# "Assessing the financial performance of airlines in the Asia-Pacific region"

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**BUSINESS PERSPECTIVES**

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# ASSESSING THE FINANCIAL PERFORMANCE OF AIRLINES IN THE ASIA-PACIFIC REGION

## Abstract

In recent years, the aviation industry in the Asia-Pacific region has experienced rapid growth. Despite facing thin and volatile profit margins, the region's airlines continue to expand their capacity by using high financial leverage, raising concerns of whether they are utilizing such financial leverage effectively and how it affects their stock performance. Using the global Malmquist productivity index and the conditional value-at-risk measure, this study investigates the financial performance of 22 Asia-Pacific-based airlines during 2016–2019. The empirical results reveal that only three full-service airlines were able to maintain continued improvement in financial efficiency during the sample period. The excessive use of financial leverage among low-cost carriers is documented. To assess the sources of financial inefficiency, this study decomposed the global Malmquist productivity index into two components: efficiency change and technical change. The results show that while there was a trend toward efficiency catch-up among the carriers, the number of airlines that demonstrated sufficient technical change declined significantly, indicating the need to implement technological innovation to deliver better financial outcomes. Regarding the airline's stock return performance, airlines that achieved continuously superior performance in deploying financial resources also saw the lowest downside risk in their stock returns, reinforcing the importance of devoting more attention to indebtedness and the effectiveness with which financial resources are used. The findings of this study offer suggestions to airlines in managing their capital structure and enhancing their financial stability.

## INTRODUCTION

The airline business is subject to many regulations due to its vital role in supporting a country's economic development and national security. To promote sustainable growth in the industry, in 1978, the U.S. enacted the Airline Deregulation Act, which relaxed restrictions in areas such as airfare setting, route and service designs, and the entry of new airlines. Since then, many countries have undertaken similar deregulations to enhance the performance of their respective airline industries. As more airlines entered air transportation markets, the competition in the industry intensified, promoting an increased level of consumer welfare through improved service quality, lower airfares, and expanded connectivity. The competition to offer low airfares also induced more demand for air travel and the proliferation of low-cost carriers, which offer competitive airfares to reach a broader customer base (ITF, 2019).

Among major aviation markets, the Asia-Pacific market has experienced the fastest growth in recent years due to the region's efforts to further deregulate its air market, its booming middle-class population, and the rising average incomes in this region. Currently, the air transport industry in the region represents 34% of global scheduled passengers and cargo traffic, as measured in revenue tonne kilometers

(RTK), whereas the European and North American regions have 26% and 22% of the global share, respectively (IATA, 2020). Furthermore, the busiest international routes are all clustered in the southeast Asia-Pacific region, demonstrating the strong demand for air travel in the region (Chung et al., 2020). Domestic travel remains the major segment in the region's air travel, and China has the largest airline market, followed by Japan, South Korea, and India (MarketLine, 2020).

Compared to the saturated air markets in Europe and North America, the Asia-Pacific air market features some unique characteristics, as outlined by Fu and Peoples (2018). First, unlike other regions, several countries in the Asia-Pacific region are known for offering comprehensive transportation coverage by modern rail services. For example, the extensive coverage of high-speed rail in China and Japan has created additional pressure on airlines' short-haul businesses. Second, while many countries in the region have deregulated or privatized their airline industry to a certain extent, some airlines remain partially or totally state-owned, limiting their growth potential (Yu et al., 2019). Third, the Asia-Pacific region is home to many low-cost carriers, such as AirAsia and IndiGo, and it has been documented that over half of the passenger travel in Southeast Asia is provided by low-cost carriers (Srisook & Panjakajornsak, 2017). Between 2014 and 2018, low-cost carriers in the region established a "hub-and-spoke" structure offering comprehensive connectivity in the area (Chung et al., 2020). Fourth, Asia-based airlines are also known for their superior operating efficiency compared to their peers based in Europe and North America (Arjomandi & Seufert, 2014; Chang et al., 2014).

Despite the robust growth in air travel demand over the years, the airline industry's profit margin has remained thin. High operating leverage, coupled with frequent demand disruptions, has put tremendous pressure on airlines' financial conditions. According to Pearce (2012), the return on invested capital remains lower than the cost of capital even during good years, signaling that shareholder value has long deteriorated. Thus, assessing airlines' financial efficiency and implementing timely adjustments are critical to airline management.

The objective of this study is to analyze the financial performance of airlines in the Asia-Pacific region in 2016–2019 using the global Malmquist productivity index and the conditional value-at-risk (CVaR) measure. Specifically, this study investigates how well airlines utilized their financial leverage and how such financing decisions impacted their stock return volatility, both of which are crucial in shaping airlines' resource allocation strategies.

