

Analysing the Performance of the Civil Aviation Sector in India in the Perspective of the COVID-19 Pandemic: Looking for a New Policy Paradigm

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Abstract:

The COVID-19 pandemic has exacerbated the already existing challenges in the Indian aviation sector, prompting a need for strategic adjustments. This study aims to assess the performance of leading airlines in India — Indigo, SpiceJet, Air India, GoAir, and Vistara — across key operational metrics in the pre- and post-COVID-19 era, spanning the period from 2013-14 to 2022-23. We use data on various parameters of airlines' performance for each airline under study, from the Director General of Civil Aviation. We employ panel data (fixed effects) regression analysis to evaluate the impact of COVID-19 on these airlines' operational dynamics. Analysis of performance metrics reveals notable trends in the resilience and adaptability of Indian airlines in the post-pandemic scenario. Despite initial setbacks, the civil aviation sector has demonstrated gradual recovery and stabilization, with Indigo and SpiceJet exhibiting commendable resilience in passenger load factor. Air India's recovery, following its transition to the Tata group, underscores the significance of strategic management. Our regression analysis highlights the influence of operational efficiency on performance metrics, emphasizing the importance of capacity utilization and service quality. Our study indicates important policy directives towards continued support for the aviation industry's recovery, prioritization of health and safety measures, fleet and network optimization, enhancement of customer experience, and adoption of sustainable practices. Collaboration among stakeholders remains crucial in navigating uncertainties and ensuring long-term prosperity in the post-pandemic era. The Governments and regulatory bodies need to prioritize measures aimed at enhancing operational efficiency and incentivizing strategic route planning initiatives.

Keywords: *Civil aviation, passenger load factor, operational efficiency*

1. Introduction

Civil aviation in India has witnessed exponential growth and development over the past few decades, transforming the country into one of the fastest-growing aviation markets globally.

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However, amidst this growth, the industry has encountered various challenges, ranging from safety concerns, such as crash landings, to operational disruptions, including flight cancellations (Pandit & Kant, 2024). These issues have highlighted the need for robust safety regulations and operational protocols.

Furthermore, the Indian aviation sector has experienced periods of turbulence, with several airlines ceasing operations due to financial constraints or operational inefficiencies (Madhavan et al., 2023). For instance, the shutdown of Jet Airways in 2019 sent shockwaves through the industry, leaving thousands of employees jobless and disrupting air travel across the country. Similarly, the debacle of Kingfisher Airlines in 2012 highlighted the challenges of sustaining a financially viable business model in the competitive aviation market. Amidst these challenges, the onset of the COVID-19 pandemic in early 2020 dealt a severe blow to the Indian aviation industry (Ang et al., 2023), exacerbating existing vulnerabilities and precipitating unprecedented disruptions. Travel restrictions, border closures, and plummeting passenger demand led to a sharp decline in revenue streams, forcing airlines to ground fleets, suspend routes, and implement cost-cutting measures to survive the economic downturn.

Against this backdrop, this paper aims to examine the impact of COVID-19 on the performance of Indian airlines, with a focus on five major carriers: Indigo, SpiceJet, Air India, GoAir, and Vistara. By analyzing key performance metrics such as passenger load factor, average speed of aircraft, average stage distance flown per aircraft departure, average number of passengers carried per aircraft departure, and average distance flown per passenger, we seek to elucidate the extent of the pandemic's disruption on the operational dynamics. Additionally, integrating an analysis of gross national income per capita alongside operational metrics could offer insights into the impact of economic growth on airlines' performance.

In the next section, we review some contemporary literature on civil aviation's performance analysis and provide an overview of the research gap that we intend to fill in through this study. In section 3, we describe the methodology of our study. Section 4 is dedicated to analyzing the trends in certain performance parameters of the airline sector. A discussion of the regression results is presented in section 5. We suggest some policy measures in the concluding part in section 6.

2. Literature Review

The COVID-19 pandemic has severely impacted the aviation industry, particularly in the Asia Pacific region, where historic disruptions, such as SARS, led to significant declines in passenger service (Peoples, Abdullah, & Satar, 2023). Theoretical models suggest that despite operating efficiently, airlines may struggle due to reduced passenger capacity and tighter constraints. Simulations indicate a decline in technical efficiency and productivity during the pandemic. Strategies such as forming alliances and optimizing flight schedules may mitigate costs. Government intervention and diversifying revenue streams can support airline performance. However, data limitations hinder a comprehensive analysis of the impact of COVID-19. The aviation industry, in response to COVID-19, has shifted focus to service quality dimensions crucial for operational performance and passenger experiences (Tansitpong,

