). A slacks-based network DEA efficiency analysis of European airlines. Transportation Planning and Technology, 37(7), 623-637.

[23] Lu, W. M., Wang, W. K., Hung, S. W., & Lu, E. T. (2012). The effects of corporate governance on airline performance: Production and marketing efficiency perspectives. Transportation Research Part E: Logistics and Transportation Review, 48(2), 529-544.

[24] Maung, Y. S. Y., Douglas, I., & Tan, D. (2022). Identifying the drivers of profitable airline growth. Transport Policy, 115, 275-285.

[25] Merkert, R., & Hensher, D. A. (2011). The impact of strategic management and fleet planning on airline efficiency–A random effects Tobit model based on DEA efficiency scores. Transportation Research Part A: Policy and Practice, 45(7), 686-695.

[26] Merkert, R., & Morrell, P. S. (2012). Mergers and acquisitions in aviation–Management and economic perspectives on the size of airlines. Transportation Research Part E: Logistics and Transportation Review, 48(4), 853-862.

[27] Merkert, R., & Pearson, J. (2015). A non-parametric efficiency measure incorporating perceived airline service levels and profitability. Journal of Transport Economics and Policy (JTEP), 49(2), 261-275.

[28] Merkert, R., & Swidan, H. (2019). Flying with (out) a safety net: Financial hedging in the airline industry. Transportation Research Part E: Logistics and Transportation Review, 127, 206-219.

[29] Nguyen, M. A. T., Yu, M. M., & Lirn, T. C. (2022). Revenue efficiency across airline business models: A bootstrap non-convex meta-frontier approach. Transport Policy, 117, 108-117.

[30] Paul, J., & Criado, A. R. (2020). The art of writing a literature review: What do we know and what do we need to know?. International Business Review, 29(4), 101717.

[31] Paul, J., & Mas, E. (2020). Toward a 7-P framework for international marketing. Journal of Strategic Marketing, 28(8), 681-701.

[32] Peng, W., & Bai, X. (2022). Prospects for improving shipping companies' profit margins by quantifying operational strategies and market focus approach through AIS data. Transport Policy, 128, 138-152.

[33] Pérez-Granja, U., Pérez-Sánchez, J. M., & Pérez-Rodríguez, J. V. (2024). Assessing economic performance and aviation accidents using zero-inflated and over-dispersed panel data models. Journal of Air Transport Management, 118, 102599.

[34] Sakthidharan, V., & Sivaraman, S. (2018). Impact of operating cost components on airline efficiency in India: A DEA approach. Asia Pacific Management Review, 23(4), 258-267.

[35] Samunderu, E., Perret, J. K., & Geller, G. (2023). The economic value rationale of fuel hedging: An empirical perspective from the global airline industry. Journal of Air Transport Management, 106, 102324.

[36] Saranga, H., & Nagpal, R. (2016). Drivers of operational efficiency and its impact on market performance in the Indian Airline industry. Journal of Air Transport Management, 53, 165-176.

[37] Schefczyk, M. (1993). Operational performance of airlines: an extension of traditional measurement paradigms. Strategic management journal, 14(4), 301-317.

[38] Scheraga, C. A. (2004). Operational efficiency versus financial mobility in the global airline industry: a data envelopment and Tobit analysis. Transportation Research Part A: Policy and Practice, 38(5), 383-404.

[39] Seufert, J. H., Arjomandi, A., & Dakpo, K. H. (2017). Evaluating airline operational performance: A Luenberger-Hicks-Moorsteen productivity indicator. Transportation Research Part E: Logistics and Transportation Review, 104, 52-68.

[40] Shukla, A., Geetika, & Shukla, N. (2022). Corporate social responsibility measures: A brief review. Business Perspectives and Research, 10(1), 101-120.

[41] Singh, J., Sharma, S. K., & Srivastava, R. (2019). What drives Indian Airlines operational expense: An econometric model. Journal of Air Transport Management, 77, 32-38.

[42] Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research, 104, 333-339.

[43] Steven, A. B., Dong, Y., & Dresner, M. (2012). Linkages between customer service, customer satisfaction and performance in the airline industry: Investigation of non-linearities and moderating effects. Transportation Research Part E: Logistics and Transportation Review, 48(4), 743-754.

[44] Swidan, H., & Merkert, R. (2019). The relative effect of operational hedging on airline operating costs. Transport Policy, 80, 70-77.

[45] Yen, B. T., & Li, J. S. (2022). Route-based performance evaluation for airlines–A metafrontier data envelopment analysis approach. Transportation Research Part E: Logistics and Transportation Review, 162, 102748.

[46] Yu, M. M., Chang, Y. C., & Chen, L. H. (2016). Measurement of airlines' capacity utilization and cost gap: Evidence from low-cost carriers. Journal of Air Transport Management, 53, 186-198.

[47] Yu, M. M., & Chen, L. H. (2023). Productivity change of airlines: a global total factor productivity index with network structure. Journal of Air Transport Management, 109, 102403.

[48] Yu, M. M., Chen, L. H., & Chiang, H. (2017). The effects of alliances and size on airlines' dynamic operational performance. Transportation Research Part A: Policy and Practice, 106, 197-214.

[49] Zou, L., Yu, C., & Dresner, M. (2015). Fleet standardization and airline performance. Journal of Transport Economics and Policy (JTEP), 49(1), 149-166.

[50] Zuidberg, J. (2014). Identifying airline cost economies: An econometric analysis of the factors affecting aircraft operating costs. Journal of Air Transport Management, 40, 86-95.