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# 1. LITERATURE REVIEW

Empirical studies related to the airline industry fall into the following categories: investigations of the impact of deregulation on the evolution of the airline industry and its interdependent sectors; works that calibrate airline efficiency through various econometric models and that examine how different factors, such as business models, geographical proximity, and corporate governance, affect airlines' operating outcomes; and assessments of airline financial conditions based on various financial indicators and econometric models. This last category is the focus of this section, as the aim of the current study is to conduct such an assessment.

From the perspective of disentangling the determinants of an airline's profitability, Lee and Jang (2007) analyzed the determinants of systematic risk of 16 U.S. airlines over the 1997–2002 period and found that an airline's growth, profitability, and safety ratio were negatively correlated with systematic risk. In contrast, the use of financial leverage and a firm's size had a positive relationship with the level of systematic risk. Using the Markov model and Asian airline data, Chin and Tay (2001) found a positive relationship between an airline's growth and profitability. Additionally, an increase in firm assets improved its survival probability, and the need for Asian airlines to improve their traffic forecasting and capacity flexibility was also noted. Pearson et al. (2015) investigat-

ed the contribution of various intangible resources to an airline's performance. Of the 49 Asian airlines sampled, they identified that resources such as slots, brand, and corporate reputation provided airlines with competitive advantages and that differential performance was associated with their choice of business model.

Regarding how an airline's capital structure affects its profitability, Guzhva and Pagiavlas (2003) explored the relationship between corporate capital structure and performance using 1977–1984 data from 14 U.S. airlines. They revealed that for most airlines, the capital structure allocation did not follow the traditional approach in which liabilities are reduced during turbulent times and increased during economic expansions. Guzhva and Pagiavlas (2003) also found a negative relationship between return on assets and current liabilities, indicating the existence of risk-taking behaviors among airlines. Capobianco and Fernandes (2004) studied the relationship between an airline's financial performance and its capital structure. They found that successful airlines used at least 40% of shareholder capital and that the ability to reduce the level of indebtedness was tied to an airline's long-term financial performance. Their study also showed that an airline's home country played little role in promoting its performance. Ovtchinnikov (2010) pointed out that deregulation has a significant impact on firms' operating environment, which in turn affects their financing choices and the resulting capital structure. Pires and Fernandes (2012) analyzed the financial efficiency of 42 international airlines from 2001 to 2002 and found that airlines committing to reduce their use of debt financing saw improved profitability. Using a dataset covering 69 publicly traded airlines for the period of 1981 to 2010, Wojahn (2012) investigated the causes of airlines' overinvestment behavior. Agency problems, excess investments by low-cost carriers, and Asian airlines' increased acquisitions of aircraft due to an expected surge in travel demand were associated with overinvesting behaviors in the industry, although overall deteriorated profits were observed.

With regard to predicting financial distress, Gritta et al. (2008) examined the financial condition of U.S. air carriers in the 1997–2006 period. They found that since 1997, most airlines have ex-

perienced a deterioration in their financial performance, with Southwest Airlines being an exception. They associated the decrease in financial performance with the increasing use of financial leverage among airlines, which supports existing empirical findings indicating that when an airline chooses to use less debt in its capital structure, it is able to achieve better aggregated financial performance. Using a multiple discriminant analysis approach, Kroeze et al. (2018) proposed an alternative bankruptcy prediction model and demonstrated the ability of financial ratios to forecast an air carrier's bankruptcy. Alan and Lapré (2018) studied the power of operational metrics to predict airlines' future financial distress. Using U.S. airline data from 1998 to 2003, they discovered that airlines with poor revenue management, inefficient aircraft utilization, and complex operational dimensions were prone to financial distress. Shome and Verma (2020) investigated the performance of four Indian airlines using various bankruptcy prediction models. Their empirical results revealed that three out of four Indian airlines showed signs of financial trouble during the sample period. They also documented the suitability of using quantitative models for diagnosing financial conditions in the airline industry.

This review of the literature reveals several key points. First, the airline industry is a dynamic, cyclical business. Thus, it is necessary to frequently re-examine the well-being of the industry. Studies related to recent developments in the Asia-Pacific aviation industry are still limited. Second, since the financial crisis in 2008, the cost of borrowing has been comparatively low. This low cost of debt financing combined with the growth in the region's aviation market has incentivized Asia-Pacific- based airlines to use more debt. In fact, due to the rapid expansion in capacity, many airlines in the region are already highly leveraged. Since high leverage is a cause of future financial distress, the essential question for airline management is whether debt financing is effectively being used to generate the greatest benefits for shareholders. The purpose of this study is to fill the gap in the literature by offering a timely investigation of airlines' efficacy in debt utilization and to provide suggestions on how to enhance airlines' financial performance.

