Czech University of Life Sciences Prague

Faculty of Economics and Management

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Bachelor Thesis

Data Visualization Tools for International Business

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

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BACHELOR THESIS ASSIGNMENT

Jaynil Nitesh Patel

Informatics

Thesis title

Data visualization tool for international business

Objectives of thesis

The main objectives of this thesis are:

• To find the best way to identify international corporate business and MNE direct foreign investment based on the Orbits and World Bank websites.
• To study the current state of international business resources and conduct a general overview of data analysis and analysis
• To compare various online data visualization tools in a case study
• To check out the proposed online visualization tool and make recommendations

Methodology

To complete our objectives, we are going to have a case study of different Airlines operating in India; we use different data analysis methods that are mentioned in our methodology to address issues regarding airline business.

The purpose of this research study is to evaluate the liquidity and profitability of a few international airlines that operate in India. Additionally, the productivity results of these airlines will be examined to determine their overall efficiency. To gain insight into the passenger experience, the study will assess how passengers feel about the caliber of services provided by international airlines and their satisfaction with in-flight amenities. Furthermore, the research will investigate the main issues that international airline passengers encounter, providing valuable insights into areas for improvement. Finally, based on the study's findings, suggestions and conclusions will be made to help enhance the overall passenger experience and improve the airlines' operations.

The proposed extent of the thesis

30-40

Keywords

Data management, Data visualization, Foreign direct investment, International Business, Current ratio, Quick ratio.

Recommended information sources

FIELD, Andy P. *Discovering statistics using IBM SPSS statistics.* Los Angeles: SAGE, 2018. ISBN 978-1-5264-1952-1.

KLEINMAN, Ken.; HORTON, Nicholas J. *SAS and R : data management, statistical analysis, and graphics.* Boca Raton: CRC Press, Taylor & Franciss Group, 2014. ISBN 9781466584495.

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Prague on 30. 11. 2023

Declaration

I declare that I have worked on my bachelor thesis titled **"Data Visualization Tools for International Business"** by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 30.11.2023   JAYNIL PATEL

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Data Visualization Tools for International Business

Abstract

This study focuses on data visualization tools for international business, with objectives to identify international corporate business and direct foreign investment, study current international business resources, compare online data visualization methods, and propose a visualization tool. The researcher analysed the high and low values of current ratio, quick ratio, gross profit ratio, and net profit margin in various international airlines during the study period. The study found that IndiGo had the highest overall current pay-out ratio, quick ratio, gross profit ratio, and net profit margin, while Air India had the lowest overall current ratio, quick ratio, and gross profit ratio. The study highlights the importance of data visualization in analysing international business and recommends the use of effective online visualization tools to improve decision-making processes.

Keywords: Data visualization, Foreign direct investment, international business, Visualization tool, Current ratio, Quick ratio.

Nástroje vizualizace dat pro mezinárodní obchod

Abstraktní

Tato studie se zaměřuje na nástroje vizualizace dat pro mezinárodní obchod s cílem identifikovat mezinárodní podnikové podnikání a přímé zahraniční investice, studovat aktuální mezinárodní obchodní zdroje, porovnávat metody vizualizace dat online a navrhnout vizualizační nástroj.

Výzkumník analyzoval vysoké a nízké hodnoty aktuálního poměru, rychlého poměru, hrubého zisku a čisté ziskové marže u různých mezinárodních leteckých společností během sledovaného období.

Studie zjistila, že IndiGo má nejvyšší celkový aktuální výplatní poměr, rychlý poměr, poměr hrubého zisku a čisté ziskové rozpětí, zatímco Air India má nejnižší celkový aktuální poměr, rychlý poměr a poměr hrubého zisku.Studie zdůrazňuje význam vizualizace dat při analýze mezinárodního obchodu a doporučuje použití efektivních online vizualizačních nástrojů ke zlepšení rozhodovacích procesů.

klíčová slova: Vizualizace dat , Přímé zahraniční investice , mezinárodní obchod,