2024). Pre-pandemic, passengers evaluated airlines based on reliability, responsiveness, assurance, empathy, and tangibles. The pandemic highlighted the importance of safety, hygiene, and flexibility. Airlines adapting to these changes gained a competitive edge. Studies have shown a link between service quality and operational outcomes, highlighting factors such as passenger interactions and efficient airport services. Networks and route optimization positively impact load factor. These insights emphasize the pivotal role of service quality dimensions in shaping customer experiences and operational achievements. Global events, such as pandemics, significantly impact airline economics, particularly in terms of load factor and fuel prices (Cicvakova, Mako, Korba, Vajdova, & Jencova, 2020). COVID-19 led to widespread travel restrictions, border closures, and plummeting passenger demand, causing a sharp decline in revenue streams. Lower fuel prices provided some relief, but reduced demand led to lower load factors and diminished revenue potential. Adjusting ticket prices and analyzing passenger load factors are critical in mitigating profitability impacts. The economic impact analysis of the pandemic on airline economics provides insights into challenges and strategies during such crises. The Indian civil aviation sector faced significant challenges due to COVID-19, resulting in revenue declines (Nagalkar & Aarthy C, 2023). Despite initial setbacks, the resurgence of domestic air passenger traffic indicates a positive recovery path. Strategies such as safety improvements and efficient resource management helped mitigate pandemic effects. Government efforts, including infrastructure investments and policy changes, supported industry recovery. Although impacted negatively, the aviation sector is gradually recovering, showcasing resilience and adaptability. The COVID-19 pandemic posed significant challenges for the Indian aviation industry, impacting domestic passenger traffic and airline revenues (Sidhu & Shukla, 2021). Various regions, including Delhi, Mumbai, and Bengaluru, were hit hardest. The pandemic highlighted the industry's economic importance and its contribution to India's GDP. Compared to previous crises, COVID-19 posed greater threats, emphasizing the need for long-term planning and flexible strategies to handle future crises effectively. COVID-19 necessitated operational changes in the aviation industry to ensure passenger safety in the 'new normal.' Adherence to safety regulations, cleanliness, and responsible operations is crucial for passenger confidence (Kumar & Kumar, 2021). Addressing passenger concerns and prioritizing safety measures are essential for industry recovery post-pandemic. COVID-19 has significantly impacted the sustainability of airlines in India, exacerbating existing challenges such as thin profit margins and intense competition. The pandemic highlighted the industry's vulnerability to external shocks, necessitating reforms and sustainable practices for long-term viability (Agrawal, 2021). Adapting revenue strategies and operational models is crucial for airline survival and resilience in a post-COVID world.

Both stage length and passenger load factor (PLF) are important indicators of the productivity of an airline (Bitzan & Peoples, 2016). PLF also has a significant impact on air ticket prices (Szabo et al., 2018). Productivity gains are important in the cost reduction of airlines (Oum & Yu, 1995). Quality of operations and speed are also other factors that determine the financial performance of an airline (Haq & Faizan, 2022). Operational efficiency can be increased by increasing the number of routes and flight frequency (Pinchemel et al., 2022). The PLF is affected by a number of factors like the size of aircraft,

flight length, fuel prices, etc. (Chu, 2024). While low-cost carriers are able to improve profitability with growth, for full-service carriers, there is a trade-off between profitability and growth (Maung, Douglas and Tan, 2022). Compared to low-cost airlines, full-service carriers with a larger number of routes have been able to outdo the negative impacts of the COVID-19 pandemic (Jaroenjitrkam, Kotcharin & Maneenop, 2023).

The review of issues related to COVID-19 and airlines' performance has provided us with various dimensions of the problems and some suggested ways forward. Our review also indicates that a comprehensive analysis focusing on specific factors, such as Passenger Load Factor, Average Speed of Aircraft, Average Stage Distance Flown per Aircraft Departure, Average Number of Passengers Carried per Aircraft Departure, and Average Distance Flown per Passenger, within the context of Indian airlines, has not yet been undertaken. We aim to address this research gap by incorporating these previously unaddressed factors comprehensively into our analysis. In this backdrop, our study is aimed at:

- Investigating the influence of the COVID-19 pandemic on the Passenger Load Factor (PLF) of some selected airlines.
- Assessing the relationship between Gross National Income per Capita (GNIPC) and the Passenger Load Factor (PLF).
- Exploring the effects of airline-specific factors which affect the Passenger Load Factor (PLF).

3. Methodology

We have collected data from various sources including Directorate General of Civil Aviation, Ministry of Statistics and Programme Implementation and India Briefing from Dezan Shira & Associates and made a graphical analysis to understand various airline-specific factors, including Passenger Load Factor, Average Speed of Aircraft, Average Stage Distance Flown per Aircraft Departure, Average Number of Passengers Carried per Aircraft Departure, and Average Distance Flown per Passenger, across the period of study from 2014 to 2023 for five prominent airlines: Indigo, SpiceJet, Air India, GoAir, and Vistara. These airlines were selected as they constitute a significant portion of air traffic.

3.1. The Model

We employ a panel data regression model spanning 10 years for five airlines to examine the impact of various performance parameter factors on the passenger load factor, a key indicator of airline productivity growth.

We frame a regression model shown below:

$$plf_t = \beta_0 + \beta_1 avg_spd_t + \beta_2 dist_arcft_t + \beta_3 pssngr_no_t + \beta_4 dist_pssngr_t + \beta_5 Covid19_t + \beta_6 PCI_t + U_i$$

Where:

- *plf* represents the passenger load factor (PLF), the dependent variable.
- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the respective coefficients.
- *avg_spd* denotes the average speed of the aircraft.
- *pssngr_no* represents the average number of passengers carried per aircraft departure.

- *dist_arcraft* indicates the average distance flown per aircraft.
- *dist_pssngr* indicates the average distance flown per passenger.
- *PCI* signifies the gross national income per capita at constant prices.
- *Covid19* represents the COVID factor (dummy variable).
- *Ui* represents the error term.
- The subscript 't' is the indicator of time (year).
- **Null Hypothesis (H0):** The null hypothesis for each coefficient is that there is no effect of the corresponding independent variable on the dependent variable ($H_0: \beta = 0$).
- **Alternative Hypothesis (H1):** The alternative hypothesis is that there is a significant effect of the independent variable on the dependent variable ($H_1: \beta \neq 0$).

We assigned the value '0' to the COVID factor dummy variables for all pre-COVID years, spanning from 2013 to 2019, and the value '1' for the post-COVID years, covering 2020 to 2023.

3.2. Description of Performance Parameters

- Passenger Load Factor = [Revenue Passenger Kilometres (total number of kilometres flown by paying passengers) / Available Seat Kilometres (total number of kilometres flown multiplied by the number of available seats)] * 100.
- Average Aircraft Speed = Total Distance Flown / Total Time Taken.
- Average Stage Distance Flown Per Aircraft Departure = Total Distance Flown / Total No. of Aircraft Departures.
- Average Number of Passengers Carried Per Aircraft Departure = Total No. of Passengers Carried / Total No. of Aircraft Departures.
- Average Distance Flown Per Passenger = Total Distance Flown / Total No. of Passengers Carried.