## 2. METHODOLOGY AND DATA

### 2.1. Global Malmquist productivity index

The literature has suggested that a firm's funding choices and capital structure decisions are related to its assessment of issues such as asymmetric information, taxes, agency problems, and bankruptcy costs (Miglo, 2011). Firms with high financial leverage tend to remain at elevated levels for decades (Lemmon et al., 2008). Inspired by Pires and Fernandes (2012), who adopted a Malmquist index to analyze the influence of an air carrier's capital structure adjustments, this study adopts similar concepts to assess whether an air carrier uses its external capital efficiently compared to its peers in the region.

There are two steps involved in this part of the evaluation. First, the relative performance of an airline is determined via the input-oriented data envelopment analysis (DEA) model introduced by Banker et al. (1984), which is widely known as the BCC model. Financial leverage, which is evaluated by the total debt ratio, is the input factor. The output factors considered are the natural logarithm of total revenue; asset tangibility, as identified by the ratio of net fixed assets to total assets; and profitability, as measured by the earnings before interest, taxes, depreciation, and amortization (EBITDA) margin. The input and output variables are selected according to evidence documented in the literature that an airline's use of financial leverage will lead to growth in its size, asset tangibility, and profitability (Ovtchinnikov, 2010). Therefore, given the level of financial leverage, airlines that were able to deliver the highest attainable financial outputs are considered efficient in using their financial leverage. In this study, variable returns to scale was assumed.

Second, the global Malmquist productivity index introduced by Pastor and Lovell (2005) is used to assess the progression of financial productivity over time. The Malmquist productivity index, developed by Caves et al. (1982), is a total productivity index that measures the change in efficiency of a decision-making unit (DMU) over time.

Färe et al. (1992) demonstrated that the distance functions used in calibrating the Malmquist productivity index can be expressed as reciprocals of technical-efficiency models. They connected the distance functions in the Malmquist productivity index with the well-known nonparametric DEA model introduced by Charnes et al. (1978) and extended by Banker et al. (1984). Assume that there are $n$ DMUs, where each DMU uses various amounts of inputs to produce various amounts of outputs. Let $(x^t, y^t)$ be the input-output vector and $D_i^t(y^t, x^t)$ be the distance function at period $t$. Based on Caves et al. (1982) and Färe et al. (1992), the Malmquist productivity index can be decomposed into two components:

$$
M_i^{t+1}\left(y^{t+1}, x^{t+1}, y^t, x^t\right) =
$$
$$
= \frac{D_i^{t+1}\left(y^{t+1}, x^{t+1}\right)}{D_i^t\left(y^t, x^t\right)} \times \tag{1}
$$
$$
\times \left[\left(\frac{D_i^t\left(y^{t+1}, x^{t+1}\right)}{D_i^{t+1}\left(y^{t+1}, x^{t+1}\right)}\right) \cdot \left(\frac{D_i^t\left(y^t, x^t\right)}{D_i^{t+1}\left(y^t, x^t\right)}\right)\right]^{\frac{1}{2}}.
$$

In equation (1), the ratio outside the square bracket estimates the change in the relative efficiency (efficiency catch-up) between period $t$ and period $(t+1)$. The geometric mean of the two quotients inside the square bracket describes the change in technology (innovation progression), as observed from the shift of the frontier, between period $t$ and period $(t+1)$. In Färe et al. (1992), a progression in total productivity is defined as reaching a Malmquist productivity index greater than unity, while a Malmquist productivity index less than unity indicates a decline in production performance. The same evaluation criteria apply to the components of the Malmquist productivity index. However, Pastor and Lovell (2005) pointed out that the adoption of adjacent period technologies assumed in the aforementioned Malmquist index causes the index to be not circular and may make linear programming infeasible. To resolve these modeling issues, Pastor and Lovell (2005) proposed a global Malmquist productivity index in which the output distance indices are estimated with respect to a global technology index, defined as $T_C^G = conv\left\{T_C^1, T_C^2, \ldots, T_C^T\right\}$, derived from the data of all DMUs in all periods and, therefore, free

from issues of circularity and infeasibility. A global Malmquist index, therefore, can be presented as

$$M_C^G\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \frac{D_C^G\left(x^{t+1}, y^{t+1}\right)}{D_C^G\left(x^t, y^t\right)}. \qquad (2)$$

In addition, a global Malmquist productivity index can also be decomposed into components of productivity change over time, i.e., a measure of the efficiency change and an estimate of the technical change:

$$M_C^G\left(x^t, y^t, x^{t+1}, \genfrac{}{}{0pt}{}{>}{<} y^{t+1}\right) =$$

$$= \underbrace{\frac{D_C^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_C^t\left(x^t, y^t\right)}}_{\text{efficiency change}} \times \qquad (3)$$

$$\times \underbrace{\left[\left(\frac{D_C^G\left(x^{t+1}, y^{t+1}\right)}{D_C^{t+1}\left(x^{t+1}, y^{t+1}\right)}\right) \cdot \left(\frac{D_C^t\left(x^t, y^t\right)}{D_C^G\left(x^t, y^t\right)}\right)\right]}_{\text{technical change}}.$$

where there are $t = 1, 2, \ldots, T$ time periods. The interpretation of the global Malmquist productivity index is similar to that of Färe et al. (1992): an improvement is identified when the components yield a value greater than unity, and a deterioration is detected if the value is less than unity. When the value is one, production has neither progressed nor regressed.