Nástroj pro vizualizaci, Současný poměr, Rychlý poměr

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1. INTRODUCTION

In the world of modern information, many different devices register processes related to human activities. A huge amount of mathematical information is being generated, and computer systems process such information. [1, p.120] The most effective way to display quantity information is to visualize the data. Displaying statistical data can be done with various viewing styles and graphical modes, such as histograms, spectrograms, box sets, and more. Each data use method serves the same purpose, which focuses on helping people interpret, analyse, compare and contrast data and interpret dependencies between variables. High-quality data stored for information is hidden, influencing the decision-making process. One of the most effective ways to make data analysis simpler is by viewing the data. It is usually a very effective and transparent data conversion, using a variety of charts and diagrams. Visualization provides the context and perspective that non-visual tools cannot provide.

Data viewing is a modern way of interpreting raw data collaboratively and effectively. In the world of innovation and advanced IT technologies, people use visualization for various purposes such as interpreting raw data, interpreting a report or business project visually so that the viewer can easily analyse the data.

The visibility of data represents any data visually in charts, maps, and other visual formats. It is important because it allows trends and patterns to be seen. Apart from these facts, today, there are many ways to search for hidden patterns in machines without losing sight of human data analytics skills. The main idea of viewing data – is to present a large amount of data in a human way where users can see something that may be difficult to distinguish by the algorithm. Besides, visual presentation of data is easy to work with, especially if the presentation is interactive. [2, p.17] Data is displayed in the form of graphic objects that the user can interact with. For instance, using a mouse or touch screen, it is possible to analyse data without much effort in the short term, which is a great benefit to the international business industry.

In order to discuss their business situation, we will talk about the airline productivity, the average stage length, the number of seats that are available per mile, as well as a number of other parameters. A modern form of improvement in a nation's transportation system is air travel. The quickest practicable mode of transportation is air travel. In the world, there are more than 1200 airlines, 180,000 aircraft, and 4000 or more airports having consecutive status. With

more than 10 passenger airlines and 2 additional cargo airlines, India has 138 airports that operate on a national and international level. An airline is a company that provides air transportation services for passengers and cargo. Airlines may enter into cooperation or partnerships with other airlines and may lease or own aircraft that provide these services for mutual benefit. [3, p.118] Aviation operating certificates or licenses issued by government aviation bodies are typically used to authorize airlines. The full international service airline operates hundreds of aircraft, which sets it apart from other airlines with only one aircraft carrying passengers and cargo. Air services are offered as scheduled or charter flights and can be classified as intercontinental, domestic, regional or international. One of the fastest growing aviation industries in the world is Indian aviation. India's air traffic has increased dramatically in recent years as the country urgently needs to build a new layer of infrastructure.

The air transportation industry has introduced enormous airline companies throughout the world. Now, there is cut a throat competition in the airline industry. They have introduced aircraft and airbuses because of rapid increase in international passengers from India and foreign nationals. The industrial revolution of 18th country brought drastic change in society. Then mass production of identical products began which have revolutionized the markets. As time passed they started investing in aircrafts. The aviation industry has seen significant changes since that time. [4]

The aviation sector was expensive in the early 21st century and out of reach for the lowest classes of society. But with the passenger of time, flying has become cheaper with integration of economies around the globe and innovations in the manufacturing sector, have paved way for the affordability of aviation sector to become the alternative. Today's government is interested in making aviation sector affordable for all and this is visible in the recent initiatives of the GOI such as Uday Desh Ka Aam Nagrik (UDAN Scheme). This scheme is to promote air connectivity within the territory of India because these initiatives have penetrated the air market. With this high level of penetration, a customer is becoming much aware of their rights. The office of DGCA, also protects the consumer rights in the civil aviation sector. It has laid down a number of guidelines to prevent a citizen from being exploited.

The competitive factors that are most heavily stressed for airline companies that provide high quality services include pricing, frequency, equipment, market access, advertising, and service quality. The quality of the services an airline provides to its customers is what sets it apart from its rivals and eventually determines its market share and profitability. In today's contemporary

environment, transportation is extremely important. It aids in lowering the obstacle of distance. A country's ability to grow economically sustainably depends on having an effective transportation system, which is also essential for advancing regional and international integration.