3.3. Data Source

- Directorate General of Civil Aviation
- Ministry of Statistics and Programme Implementation
- India Briefing from Dezan Shira & Associates

4. Trends in Aviation Sector Performance Parameters

We begin with a comparative study of the PLF of the 5 airlines under study. Figure 1 illustrates the Passenger Load Factor (PLF) for five prominent airlines — Indigo, SpiceJet, Air India, GoAir, and Vistara, during the period 2013-14 to 2022-23.

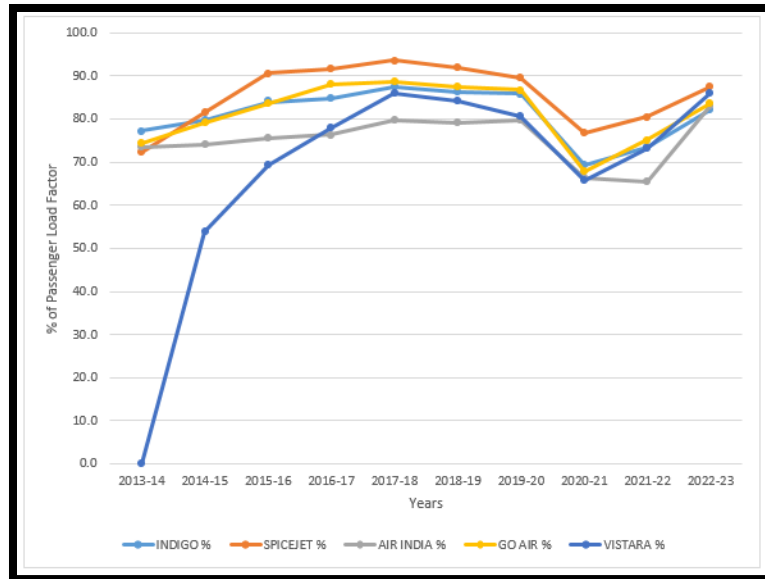


Figure 1: Comparison of Passenger Load Factor for Airlines

Source: DGCA

Figure 1 indicates that Indigo has consistently maintained high PLF levels, typically ranging from 75% to 90%. However, the impact of the COVID-19 pandemic was evident during the 2020-21 period, as indicated by a noticeable decline in PLF from 85.8% in 2019-20 to 69.4%. Despite this setback, Indigo gradually rebounded, achieving a PLF of 73.6% in 2021-22, demonstrating resilience and effective crisis management. Similarly, SpiceJet maintained consistently high PLF levels, typically between 70% and 95%. However, the pandemic's adverse effects were evident in 2020-21, with PLF decreasing from 89.6% in 2019-20 to 76.8%. Nonetheless, SpiceJet began to recover, with a PLF of 80.5% in 2021-22, showcasing adaptability and effective response strategies. Air India's PLF levels remained relatively stable throughout the period, hovering around 70% to 80%. However, a significant decline was observed in 2020-21, with PLF dropping to 66.3% from 79.8% in 2019-20, followed by a further decrease to 65.3% in 2021-22. The airline experienced a remarkable recovery in 2022-23, reaching a PLF of 82.9%, attributed mainly to its handover to the TATA group in January 2022. GoAir experienced a trend like Indigo, albeit with a slightly more pronounced decline in PLF during 2020-21, decreasing from 86.7% to 67.9%. However, the airline exhibited a better recovery compared to Indigo, with PLF increasing from 67.9% to 75.1% in 2021-22. Vistara initiated with a lower PLF but steadily increased over time. A notable decline was observed in 2020-21, with PLF dropping from 80.7% in 2019-20 to 65.8%. However, the airline demonstrated robust recovery in the following years, with PLF rising to 73.3% in 2021-22 and further to 85.9% in 2022-23. The downturn witnessed across all airlines during 2020-21 aligned with the onset of the COVID-19 pandemic, resulting in plummeting PLFs due to travel restrictions, passenger apprehensions, and reduced demand. Despite encountering unprecedented challenges, the post-2020-21 recovery efforts underscored the industry's resilience, adaptability, and gradual return to stability.

A study of the average speed of aircraft gives us interesting results. Figure 2 illustrates the Average Speed of Aircraft for the five airlines, spanning from the fiscal year 2013-14 to 2022-23.