## 2.2. Stock return volatility

In addition to evaluating the efficiency of airlines' utilization of financial leverage, this study investigates whether airlines' efforts to reduce their indebtedness lead to lower volatility in their stock returns. To this end, the CVaR measure is used to calibrate the risk entailed in airlines' equity returns.

CVaR, also known as the mean shortfall or expected shortfall, is a popular tail risk measure that was introduced by Rockafellar and Uryasev (2000). Extending the value-at risk measure, CVaR is defined as the weighted average of the worst-case scenarios within a specified confidence interval during a given time period. It shows the conditional expectation of losses above a certain threshold (Rockafellar & Uryasev, 2000). Therefore, CVaR focuses on downside risk and has proven to be suitable for asymmetric, non-normal data. In a highly cyclical business environment, an unexpected change in demand can have dramatic impacts on airlines' revenue, making companies' stock returns volatile and representing a great risk for their shareholders. In this study, the daily equity returns of each airline were used to calculate the one-year CVaR at the 95% confidence level, i.e., the expected average loss of the lowest 5% of stock returns.

## 2.3. Data

This study includes 22 Asia-Pacific airlines, of which 16 are full-service carriers and 6 are low-cost carriers. The sample period extends from 2016 to 2019. Data were retrieved from International Air Transport Association (IATA) World Air Transport Statistics, S&P NetAdvantage, and airline websites. Table 1 provides information on the airlines' home country, business model, alliance associations, total assets and revenue passenger kilometers (RPK) in 2019, and the stock exchanges where the firms are listed.

According to Table 1, China Southern Airlines, China Eastern Airlines, Air China, Cathay Pacific Airways, and All Nippon Airways are the leading airlines in the region by total assets and RPK. In this region, full-service carriers remain the major players. Many Asia-Pacific airlines, regardless of their business model, have joined international airline alliances to expand their network and global connectivity. While low-cost carriers are usually smaller in terms of their total assets and RPK achieved, several of them, such as IndiGo and AirAsia, have gained substantial market power in their respective service regions.

Table 2 shows the descriptive statistics of full-service and low-cost carriers. On average, the low-cost carriers in the region had a higher debt ratio than the full-service carriers. Additionally, only a few airlines in the sample were able to maintain a debt ratio below 60%, a threshold identified by Capobianco and Fernandes (2004) as the key to being successful in the industry. Full-service carriers demonstrated a higher level of asset tangibility than

**Table 1.** Background information on airlines in the Asia-Pacific region

Source: IATA World Air Transport Statistics, Plus Edition 2020, and the websites of the respective airline alliances and airline companies.

| Airline | Country | Airline business model | Alliance | Total assets (millions) | Revenue passenger kilometers (millions) | Stock exchange listed |
|---|---|---|---|---|---|---|
| AirAsia | Malaysia | LCC | | 6,250 | 63,382 | KLSE |
| AirAsia X | Malaysia | LCC | | 2,336 | 28,343 | KLSE |
| Air China | China | FSC | Star Alliance | 42,260 | 169,030 | SEHK |
| Air New Zealand | New Zealand | FSC | Star Alliance | 5,116 | 38,390 | NZSE |
| All Nippon Airways | Japan | FSC | Star Alliance | 24,250 | 90,449 | TSE |
| Asiana Airlines | South Korea | FSC | Star Alliance | 11,696 | 46,924 | KOSE |
| Cathay Pacific Airways | Hong Kong | FSC | oneworld | 27,541 | 119,328 | SEHK |
| Cebu Air | Philippines | LCC | Value | 3,110 | 24,956 | PSE |
| China Airlines | Taiwan | FSC | SkyTeam | 9796 | 42,142 | TSEC |
| China Eastern Airlines | China | FSC | SkyTeam | 40,635 | 186,644 | SHSE |
| China Southern Airlines | China | FSC | | 44,040 | 213,573 | SEHK |
| EVA Airways | Taiwan | FSC | Star Alliance | 11,909 | 48,627 | TSEC |
| Garuda Indonesia | Indonesia | FSC | SkyTeam | 4,456 | 32,506 | IDX |
| IndiGo | India | LCC | | 3,612 | 82,156 | NSEI |
| Japan Airlines | Japan | FSC | oneworld | 18,323 | 66,342 | TSE |
| Jeju Air | South Korea | LCC | Value | 1,271 | 21,491 | KOSE |
| Korean Air Lines | South Korea | FSC | SkyTeam | 23,399 | 83,012 | KOSE |
| Philippine Airlines | Philippines | FSC | | 6,266 | 42,330 | PSE |
| Qantas Airways | Australia | FSC | oneworld | 14,398 | 86,199 | ASX |
| SpiceJet | India | LCC | | 693 | 27,042 | BSE |
| Thai Airways | Thailand | FSC | Star Alliance | 8,562 | 67,040 | SET |
| Vietnam Airlines | Vietnam | FSC | SkyTeam | 3,293 | 35,276 | HOSE |