In the recent past, airlines have offered an opulent mode of transportation. However, it is now among the most widely used forms of transportation. When compared to earlier options, air travellers today have more options when selecting their foreign airlines. Indian private airlines are used by passengers for some domestic and international flights. Public Airlines run both domestic and international (both long- and short-haul) services in India. Additionally, the majority of travellers currently favour using foreign airlines for international travel (Both long haul and short haul). The most crucial thing for carriers to understand is not just the passengers' intentions for their service offerings, but also the passengers' desires for the services and the nature of the services. [5]

The previous 20 years have seen significant advancements in aviation technology, making air travel more affordable, rapid, almost safe, and convenient. Thus, the desire to travel by air is growing. The increase in the number of airlines operating on the same routes has increased traffic competition, requiring passengers to choose which airline they wish to fly with at a specific time. There are numerous factors that could have influenced the passenger's choice of airline. The cost of the ticket, the availability of flights, the convenience, etc. are a few of them. These factors differ from one traveller to the next.

The study focuses on passenger satisfaction in international airlines. A ground work among the passengers will give an idea about airline services offered by international airlines. Another part of the study focuses on the operational performance which indicates its performance efficiency of operation by the entity concerned. Here the entity is the selected international airline. The operations include charter services, operating expenses, rent for the aircraft, handling fee for the airport, maintenance costs, amortization, and depreciation cost of the aircraft and structure of taxes which determine the operational expenses of an airline.

In order to maximize happiness, passengers make judgments by distributing their limited budget across all desirable commodities. Generally speaking, we claim that passengers increase their utility based on their restricted income and discretionary income. [6, p.522] Utility is characterized as the satisfaction a user derives from using a good or service. Customer

satisfaction can be achieved in a variety of circumstances and is related to both products and services. It is solely a matter of opinion, and passenger perceptions have a significant impact. The passenger's familiarity with both firm associations and personal happenings is a key factor in determining satisfaction. Passenger satisfaction is a sense that someone, a company, or an organization has adequately provided a good or service that meets the customer's requirements in the situation where the customer is accustomed to utilizing the good or service. Satisfaction is a socially constructed reaction to the link between a passenger, the product, and the firm or business and is not deeply entrenched in the traveller or the product. [7, p.332] A firm or business can affect passenger happiness to the extent that it has control over the various relationship dimensions.

2. OBJECTIVE AND METHODOLOGY

2.1. OBJECTIVES

These are this thesis's principal goals:

● To find the best way to identify international corporate business and MNE direct foreign investment.

● To study the current state of the international business resources and conduct a general overview of data analysis.

● To check out various online data visualization Methods in a case study

To enhance the overall passenger experience and improve the operational efficiency of selected international airlines operating in India by evaluating their financial performance and addressing key concerns.

2.2. METHODOLOGY

The liquidity and profitability of several international airlines operating in India are being evaluated through this research study. Additionally, the productivity results of these airlines are being examined to ascertain their overall efficiency. Insights into the passenger experience are being sought by assessing the perception of services' quality provided by international airlines and the level of satisfaction with in-flight amenities. Moreover, the main issues encountered by international airline passengers are being investigated, offering valuable insights into areas requiring improvement. Ultimately, suggestions and conclusions will be derived from the study's findings to aid in the enhancement of the overall passenger experience and the improvement of airline operations.

- **Achieving the Goal:**

  1. **Data Collection and Analysis Phase:**

The process begins by collecting financial data sourced from annual reports and industry outlets. These data points serve as the foundation for analysis, providing a comprehensive understanding of the financial landscape. Next, statistical tools and specifically IBM SPSS are employed for quantitative analysis, offering a robust framework to delve deeper into the numbers and uncover meaningful insights. This analytical approach enables a thorough examination of financial performance metrics. Simultaneously, a focus on operational efficiency is achieved by applying trend analysis methodologies and pertinent theoretical models. These tools aid in assessing how productivity and efficiency have evolved over time, spanning the operational spectrum. The utilization of trend analysis provides a longitudinal view, while theoretical models contribute nuanced perspectives for operational improvement strategies, ensuring a comprehensive assessment of efficiency metrics.