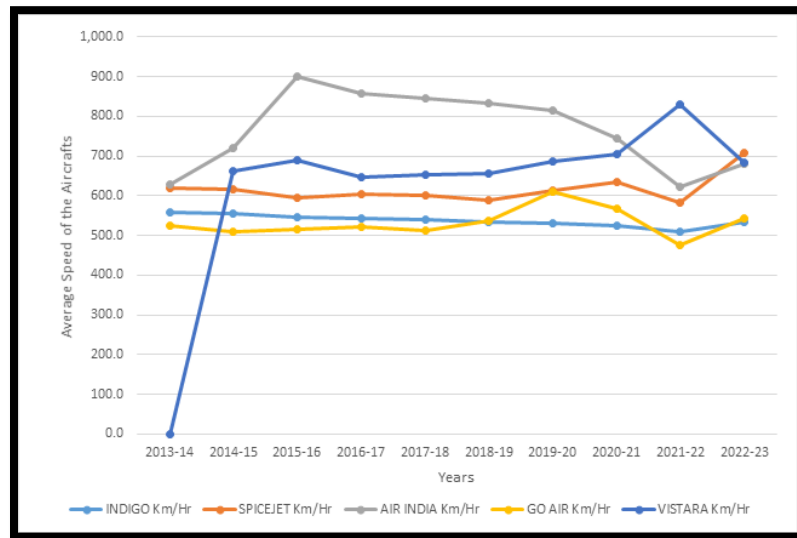


Figure 2: Comparison of Average Speed of Aircrafts for the Airlines
Source: DGCA

Indigo's average aircraft speed portrays a fluctuating trend over the decade, resembling a series of peaks and valleys. It initiated at 559.3 km/hr in 2013-14, gradually descending to 530 km/hr in 2020-21, and further declining to 508.3 km/hr in 2021-22, illustrating a distinct downward slope in the curve. This downturn can be attributed to the impact of the COVID-19 pandemic, which led to disruptions in air travel operations and a subsequent reduction in average aircraft speed. However, there was a slight recovery observed, with the speed rebounding to 532.8 km/hr in 2022-23, indicating a gradual return to pre-pandemic levels. Similarly, SpiceJet's average aircraft speed demonstrated a relatively stable performance with occasional fluctuations, akin to undulating terrain. Beginning at 618.2 km/hr in 2013-14, it experienced a modest decline in 2021-22 to 583.5 km/hr, marking its lowest point in the curve, before ascending to a peak of 707.1 km/hr in 2022-23, showcasing a consistent upward trajectory over the years. Contrastingly, Air India's average aircraft speed exhibited a more erratic pattern compared to its counterparts, resembling a roller coaster ride. Commencing at 627.9 km/hr in 2013-14, it underwent significant fluctuations, reaching its zenith at 900.8 km/hr in 2015-16, before gradually declining to 622.1 km/hr in 2021-22, followed by a slight recovery to 680.0 km/hr in 2022-23. These fluctuations could be attributed to various factors, including changes in flight routes, operational inefficiencies, and fleet adjustments. GoAir's average aircraft speed exhibited a fluctuating trend over the years, resembling a wave-like motion. Starting at 525.5 km/hr in 2013-14, it reached its peak at 611.4 km/hr in 2019-20, before descending to 567.4 km/hr in 2020-21 and further to 476.3 km/hr in 2021-22, showcasing a noticeable downward slope in the curve. This decline can be attributed to the adverse effects of the COVID-19 pandemic, including reduced air

traffic and operational constraints. However, there was a subsequent rebound, with the speed rising to 544.6 km/hr in 2022-23, indicating signs of recovery. Vistara's average aircraft speed demonstrated a generally increasing trend over the years, resembling a steady ascent. Although data for 2013-14 is unavailable, it commenced at 661.9 km/hr in 2014-15 and experienced a gradual rise, peaking at 829.7 km/hr in 2021-22, before slightly decreasing to 684.9 km/hr in 2022-23, indicating a minor dip in the curve. This decline could be attributed to factors such as changes in operational procedures, fleet composition, and network expansion strategies. In contrast to the fluctuating trends observed in the Passenger Load Factor (PLF), where the downturn was predominantly seen during 2020-21 due to the onset of the COVID-19 pandemic, the average speed of aircraft for these airlines displayed a distinct pattern. In most cases, the downturn in average speed was observed during 2021-22, reaching its lowest point in the curve, except for Vistara, which experienced its peak during this year but then demonstrated a significant decline in the following year. Although the COVID-19 pandemic did impact the average speed of aircraft for these airlines, the magnitude of this effect was relatively moderate compared to other operational metrics. Furthermore, the airlines have showcased remarkable recovery in recent years, underscoring their resilience and adaptability in navigating challenges within the aviation industry.

We also analyze the trends in another important factor, the average stage distance flown per aircraft. This is depicted in figure 3.

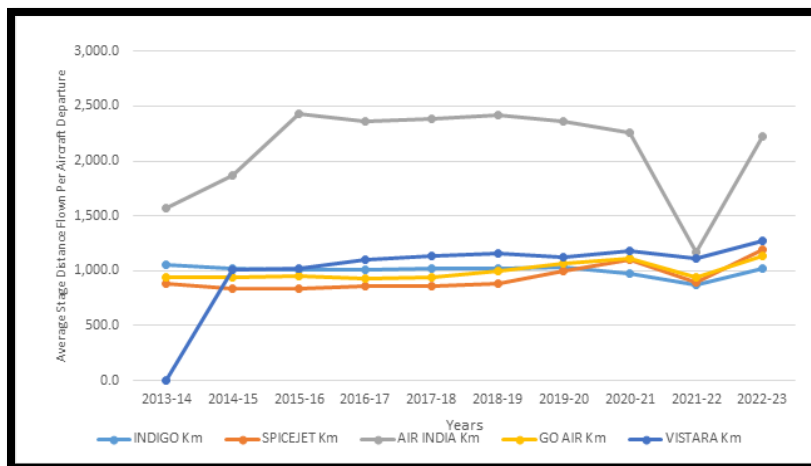


Figure 3: Comparison of Average Stage Distance Flown Per Aircraft Departure for the Airlines