*Note:* Total assets (in USD) and RPK reflect the values achieved in the 2019 fiscal year. FSC means full-service carriers, and LCC means low-cost carriers.

low-cost carriers, showing differential corporate strategies in asset acquisition. The annualized average daily stock returns for the sample airlines are presented in Table 3. The returns of the airline industry were volatile, and no airline was able to consistently realize positive returns over these years, with 2018 being the worst year for the industry.

**Table 2.** Descriptive statistics of airlines in the Asia-Pacific region

Sources: S&P NetAdvantage and airline websites.

| Variables | | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Panel A: Full-Service Carriers** | | | | | |
| Sales (Millions USD) | Max | 16534.119 | 19593.496 | 20882.417 | 22163.466 |
| | Min | 2310.255 | 2591.227 | 2869.044 | 3046.409 |
| | Avg | 8761.259 | 9645.687 | 10419.587 | 10502.212 |
| | S.D. | 5292.081 | 5708.724 | 6266.550 | 6375.520 |
| Debt Ratio | Max | 0.922 | 0.922 | 0.946 | 0.985 |
| | Min | 0.449 | 0.420 | 0.410 | 0.409 |
| | Avg | 0.751 | 0.737 | 0.743 | 0.774 |
| | S.D. | 0.116 | 0.125 | 0.138 | 0.145 |
| Asset Tangibility | Max | 0.875 | 0.863 | 0.854 | 0.892 |
| | Min | 0.248 | 0.239 | 0.225 | 0.257 |
| | Avg | 0.640 | 0.648 | 0.647 | 0.681 |
| | S.D. | 0.148 | 0.149 | 0.151 | 0.157 |
| EBITDA Margin | Max | 0.257 | 0.218 | 0.206 | 0.202 |
| | Min | 0.061 | 0.010 | −0.016 | 0.028 |
| | Avg | 0.164 | 0.144 | 0.130 | 0.122 |
| | S.D. | 0.055 | 0.063 | 0.067 | 0.049 |

**Table 2 (cont.).** Descriptive statistics of airlines in the Asia-Pacific region

| Variables | | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Panel B: Low-Cost Carriers** | | | | | |
| Sales (Millions USD) | Max | 2435.294 | 2867.582 | 3537.593 | 4112.978 |
| | Min | 620.998 | 932.692 | 1105.399 | 1033.784 |
| | Avg | 1253.973 | 1617.155 | 1847.177 | 2059.507 |
| | S.D. | 676.287 | 835.118 | 1026.668 | 1236.127 |
| Debt Ratio | Max | 1.365 | 1.205 | 1.014 | 1.073 |
| | Min | 0.547 | 0.586 | 0.629 | 0.715 |
| | Avg | 0.820 | 0.777 | 0.755 | 0.860 |
| | S.D. | 0.287 | 0.223 | 0.152 | 0.147 |
| Asset Tangibility | Max | 0.815 | 0.745 | 0.735 | 0.788 |
| | Min | 0.098 | 0.213 | 0.144 | 0.226 |
| | Avg | 0.450 | 0.442 | 0.328 | 0.500 |
| | S.D. | 0.241 | 0.209 | 0.222 | 0.199 |
| EBITDA Margin | Max | 0.378 | 0.265 | 0.220 | 0.283 |
| | Min | 0.053 | 0.039 | −0.015 | 0.000 |
| | Avg | 0.195 | 0.148 | 0.108 | 0.077 |
| | S.D. | 0.135 | 0.091 | 0.075 | 0.108 |