  2. **Synthesis and Recommendations Phase:**

The integration phase consolidates findings from three distinct areas: financial analysis, operational efficiency assessment, and passenger feedback. This amalgamation allows for a comprehensive overview, aligning various perspectives to form a cohesive understanding of

the airline's performance and service quality. Through this process, common themes and recurring patterns across the financial, operational, and customer-centric data are identified, serving as focal points for improvement initiatives.

By identifying these commonalities, specific areas for enhancement are pinpointed. This phase sheds light on critical aspects that require attention and refinement within the airline's operations, services, or strategies. It serves as a crucial step in developing a targeted and effective plan for improvement.

3. Communication and Implementation Phase:

The culmination of the assessment and recommendations is a comprehensive report featuring clear data visualization. This report encapsulates the integrated findings from financial analysis, operational efficiency assessment, and passenger feedback in a format that's easily digestible and visually engaging. It serves as a robust documentation of insights, ensuring stakeholders grasp the key aspects requiring attention and improvement.

In addition to the report, presentations and discussions are orchestrated with airline stakeholders. These sessions are interactive, providing an opportunity to delve deeper into the findings, elucidate nuances, and address queries or concerns. Through these engagements, stakeholders gain a comprehensive understanding of the assessment outcomes and the rationale behind the proposed recommendations. Moreover, these discussions foster a collaborative environment, enabling alignment of goals and strategies among all involved parties.

3. REVIEW OF LITERATURE

A literature review is a publication aimed at exploring the methodological framework and current data available in a particular research area. It is an ideal way to highlight the progress and status of this field from a national and international perspective. [13, p.134] A literature review can be considered a secondary source of information, but does not provide a detailed description of the methodology of the work. Literature review often accompanies academic related information, such as a thesis, and it normally precedes the section on research proposal

and also is placed before the section on result. The definitive purpose of this section is to bring out the progress in the given field of study, and enable the reader to get an idea of the earlier research conducted in the related field.

3.1. INTRODUCTION

Chris Tofallis (1997) In his study observed that proportion of proficiency or efficiency is the proportion of yield to include. At the point when there are numerous yields or inputs, one methodology is taking weighted blends before ascertaining the proportion. This is a huge suggestion of basic leadership that have all the earmarks of being effective. Furthermore, in the light of the fact that it is an outspread proportion of effectiveness it expects that all contributions at a normally encompassed creation unit should be diminished by a similar extent for proficiency to be accomplished. [14, p.358] By exploring the use of individual sources of info we can recognize best practice in every territory. It is very much believable that no unit shows best-practice in each territory; thus, every unit will have focuses to progress in its direction. This is naturally engaging just as furnishing a connection with the theory of best work on benchmarking

Erdmann A (2001) In his paper concentrated on the issue which emerges at sanctioned organizations, as opposed to aircraft, which work on standard calendar, the market for contract carrier was notable and the timetable was permitted to change totally from period to period. Along these lines, exact acclimation to the requests of the market had an extraordinary potential for limiting working expense. [15, p.7] This study presents a capacitated and organized configuration show and proposed a consolidated branch – and – slice way to deal with the take care of the carrier plan age issue.

Yu-Hern Chang, HsingYeh (2002) In their study assessed the administrative nature of local traveller aircraft by client overview. A fluffy multi-criterion examination (MA) display is utilized to detail the assessment issue. An exact investigation of residential aircraft on an exceptionally focused volute in Taiwan led to show the adequacy of the methodology. [16, p.30] The assessment result furnishes a carrier with their interior and outside upper hands, two rivals regarding client – saw quality dimension of administrations.