Source: DGCA

In this case, Indigo has exhibited fluctuations throughout the decade. It commenced at 1,050.5 km in 2013-14, gradually declining to 969.4 km in 2020-21, followed by a further decrease to 874.4 km in 2021-22, before experiencing a slight increase to 1,016.5 km in 2022-23. These fluctuations coincided with the onset of the COVID-19 pandemic, which significantly impacted air travel demand and necessitated adjustments in route planning and network optimization strategies to adapt to changing market conditions. Similarly, SpiceJet has also demonstrated variability over the years, resembling a series of peaks and valleys. Starting from 884.0 km in 2013-14, it reached 1,103 km in 2020-21, before experiencing a

slight decline to 894.0 km in 2021-22, and then surging to its peak of 1,193.7 km in 2022-23. These fluctuations reflected the dynamic responses of the airline to the challenges posed by the COVID-19 pandemic, including changes in travel restrictions, passenger preferences, and market demand, leading to strategic adjustments in route planning and operational practices. In contrast, Air India's average stage distance flown per aircraft departure showcases a fluctuating pattern, resembling a roller coaster ride. Beginning at 1,576.3 km in 2013-14, it peaked at 2,432.7 km in 2015-16, before gradually declining to 1,174.7 km in 2021-22, and then rising again to 2,222.0 km in 2022-23. The notable increase seen in 2022-23 can be attributed to the airline's handover to the TATA group in January 2022, coupled with strategic adjustments made in response to evolving market dynamics and recovery efforts following the COVID-19 pandemic. GO AIR's average stage distance flown per aircraft departure has displayed fluctuations over the years, resembling waves in the ocean. Starting at 943.1 km in 2013-14, it declined to 935.7 km in 2021-22, before reaching its peak at 1,129.8 km in 2022-23. These fluctuations reflected the airline's adaptive strategies in response to the unprecedented challenges posed by the COVID-19 pandemic, including changes in operational procedures, route optimization, and fleet management. Vistara's average stage distance flown per aircraft departure has demonstrated a generally increasing trend over the years, resembling a steady ascent. Initiating at 1,005.4 km in 2014-15, it experienced a gradual rise, reaching its peak at 1,276.1 km in 2022-23, with a slight decline to 1,110.7 km in 2021-22. These trends highlighted the airline's resilience and adaptability in navigating the challenges presented by the COVID-19 pandemic, including shifts in travel patterns, operational constraints, and market dynamics. The fluctuations and trends observed in the average stage distance flown per aircraft departure for these airlines closely mirror those seen in the average speed of aircraft. The downturn in the average stage distance flown per aircraft departure was notably observed during 2021-22, reaching its lowest point across the analyzed period. While the COVID-19 pandemic significantly impacted this metric for these airlines, the magnitude of its effect was considerable. Nevertheless, the airlines have demonstrated remarkable recovery in recent years, highlighting their resilience and adaptability in overcoming challenges within the aviation industry.

We now turn to the discussion of the average number of passengers carried per aircraft departure, as shown in figure 4, for the five major airlines during the period under study. Indigo's average number of passengers carried per aircraft departure has displayed fluctuations over the decade, resembling a wave-like pattern. It commenced at 123.5 passengers in 2013-14, reaching its peak at 150.0 passengers in 2017-18, before experiencing a decline to 118.0 passengers in 2020-21. This downturn can be directly attributed to the onset of the COVID-19 pandemic, which led to travel restrictions, heightened passenger fear, and a decline in air travel demand. However, the airline gradually began to recover, with a slight increase to 124.1 passengers in 2021-22 and further to 143.3 passengers in 2022-23, indicating a resurgence in passenger confidence and a gradual return to normalcy. Similarly, SpiceJet's average number of passengers carried per aircraft departure has exhibited variability over the years, resembling a rollercoaster ride. Beginning at 103.6 passengers in 2013-14, it peaked at 130.8 passengers in 2017-18, before declining to 100.1 passengers in 2020-21. This decline mirrors the impact of the COVID-19 pandemic

on air travel demand. However, there was a slight recovery observed, with the number of passengers per departure increasing to 107.6 passengers in 2021-22 and further to 130.3 passengers in 2022-23, indicating a rebound in passenger confidence and an upward trajectory in demand. Air India's average number of passengers carried per aircraft departure has also demonstrated fluctuations over the years, resembling a series of peaks and valleys. Starting at 112.8 passengers in 2013-14, it peaked at 139.6 passengers in 2018-19, before declining to 111.1 passengers in 2020-21. This decline can be attributed to the adverse effects of the COVID-19 pandemic on air travel demand. However, there was a gradual recovery observed, with the number of passengers per departure increasing to 142.4 passengers in 2022-23, signalling resurgence in passenger confidence and a positive trajectory for the airline.

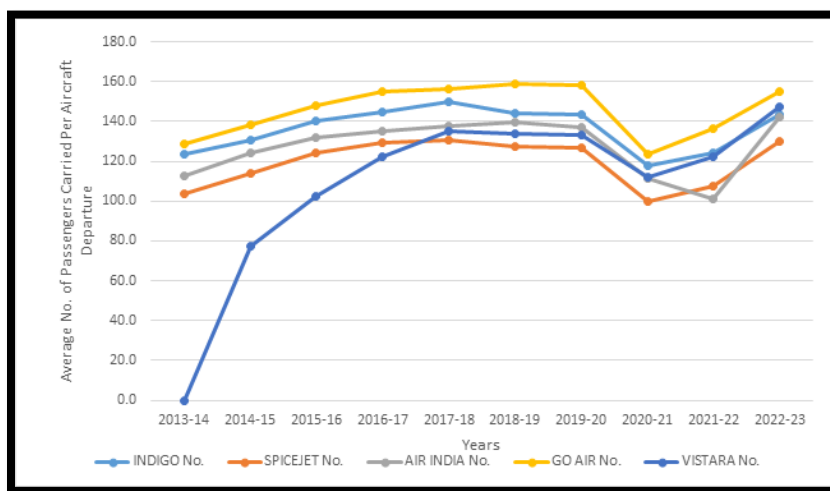


Figure 4: Comparison of Average No. of Passengers Carried Per Aircraft Departure for the Airlines