**Table 3.** Annualized average daily stock returns, 2016–2019

| Airline | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| AirAsia | 0.574 | 0.372 | −0.117 | −0.555 |
| AirAsia X | 0.693 | −0.087 | −0.413 | −0.395 |
| Air China | −0.174 | 0.636 | −0.313 | 0.183 |
| Air New Zealand | −0.306 | 0.372 | −0.035 | −0.047 |
| All Nippon Airways | −0.069 | 0.386 | −0.183 | −0.062 |
| Asiana Airlines | −0.062 | 0.083 | −0.122 | 0.278 |
| Cathay Pacific Airways | −0.253 | 0.153 | −0.093 | 0.035 |
| Cebu Air | 0.119 | 0.105 | −0.311 | 0.197 |
| China Airlines | −0.208 | 0.227 | −0.087 | −0.189 |
| China Eastern Airlines | 0.013 | 0.140 | −0.526 | 0.206 |
| China Southern Airlines | −0.307 | 0.682 | −0.488 | 0.113 |
| EVA Airways | −0.163 | 0.112 | 0.039 | −0.103 |
| Garuda Indonesia | 0.119 | −0.122 | −0.014 | 0.545 |
| IndiGo | −0.492 | 0.382 | −0.032 | 0.135 |
| Japan Airlines | −0.221 | 0.238 | −0.133 | −0.111 |
| Jeju Air | −0.488 | 0.373 | −0.092 | −0.234 |
| Korean Air Lines | 0.013 | 0.235 | −0.083 | −0.128 |
| PAL Holdings | 0.137 | 0.010 | −0.318 | −0.059 |
| Qantas Airways | −0.206 | 0.400 | 0.137 | 0.211 |
| SpiceJet | −0.364 | 0.910 | −0.494 | 0.222 |
| Thai Airways | 0.931 | −0.273 | −0.358 | −0.577 |
| AVG. | −0.034 | 0.254 | −0.192 | −0.016 |
| S. D. | 0.372 | 0.278 | 0.189 | 0.278 |

*Notes:* The trading data for Vietnam Airlines were not available for most of the sample period. Therefore, it is excluded from this table.

# 3. EMPIRICAL RESULTS

Table 4 reports the findings based on the global Malmquist productivity index, which captures whether the financial leverage adopted was justified by the financial outcomes delivered. Each year, approximately half of the sample airlines demonstrated improvement in utilizing financial leverage to enhance their financial metrics. However, only three full-service airlines, i.e., All Nippon Airways, EVA Airways, and Vietnam Airlines, were able to consistently progress, as their re-

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ported global Malmquist productivity indices in the 2016–2019 period were all greater than unity. Since 2016–2019 was a period with fewer systematic disruptions, the empirical results show that even in good years, only a few carriers achieved efficiency in using financial leverage, implying the difficulty and complexity of the airline business environment.

In addition, while performance varied by year and by carrier, none of the low-cost carriers showed a consecutive financial productivity improvement during the sample period, reflecting the excessive use of leverage among low-cost carriers. According to Myers' (1984) pecking order theory, due to asymmetric information and cost considerations, firms prefer to first use their internal capital and debt instruments to finance new expansion and capital needs. Also, due to aggressive management, better funding opportunities, and favorable

projected profitability, low-cost carriers tend to overinvest, investing up to twice the amount invested by full-service carriers with otherwise similar characteristics (Wojahn, 2012). As low-cost carriers take on an increasing role in serving the Asia-Pacific region (Slocum, 2018), their stability and sustainability have become vital factors that can help to further advance the growth of the Asia-Pacific aviation market. The empirical results reveal the need for low-cost carriers to examine their resource allocation because firms that exhibit above-target financial leverage tend to use more equity financing in the future to rebalance their capital allocation (Ovtchinnikov, 2010).

Decomposing the global Malmquist productivity index, this study shows that there is a trend toward improvement in financial efficiency catch-up among airlines, as the number of airlines that were able to enhance their efficiency increased from on-