Lan Humphreys and Graham Francis Jackie Fry (2002) In their study focused on airport terminal execution estimation framework under fluctuating proprietorship designs in

Europe and the US, uniting a rich picture of various practices. The requirement for air terminals to give more noteworthy accentuation to their operational setting to assess their execution unbiased is underscored. [17, p.238] Numerous execution estimates are right now being used as yield factors, typically quantitative and dependent on what is anything but difficult to quantify instead of what is essential to gauge.

Yonghwa Park (2003) In his research paper gathered data from distributed sources and through meeting with senior administration of the two aircrafts. The aircraft carrier presented gives to the full of universal challenge and brought about greater expenses and lower money related returns. Interestingly, no nonsense methodology of Ryanair enabled low costs to be upheld and drawn no different types of transport.

Chien-Ta Ho and Kim Hua Tan (2004)numerous small and medium-sized Taiwanese trust businesses that were recently transformed into business banks were included in their study. The ability to identify and eliminate problems at the outset of the redesign depends on the administrator being aware of their operational efficacy when their arrangement is changed. The estimation process is challenging, though, because financial data has frequently been insufficient or ambiguous. [18, p.225] In order to assist the director in evaluating bank execution throughout the rearrangement, this study utilizes the information envelopment investigation (DEA) methodology. The result demonstrates that DEA models can be coupled to evaluate bank execution.

Rong –Tsu Wang, Chien –Ta Ho, Cheng-Min Feng, Yung-Kai Yang (2004) Their study evaluated and compared the operational efficiency of 10 major airports in Taiwan. The connections between his four elements – airports, passengers, airlines and firefighters – form the basis of operational performance measurement. Use Gray Relationship Analysis to group initial metrics and select representative metrics to overcome the limitations of small sample sizes.

Sarkar R, Rajat K, Baisya (2005) In this white paper, we've covered two key areas that have changed market dynamics in recent years, as well as a number of ancillary factors that are relevant to your business. [19, p.356] Their investigation revealed that the domestic airline industry was going through an exciting period.

John F.O Connell, George Williams (2006) According to their analysis, new regulatory initiatives have changed the availability of domestic aviation service. In Mumbai, a

sizable passenger study was undertaken to find out how sensitive passengers were to pricing changes and which flight conditions might sway them toward full-service or low-cost airlines. According to the report, leisure passengers flying on full-service and budget airlines as well as low-cost carriers need a uniform range of flight items.

Andrew J. Schaefer. George L. Nemhauser (2006) They came to the conclusion that the initial stage of the airline planning process is often schedule development. After determining a crew schedule, they developed a framework for changing the timings of scheduled departures and arrivals.

Frederic Dobruszkes (2006) According to his research, LCCS expansion is currently concentrated in Western Europe, where LCCS plays a major role in the development of aviation networks. By seat, it accounts for 18% of all air travel in the region. The network is not overly congested as only short and medium haul flights are available. (no hub). They operate north and south, competing with charter flights that they have not replaced. Freedom of flight beyond the fourth is still seldom used, but dedicated routes associated with secondary (urban and regional) airports and/or niche selection are common. [20, p.161] Last but not least, low-cost carriers are giving point-to-point routes new power by adding new networks to the networks of full-service network carriers. (FSNCS). Where these new networks lack hubs themselves, critical locations are characterized by significant concentrations.

Claudio Piga A and Enrico Bachis (2006) They made the underlying assumption in their study that airline prices rise monotonically over time, culminating just before departure. They demonstrate various cases in which the monotonic property does not hold using fares for roughly 650 000 flights run by both low cost and full-service airlines. [21, p.836] Additionally, they demonstrate that price volatility rises in the final four weeks prior to departure, which coincides with the time when airlines are best able to anticipate the flight load factor. Finally, full-service carriers may offer lower fares than those listed by low-cost carriers, particularly over the past two weeks.

Giovanna Nicoline and SilvaSalini(2006) In their study applied two different non classic methods to evaluate customer satisfaction i.e a decision free, probabilistic model and research is applied with the aim to distinguish the two components of customer satisfaction and quality. [22, p.21]

Business Week (2006) In this study analysed the different aspects of Singapore airline.