Source: DGCA

Similarly, GoAir's average number of passengers carried per aircraft departure has displayed fluctuations over the years, resembling undulating terrain. Beginning at 129.0 passengers in 2013-14, it peaked at 156.6 passengers in 2017-18, before reaching its lowest point at 123.4 passengers in 2020-21. This decline mirrors the impact of the COVID-19 pandemic on air travel demand. However, there was a gradual recovery observed, with the number of passengers per departure increasing to 136.6 passengers in 2021-22 and further to 155.2 passengers in 2022-23, indicating resurgence in passenger confidence and a positive outlook for the airline. Vistara's average number of passengers carried per aircraft departure has demonstrated a generally increasing trend over the years, resembling a steady ascent. Starting at 77.4 passengers in 2014-15, it experienced a gradual increase, with a slight drop to 112.2 passengers in 2020-21 due to the impact of the COVID-19 pandemic on air travel demand. However, there was a recovery observed, with the number of passengers per departure increasing to 122.5 passengers in 2021-22 and further to 147.3 passengers in 2022-23, signalling resurgence in passenger confidence and a positive trajectory for the airline. The downturn observed across all airlines during 2020-21 directly correlates with

the onset of the COVID-19 pandemic. Travel restrictions, fear, and reduced demand led to a decline in the average number of passengers carried per aircraft departure. Despite facing unprecedented challenges during this period, the recovery efforts post-2020-21 demonstrated the industry's resilience, adaptability, and gradual return to normalcy. Notably, the recovery of Air India in 2022-23 stands out as remarkable. The airline's resurgence can be attributed to its handover to the TATA group in January 2022. This strategic move likely injected fresh capital, operational efficiencies, and renewed vigour into the airline, enabling it to swiftly rebound and regain passenger confidence. As travel restrictions ease and confidence in air travel gradually restores, airlines have shown resilience in adapting their operations to meet evolving passenger demands. This recovery underscores the industry's ability to navigate through challenging times and signals a positive trajectory towards restoring passenger confidence and rebuilding air travel demand.

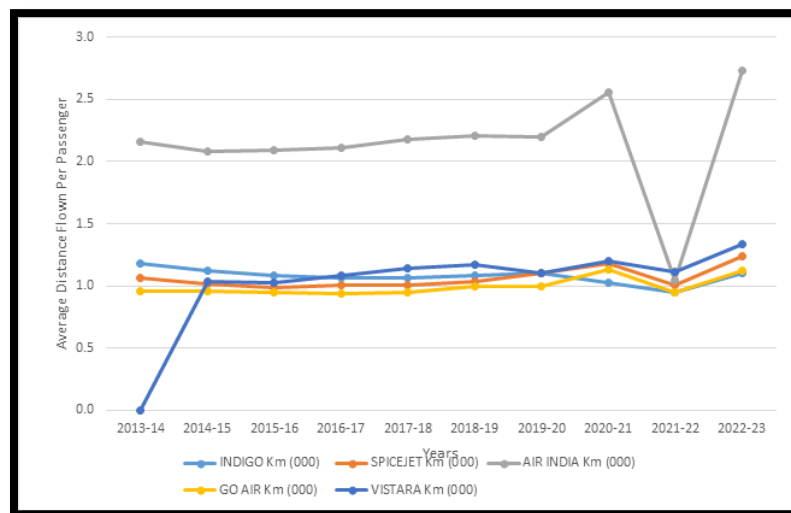


Figure 5: Comparison of Average Distance Flown Per Passenger for the Airlines

Source: DGCA

Figure 5 presents the average distance flown per passenger. Indigo's average distance flown per passenger has demonstrated relative consistency throughout the decade. It began at 1,200 kilometres in 2013-14, maintaining around 1,100 kilometres in subsequent years. However, there was a slight decline to 900 kilometres in 2021-22, followed by a modest rebound to 1,100 kilometres in 2022-23. This stability suggests a focus on short-haul routes and point-to-point connectivity within Indigo's network. Similarly, SpiceJet's average distance flown per passenger remained stable over the years, starting at 1,100 kilometres in 2013-14 and maintaining around 1,000 kilometres in subsequent years. Although there was a peak of 1,200 kilometres in 2020-21, there was a slight decline to 1,000 kilometres in 2021-22, followed by a return to 1,200 kilometres in 2022-23, indicating a consistent approach to route planning and connectivity. Air India's average distance flown per passenger displayed more variability, starting at 2,200 kilometres in 2013-14 and hovering around 2,000 kilometres in subsequent years. However, there was a significant drop to 1,000 kilometres in 2021-22, followed by a notable recovery to 2,700 kilometres in 2022-23, likely influenced by

the effects of the COVID-19 pandemic and subsequent changes in operational strategies. GO AIR's average distance flown per passenger also showed consistency, beginning at 1,000 kilometres in 2013-14 and hovering around 900 kilometres in subsequent years. While there was a slight increase to 1,100 kilometres in 2020-21, there was a subsequent decrease to 900 kilometres in 2021-22, and then a return to 1,100 kilometres in 2022-23, reflecting ongoing adjustments in the airline's operations. Vistara's average distance flown per passenger remained stable over the years, starting at 1,000 kilometres in 2014-15 and maintaining around 1,100 kilometres in subsequent years. However, there was a slight increase to 1,300 kilometres in 2022-23, likely influenced by evolving passenger preferences and changes in route structures. Overall, while stability and consistency were observed in the average distance flown per passenger for these airlines, the changes observed, particularly during 2021-22, can be attributed to the impact of the COVID-19 pandemic on travel patterns and operational decisions within the aviation industry.

5. Results and Discussion

We now proceed to the discussion of the panel data regression analysis of the model described in the Methodology section. We present the summary statistics of the data in table 1.