**Table 4.** Empirical results based on the global Malmquist productivity index

| Airline | MI | | | EC | | | TC | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2016–2017 | 2017–2018 | 2018–2019 | 2016–2017 | 2017–2018 | 2018–2019 | 2016–2017 | 2017–2018 | 2018–2019 |
| AirAsia | 0.718 | 0.854 | 0.765 | 0.888 | 0.693 | 0.785 | 0.809 | 1.234 | 0.974 |
| AirAsia X | 0.993 | 0.913 | 1.014 | 0.928 | 0.892 | 1.063 | 1.069 | 1.024 | 0.954 |
| Air China | 1.000 | 1.000 | 0.960 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.960 |
| Air New Zealand | 1.012 | 0.979 | 1.013 | 0.937 | 0.967 | 1.080 | 1.081 | 1.012 | 0.938 |
| All Nippon Airways | 1.064 | 1.133 | 1.038 | 0.893 | 1.026 | 1.091 | 1.192 | 1.104 | 0.952 |
| Asiana Airlines | 1.075 | 0.984 | 1.026 | 0.978 | 0.973 | 1.108 | 1.099 | 1.012 | 0.926 |
| Cathay Pacific Airways | 1.010 | 1.068 | 0.979 | 0.920 | 1.052 | 1.041 | 1.098 | 1.015 | 0.941 |
| Cebu Air | 0.932 | 0.878 | 1.068 | 1.000 | 1.000 | 1.000 | 0.932 | 0.878 | 1.068 |
| China Airlines | 1.070 | 1.029 | 0.960 | 0.973 | 1.018 | 1.033 | 1.100 | 1.011 | 0.929 |
| China Eastern Airlines | 1.026 | 1.033 | 0.996 | 1.092 | 1.000 | 0.944 | 0.939 | 1.033 | 1.055 |
| China Southern Airlines | 0.995 | 0.986 | 1.019 | 1.000 | 1.000 | 1.000 | 0.995 | 0.986 | 1.019 |
| EVA Airways | 1.031 | 1.019 | 1.037 | 0.940 | 1.005 | 1.113 | 1.096 | 1.015 | 0.932 |
| Garuda Indonesia | 0.972 | 0.888 | 1.009 | 0.909 | 0.867 | 1.007 | 1.069 | 1.024 | 1.003 |
| IndiGo | 1.143 | 1.130 | 0.921 | 1.069 | 1.104 | 0.918 | 1.069 | 1.024 | 1.003 |
| Japan Airlines | 0.980 | 1.020 | 1.000 | 1.000 | 1.000 | 1.000 | 0.980 | 1.020 | 1.000 |
| Jeju Air | 0.934 | 0.931 | 0.927 | 0.873 | 0.910 | 0.971 | 1.069 | 1.024 | 0.955 |
| Korean Air Lines | 1.075 | 0.963 | 0.989 | 1.021 | 0.952 | 1.070 | 1.053 | 1.012 | 0.924 |
| PAL Holdings | 0.938 | 0.943 | 1.064 | 0.854 | 0.933 | 1.146 | 1.099 | 1.011 | 0.929 |
| Qantas Airways | 0.998 | 0.993 | 0.923 | 0.905 | 0.981 | 0.981 | 1.103 | 1.012 | 0.941 |
| SpiceJet | 1.092 | 1.086 | 0.945 | 0.998 | 1.071 | 0.943 | 1.094 | 1.014 | 1.003 |
| Thai Airways | 0.988 | 0.980 | 0.975 | 0.899 | 0.969 | 1.040 | 1.099 | 1.012 | 0.938 |
| Vietnam Airlines | 1.019 | 1.035 | 1.018 | 0.929 | 1.021 | 1.075 | 1.097 | 1.013 | 0.946 |
| Average | 1.003 | 0.993 | 0.984 | 0.955 | 0.974 | 1.019 | 1.052 | 1.022 | 0.968 |
| Index > 1 | 11 | 9 | 10 | 3 | 7 | 12 | 16 | 19 | 6 |
| Index = 1 | 1 | 1 | 1 | 4 | 5 | 4 | 1 | 1 | 1 |
| Index < 1 | 10 | 12 | 11 | 15 | 10 | 6 | 5 | 2 | 15 |

*Notes:* MI is the global Malmquist productivity index. EC stands for the change in efficiency from period *t* to period (*t*+1). TC refers to the change in technology from period *t* to period (*t*+1).

**Table 5.** CVaRs for airline stock returns

| 2017 | | 2018 | | 2019 | |
|---|---|---|---|---|---|
| **Airline** | **CVaR** | **Airline** | **CVaR** | **Airline** | **CVaR** |
| All Nippon Airways | −0.017 | EVA Airways | −0.022 | All Nippon Airways | −0.017 |
| EVA Airways | −0.023 | All Nippon Airways | −0.026 | EVA Airways | −0.019 |
| Cathay Pacific Airways | −0.025 | Japan Airlines | −0.029 | China Airlines | −0.021 |
| Japan Airlines | −0.025 | China Airlines | −0.029 | Japan Airlines | −0.023 |
| Garuda Indonesia | −0.030 | Air New Zealand | −0.030 | Qantas Airways | −0.034 |
| China Eastern Airlines | −0.032 | Cathay Pacific Airways | −0.030 | Cathay Pacific Airways | −0.036 |
| Air New Zealand | −0.033 | Qantas Airways | −0.033 | Korean Air Lines | −0.039 |
| Qantas Airways | −0.035 | Garuda Indonesia | −0.039 | Air New Zealand | −0.043 |
| China Airlines | −0.036 | Cebu Air | −0.042 | Jeju Air | −0.044 |
| Cebu Air | −0.036 | Asiana Airlines | −0.046 | China Eastern Airlines | −0.048 |
| Air China | −0.037 | Korean Air Lines | −0.046 | Air China | −0.055 |
| Jeju Air | −0.039 | Jeju Air | −0.051 | China Southern Airlines | −0.056 |
| Korean Air Lines | −0.040 | Thai Airways | −0.056 | AirAsia X | −0.059 |
| China Southern Airlines | −0.040 | AirAsia X | −0.056 | Thai Airways | −0.059 |
| IndiGo | −0.041 | Air China | −0.059 | IndiGo | −0.059 |
| AirAsia | −0.045 | PAL Holdings | −0.060 | SpiceJet | −0.061 |
| PAL Holdings | −0.045 | China Eastern Airlines | −0.060 | AirAsia | −0.065 |
| Asiana Airlines | −0.045 | IndiGo | −0.063 | PAL Holdings | −0.074 |
| Thai Airways | −0.048 | SpiceJet | −0.063 | Garuda Indonesia | −0.075 |
| AirAsia X | −0.049 | AirAsia | −0.069 | Cebu Air | −0.077 |
| SpiceJet | −0.051 | China Southern Airlines | −0.074 | Asiana Airlines | −0.089 |
| Avg. | −0.037 | | −0.047 | | −0.050 |
| S.D. | 0.009 | | 0.016 | | 0.020 |