They came to the conclusion that it was packing passengers on its Boeing flight into every available square inch while reducing meals and other benefits. [23, p.834] Its operations now follow this as regular operating procedure.

AraujoJr, Santos,andPires (2006) They compared the productivity growth and operational performance indicators of major Brazilian airlines from 2000 to 2005 with selected full service companies (FSCs), regional airlines, and low fare/airlines as industry benchmarks. Compared to low cost companies (LCCs). [24,p.316]

Ahmed A. M, ZairM and Almarri K. S (2006) In order to discover best practices and important success criteria for the adoption of total quality management, their study work is based on secondary case studies on the aviation industry. In terms of both traffic volume and corporate assets, it was discovered that Air China is the biggest airline in China. It enjoys a solid reputation both domestically and abroad. [25] The world's top airlines compete with China's airline industry, which are developing faster than their GDP. This essay is a thorough investigation that details the advantages, disadvantages, possibilities, and risks facing airlines.

Robin Riedel (2006) He used a method to forecast airline operational performance based on flight schedules and aircraft assignments in his study. The methodology makes use of averaging measurements for aircraft assignment attributes. [26, p.88] Aircraft assignment vital performance of the airlines is what it is called. A simulation experiment is set up to collect a substantial amount of data for examination. The KPI is used as the foundation for initial planning and corrective measures using control theory approaches in airline operations.

Don Harris (2006) In his study, the author used a socio-technical systems approach to investigate how, from the standpoint of human factors, aircraft operational efficiency may be improved. [27, p.162] This perspective is used to analyze four case studies: improving operational efficiency on the airport ramp; improving operational efficiency through flight crew resting; encouraging direct routing; and improving operational efficiency through higher flight deck automation.

It is asserted that the increase in operational efficiency will be negligible if the human aspect is the only consideration.

Bilotkach (2007) In his study was considered scheduling co-ordination both as a reason for and consequences of airline consolidation. [28, p.493] The author models this formal dimension of airline partnership, with complementary alliance where stop –over delays

affected passenger utility. They compared partnership which were only carriers were allowed to coordinate schedules to the run, where airlines can jointly set price and schedule.

Chien Ta Bruce Ho(2007) Most prior studies on corporate performance, efficacy, which may directly affect a firm's survival, are typically neglected in his study, which measured performance in various Taiwanese electronic companies. [29] In order to clarify what is meant by "performance," this research constructs a conceptual framework using financial statement analysis (FSA). Using a novel two-layer data envelopment analysis (DEA) model that disentangles efficiency and effectiveness, this research also offers a study analyzing the performance of 59 Taiwanese listed businesses in the electronics industry. Empirical results have shown that efficient firms are not always more effective. No obvious correlation between these two metrics. [30]

Sergio G Lazzarini (2007) His research found that many industries have formed multi-partner alliances or constellations competing for both customers and members. Using the global aviation industry as an empirical setting for this study, the airline constellation membership allows airlines to capture externalities from other firms in the form of direct or indirect traffic flows. [31, p.198] We valued the claim that it could improve operational performance. His two methods of drawing constellation boundaries are also distinguished explicit or implicit. They found that the groups with the highest total traffic and the airlines that accounted for the majority of the group's capacity had the greatest member benefits. The results are valuable and analyze different membership patterns simultaneously. This is because they can have different effects on the company's performance.

Wilfred Manuala S (2007) His research examined the impact of liberalization on air fares. As a result, by 2003, at least on routes served by two airlines, he found that on average the fares per kilometer were 10% cheaper for him. [32, p.2963] This indicates that most passengers benefit from low fares as discounts and promotions have surged as a result of competition.

Girish Prayag (2007) This study explored papers assessing the quality of service of small airlines, using the SERQUAL model to assess air transit times, and determining the relative importance international tourists give to quality aspects. [33, p.42]

Jin Long Lu, Feng I Ling (2008) They discovered that although Taiwan and mainland China share a same culture and language, their views of service quality are quite different. As a result,

using data collected from passengers in Taiwan and mainland China, we looked at how different passenger demographics' views of air service quality varied. [34]. Researchers observed that passengers flying between Taiwan and mainland China saw notably different levels of service quality than those flying within Taiwan.