Variable		Mean	Std. dev.	Min	Max	Observations	
PCI	overall	97439.56	11684.15	77370.32	115261	N =	50
	between		0	97439.56	97439.56	n =	5
	within		11684.15	77370.32	115261	T =	10
plf	overall	25.5	14.57738	1	50	N =	50
	between		8.290959	16.4	36.4	n =	5
	within		12.50543	-1.9	45.5	T =	10
avg_spd	overall	25.5	14.57738	1	50	N =	50
	between		13.66217	10.7	42.4	n =	5
	within		7.754262	-7.8	40.8	T =	10
dist_a~t	overall	25.5	14.57738	1	50	N =	50
	between		10.79305	14	36.2	n =	5
	within		10.83541	1.3	59.5	T =	10
pssngr~o	overall	25.5	14.57738	1	50	N =	50
	between		8.786922	15	37.8	n =	5
	within		12.22585	1.7	54	T =	10
dist_p~r	overall	24.64	13.7288	1	48	N =	50
	between		10.98467	11.5	41.6	n =	5
	within		9.485757	-.56	45.14	T =	10

Table 1: Summary Statistics

Source: Authors' Computation

The results of the panel data regression using the fixed effects model for the five airlines —Indigo, SpiceJet, Air India, GoAir, and Vistara — over a 10-year period (2014-2023) are presented in table 2.

	(1)
	fixed
Variables	PLF
avg_spd	-0.1839
	(0.1923)
dist_arcrft	0.0479
	(0.1041)
pssngr_no	0.4745***
	(0.1207)
dist_pssngr	0.2015
	(0.1634)
Covid19	-15.1768***
	(4.0023)
PCI	0.0007***
	(0.0002)
Constant	-48.1298***
	(14.3436)
Observations	50
Number of AIRLINES	5
R-squared	0.7208

*Table 2: Regression Results
Standard Errors in Parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Source: Author's Calculation*

We have conducted a Hausman test, which indicates that random effects are not the appropriate model to be used for this data. The fixed effects model can capture the time-invariant changes in the variables in our model. Necessary robustness tests have been conducted, including tests for multicollinearity and heteroskedasticity, to ensure the reliability of the results. The tests conclusively indicate that the model is free of heteroskedasticity and multicollinearity.

The coefficients and standard errors associated with each independent variable are given in the table. The coefficient of determination (R-squared) for the model is 0.7208, indicating that approximately 72.08% of the variation in the passenger load factor is explained by the independent variables included in the model. The coefficients are marked according to the level of significance indicated by the p-values. The regression result gives us the following estimated equation:

$$\text{plf} = -48.1298 + 0.4745 \text{ pssngr_no} - 15.1768 \text{ Covid19} + 0.0007 \text{ PCI}$$

The coefficient of the COVID-19 factor has a significant negative impact on the passenger load factor (PLF), with a coefficient of -15.18, suggesting that COVID-19 had a strong negative impact on the civil aviation sector, reducing its efficiency to a great extent. The result also indicates that pent-up demand for air travel has contributed to increased demand and higher PLF in the post-COVID period. The absence of COVID-19 restrictions has led to an increase in PLF, whereas the COVID years have seen a reduction in PLF. The other factors, average distance travelled per aircraft and average distance travelled per passenger, have a positive impact on PLF, but the impact is not significant. This is because the load factor indicates the capacity utilization, where the distance travelled has very little role to play. Even a short-distance flight might travel at full capacity if the route is a busy one. Conversely, the coefficient for the average speed of the aircraft has a negative but insignificant impact on the PLF, indicating that passengers prioritize factors like comfort, safety, and hygiene over aircraft speed when purchasing tickets. However, the average number of passengers carried

per aircraft departure exhibits a highly significant, positive impact on PLF, implying that airlines operating larger aircraft achieve higher PLF and operate more efficiently. Additionally, gross national income per capita has a positive and significant impact on the PLF, but the coefficient is quite small. Although per capita income has a positive influence on an airline's efficiency, the impact is relatively small. Since air travel in India is mostly availed of by the high-income and high-middle-income classes, which constitute a small proportion of the population, the rise in per capita income does not have a significant impact on the PLF. Therefore, airline-specific factors primarily drive efficiency rather than the country's economic prosperity, given the necessity of air travel for various sectors.

6. Conclusion and Policy Implications

The analysis of passenger load factor (PLF) trends, average aircraft speed, average stage distance flown per aircraft departure, average number of passengers carried per aircraft departure, and average distance flown per passenger across five prominent airlines—Indigo, SpiceJet, Air India, Go Air, and Vistara—provides valuable insights into the aviation industry's performance amidst the challenges posed by the COVID-19 pandemic. Despite the significant disruptions caused by the pandemic, the aviation sector has exhibited resilience and adaptability, with airlines implementing strategies to navigate the crisis and facilitate a gradual recovery. While the downturn in various metrics, such as PLF and average aircraft speed, during the peak of the pandemic in 2020-21 was notable, the subsequent years have seen encouraging signs of recovery and stabilization. Indigo and SpiceJet, known for their consistently high PLF levels, showcased commendable resilience, gradually rebounding from the pandemic-induced setbacks. Air India's remarkable recovery in 2022-23 following its transition to the TATA group underscores the importance of strategic management and operational adjustments in response to changing market dynamics. Go Air and Vistara also demonstrated resilience, with promising signs of recovery in key performance metrics. Regression analysis revealed that while the COVID-19 restriction period had a highly significant and substantial negative impact on PLF, the absence of the restriction in the previous and subsequent periods showed resilience in PLF due to other airline-specific variables, which mitigated the influence of the pandemic. Notably, the average number of passengers carried per aircraft departure emerged as a significant driver of PLF, emphasizing the importance of operational efficiency and capacity utilization. Furthermore, conducting further primary surveys on passenger airlines can reveal passengers' expectations from airlines, providing crucial insights for enhancing service quality and customer satisfaction.