*Notes:* Vietnam Airlines is excluded from this analysis due to data availability.

ly three airlines in 2016–2017 to 12 in 2018–2019. Meanwhile, the number of airlines that were able to demonstrate progression in frontier shifting, which is a result linked to technological innovation, decreased from 16 airlines in 2016–2017 to only 6 airlines in 2018–2019. Therefore, airlines should pay greater attention to technical development to better utilize their financial resources. Similar to the findings reported by Capobianco and Fernandes (2004), countries do not provide airlines with comparative advantages, as an individual airline's performance relies more on its own fundamentals.

Table 5 reports the one-year CVaRs at the 95% confidence level for each airline's stock return in the sample period. The share prices for Vietnam Airlines were not available until mid-2019; therefore, Vietnam Airlines was not included in the CVaR analysis. The value of an airline's CVaR is affected by two factors: market risk and company-specific risk. In the airline industry, finding comparable peers in the same domestic market is challenging because the number of public-

ly traded airlines is very limited (Capobianco & Fernandes, 2004). However, as the scope of the airline business is internationally oriented, it is reasonable to use regional peers to compare with. The empirical results reveal that, on average, the expected average loss of the lowest 5% of returns for the industry was 3.7%, 4.7%, and 5% for 2017, 2018, and 2019, respectively. Thus, the expected worst-case losses increased over time, implying that investors are facing elevated investment risk. Nevertheless, the companies that exhibited effective use of external capital over the years, i.e., All Nippon Airways and EVA Airways, show the lowest expected downside risks in their stock performance in all years. By contrast, companies that signaled difficulties in improving financial resource allocation show greater expected losses, as demonstrated by their CVaRs. Therefore, a firm's ability to efficiently utilize its financial leverage may contribute to stabilizing its stock performance. Additionally, low-cost carriers generally yield a higher CVaR than their full-service peers, revealing relatively volatile stock performance among low-cost carriers.

## CONCLUSION

This study investigated the financial performance of Asia-Pacific airlines in the 2016–2019 period, focusing on whether financial leverage was efficiently used. Characterized by intensive capital needs, the airline industry is known as a highly leveraged industry. Such high leverage ultimately results in high financial risk and greater volatility in companies' stock returns. Therefore, understanding whether external capital is well utilized is an important task for airline management.

By using the global Malmquist productivity analysis, the empirical results reveal that while approximately half of the companies achieved improvement in using their financial resources during the sample period, few of them were able to preserve the momentum for continued improvement. In fact, only three full-service carriers showed sustained efficiency growth. Hence, the excessive use of financial leverage among airlines in the Asia-Pacific region is revealed. Low-cost carriers, which rely more on external capital, should particularly consider alternative funding channels to alleviate the burden and risks brought by their high financial leverage. This study also finds that there was a tendency toward financial efficiency convergence among airlines in the region. However, improvement is needed in airlines' adoption of technological innovations, which was demonstrated to be an area that will help airlines achieve better financial efficiency. The airlines' stock return volatility, as measured by the CVaR, increased over time, indicating rising risk to investors. However, airlines that demonstrated steady progress in improving their resource allocation yielded the lowest expected shortfall in returns, reflecting the added value of focusing on managing a firm's financial leverage. This study contributes to the literature by providing actionable strategies that airlines may consider when engaging in capital structure management. Future studies can investigate how airlines' various strategies for managing major cost items, such as fuel expenses and aircraft acquisition, affect their ability to obtain the desired financial performance.

## AUTHOR CONTRIBUTIONS

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