NeerajKausik, VK Kausik, Grish Tanja (2008) Their study explores passenger satisfaction in the Indian domestic aviation sector. This survey is an attempt to examine customer preferences and satisfaction on various subjects. [35] A chi-square analysis found that customers differ greatly in the factors they consider when choosing an airline or making a ticket purchase. Use multidimensional scaling to perceptually map different components of your marketing mix.

Rard (2008) His research looks at the impact of modern codeshare agreements on consumer well-being, but on average his research finds no significant impact on consumers. [36, p.982] With the increase, the average surplus of transit passengers decreased, but the average surplus of direct passengers decreased.

David Nyquist C, Kathleen Fadden L.MC (2008) The focus of their article was on finding ways to reduce boarding costs without sacrificing service quality or customer happiness. It was decided that a variant of it should be used. [37, p.488] The results reveal that in order to improve the boarding process, airline management need to better distribute boarding activities on board, develop better regulations for handling carry-on bags, and get rid of issues involving simultaneous loading via the door has to be thought about.

Jesus Manual Lopee, Bonilla, Luis Miguel (2008) Their research explored whether national airlines have lower service levels than commercial airlines by examining things like check-in, information services, courtesy, in-flight entertainment delays, positive word of mouth, and overall satisfaction. I'm looking into They found that national airlines were less satisfied than privately-owned and mixed-ownership airlines.

JorgLindenmeis, Dieter K.Techelulin (2008) The impact of seat inventory management and refused boarding on customers' happiness was evaluated. 38, p.48] Seat inventory management's impacts were found to vary by booking class, as determined by a dummy regression analysis and an empirical analysis of variance.

Abdul Moneim MB Ahmed (2008) His research examines the importance of the

customer value concept in the airline industry given the current tourism boom. The study found that in business, strategic planning is an integral part of the value proposition, with four main functions: strategic planning, strategy development, operational execution, and measurement and adaptation.

Philip Gayle G (2008) In his research conducted an empirical analysis of their effect on price and traffic level. [39, p.66] The study was done with the objectives of conducting and analysing with particular focus on testing whether the data are consistent with behaviour by three airlines.

Hsin-Li Chang, Hua Ynag (2008) In their research aims at the importance and the steps needed to improve the attractiveness of kiosks. [40, p.22] The users expected their check in an environment to be highly controlled and frequent flyers expected additional benefits from kiosks and they expected the kiosks to have light-weight and compute and to be installed near the luggage conveyor belt.

4. PRACTICAL PART

4.1.1. HYPOTHESES OF THE STUDY

The examination of 14 hypotheses concerning the financial performance of selected international airlines operating in India was conducted in the current study. It was observed that there was no discernible variation in the current ratio values of the airlines, and no appreciable variations in these values between the years 2015-16 and 2021-22 were noted. Similarly, the quick ratio values were not noticeably different, and there were no appreciable variations in these values over the same period. [8] The gross profit ratio of the selected international airlines was found not to be significantly different, and there was no correlation detected between the gross profit ratio values from 2015-16 to 2021-22. The values of net profit margin and operating profit ratio were not noticeably different, and there were no significant changes in these values between 2015-16 and 2021-22. Return on assets and return on equity values were not noticeably different among the chosen airlines, and there were no appreciable variations in these values between different years. Overall, it is suggested by the study that a relatively stable financial performance has been maintained by the selected international airlines over the years under investigation.

4.1.2. SAMPLE DESIGN OF THE AIRLINES

Secondary data sources are utilized in the current study, which is analytical in nature [9, p.265]. Four international airlines out of the five that are operated in India, encompassing both passenger and cargo airlines, have been selected by the researcher.