Governments and regulatory bodies should prioritize support measures aimed at enhancing operational efficiency for airlines, including incentivizing the adoption of larger aircraft types to increase the average number of passengers carried per aircraft departure, thereby improving passenger load factor (PLF). Financial assistance and regulatory flexibility can be directed towards initiatives that promote fleet modernization and optimization, ensuring airlines can efficiently meet demand while minimizing environmental impact. Additionally, airlines should be encouraged to engage in strategic route planning initiatives that prioritize factors beyond flight distance, as indicated by the weakly significant impact of average distance flown per passenger on PLF. Governments can provide incentives for airlines to expand connectivity to underserved regions or optimize existing routes to better align with passenger preferences and market demand, thereby enhancing overall operational performance and competitiveness in the aviation sector. Furthermore, airlines should focus on communicating robust health and safety measures to reassure passengers and restore confidence in air travel, given the findings regarding the COVID-19 factor. Effective communication of hygiene protocols, vaccination requirements, and contactless processes can help mitigate concerns and encourage travellers to return to the skies, with collaborative efforts between airlines, regulatory bodies, and health authorities ensuring consistency and effectiveness in implementing these measures across the industry. It is important to acknowledge that despite substantial progress in recovery, challenges persist. Continued collaboration among airlines, governments, and stakeholders is crucial in navigating uncertainties and charting a sustainable path forward. Vigilance, adaptation, and innovation will remain essential in ensuring the aviation industry's resilience and long-term prosperity in the post-pandemic era.

7. References

- i. Agrawal, A. (2021). Sustainability of airlines in India with Covid-19: Challenges ahead and possible way-outs. *Journal of Revenue and Pricing Management* (2021), 16.
- ii. Ang, L., Hernández-Rodríguez, E., Cyriacque, V., & Yin, X. (2023). COVID-19's environmental impacts: Challenges and implications for the future. *Science of The Total Environment*, 899, 165581. <https://doi.org/10.1016/j.scitotenv.2023.165581>
- iii. 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. <https://doi.org/10.1016/j.retrec.2016.07.003>
- iv. Chu, H.-C. (2024). An exploration of adjusted flight operations affecting passenger load factors in the post-pandemic recovery. *Research in Transportation Business & Management*, 55, 101144. <https://doi.org/10.1016/j.rtbm.2024.101144>
- v. Cicvakova, M., Mako, S., Korba, P., Vajdova, I., & Jencova, E. (2020). Significance of variables affecting the profitability of airlines. *20th International Multidisciplinary Scientific GeoConference SGEM 2020*. STEF92 Technology.
- vi. Faizan, R., & Ul Haq, I. (n.d.). Role and effectiveness of five-performance indicators (price, dependability, speed, quality & flexibility) in attaining competitive edge in the aviation industry. *International Journal of Applied Business and Management Studies*, 7(2), 2022. <https://www.researchgate.net/publication/366187093>

- vii. Jaroenjitrkam, A., Kotcharin, S., & Maneenop, S. (2023). Corporate resilience to the COVID-19 pandemic: Evidence from the airline industry. *Asian Journal of Shipping and Logistics*, 39(4), 26–36. <https://doi.org/10.1016/j.ajsl.2023.10.003>
- viii. Kumar, A., & Kumar, S. (2021). Pandemic outbreak and aviation business survival: COVID-19 impacts, challenges, and passengers' future expectations in the new normalization of Indian domestic aviation. *ZENITH International Journal of Multidisciplinary Research*, 18.
- ix. Madhavan, M., Ali Sharafuddin, M., Piboonrungrroj, P., & Yang, C.-C. (2023). Short-term forecasting for airline industry: The case of Indian air passenger and air cargo. *Global Business Review*, 24(6), 1145–1179. <https://doi.org/10.1177/0972150920923316>
- x. Maung, Y. S. Y., Douglas, I., & Tan, D. (2022). Identifying the drivers of profitable airline growth. *Transport Policy*, 115, 275–285. <https://doi.org/10.1016/j.tranpol.2021.11.007>
- xi. Nagalkar, P. M., & Aarthy C, C. J. (2023). A study on resurgence of Indian domestic civil aviation passenger traffic after COVID-19 pandemic. *European Chemical Bulletin*, 8.
- xii. Oum, T. H., & Yu, C. (1995). A productivity comparison of the world's major airlines. *Journal of Air Transport Management*, 2(3–4), 181–195. [https://doi.org/10.1016/0969-6997\(96\)00007-5](https://doi.org/10.1016/0969-6997(96)00007-5)
- xiii. Pandit, A. V., & Kant, V. (2024). *Aviation accidents in India: 1970–2020* (pp. 297–311). https://doi.org/10.1007/978-981-97-3087-2_25
- xiv. Peoples, J., Abdullah, M. A., & Satar, N. M. (2023). COVID-19 and airline performance in the Asia Pacific region. *Emerald Open Research*.
- xv. Pinchemel, A., Caetano, M., Rossi, R., & Silva, M. (2022). Airline's business performance indicators and their impact on operational efficiency. *Brazilian Business Review*, 19(6), 642–665. <https://doi.org/10.15728/bbr.2022.19.6.4.en>
- xvi. Sidhu, P. K., & Shukla, R. (2021). Impact of the COVID-19 pandemic on the Indian domestic aviation industry. Retrieved from *IEEE Xplore*.
- xvii. Szabo, S., Makó, S., Tobisová, A., Hanák, P., & Pilát, M. (2018). Effect of the load factor on the ticket price. *Transport Problems*, 13(3), 41–49. <https://doi.org/10.20858/tp.2018.13.3.4>
- xviii. Tansitpong, P. (2024). Unveiling key differentiated service dimensions of the airlines performances in the COVID-19 aftermath: An empirical investigation on operational and service outcomes on market share and load factor. *International Journal of Asian Business and Information Management (IJABIM)*, 19.