- IndiGo
- Jet Airways
- Air India
- Spice Jet

4.1.3. COLLECTION OF DATA

Secondary data, including important publications and reports such as annual reports of selected airline corporations and newsletters, were sourced. Textbooks on related topics and reputable journals were also accessed [10, p.106]. Furthermore, data collection from the offices of the apex bodies of the airline companies, including the Directorate of General Civil Aviation (DGCA), IATA, AAI, and ICAO, was conducted by the researcher.

4.1.4. FRAMEWORK OF ANALYSIS

The gathered information was handled with care, and the data were tabulated based on their type and volume. Appropriate statistical tools were employed for the analysis [11].

For assessing the productivity increase in the past 7 years, from 2015-2016 to 2021-2022, frequency analysis and statistical summaries utilizing mean, standard deviation, coefficient of variation, correlation matrix, multiple regression, trend analysis, ANOVA, and two-way ROC were utilized. The trend analysis has been performed to scrutinize the productivity efficiency during the study period.

> In the literature review, several critical theories and models, including "business process redesign (BPR)" and "Reconfigurable Manufacturing Tools," will be reviewed [12, P.145]. Quantitative data collected will be assessed using "IBM SPSS" for detailed analysis. Additionally, another data visualization tool will be employed for strategic data analysis, encompassing One way nova, Regression, Histogram, and Bar Chart Diagram for graphical representation, Chi-Square Test, and similar methods. Furthermore, all secondary data will be sourced from Google Scholar and credible platforms to uphold ethical considerations.

The importance of this study lies in its financial analysis and in the formulation of various policies for the selected international airlines. Various ratios are employed by the researcher to analyze the liquidity and profitability performance of selected international airlines. The ratios used for the comparative financial analysis of the selected International Airlines are listed in this section. The financial strengths and weaknesses of the chosen international airlines in India are analyzed using the following ratios in this study.

4.2 LIQUIDITY RATIO

The capacity to pay its short-term debts is measured by liquidity. A company's liquidity is of primary concern to creditors as cash flow is crucial for the survival of any organization. How the company manages its short-term cash flow is of interest to management. The movement of money is an integral part of the business process. Assessing the liquidity position involves using a limited number of liquidity ratios,

- Current ratio
- Quick (Acid-test) ratio

4.2.1 CURRENT RATIO OF SELECTED INTERNATIONAL AIRLINES

Table 4.1 presents the Current Ratio (CR) of the International Airline's current asset over the period from 2015-16 to 2021-22. Mean and standard deviation for each international airline company throughout the study period are also depicted in Table 4.1.

The Current Ratio of IndiGo airline in 2015-16 was noted as 1.74, decreasing to 0.86 in 2021-22, resulting in a 50.57 per cent decrease in the growth of the Current Ratio. From 2015-16 to 2016-17, the ratio decreased from 1.74 to 1.64, indicating a 5.74 per cent decline. In the subsequent year, 2016-17 to 2017-18, it decreased from 1.64 to 0.69, leading to a 57.92 per cent decrease in the growth of the Current Ratio. However, between 2017-18 and 2018-19, there was an increase from 0.69 to 0.80, resulting in a 15.94 per cent growth in the Current Ratio. Continuing to 2018-19 and 2019-20, the ratio increased from 0.80 to 0.99, representing a 23.75 per cent growth. Conversely, from 2019-20 to 2020-21, the Current Ratio decreased from 0.99 to 0.85, resulting in a 14.14 per cent decrease in growth. Interestingly, from 2020-21 to 2021-22, there was a slight increase from 0.85 to 0.86, indicating a 1.17 per cent growth

in the Current Ratio. Despite fluctuations within the data, a consistent decline in the Current Ratio is observed throughout the study period.

Table 4.1 Current Ratio of Selected International Airlines

For the year from 2015-2016 to 2017- 2018 (Times)

Company Years	INDIGO	JET AIRWAYS	AIR INDIA	SPICE JET
2015-16	1.74	1.41	1.59	0.59
2016-17	1.64	0.62	0.23	0.32
2017-18	0.69	0.59	0.23	0.43
2018-19	0.8	0.7	0.18	0.36
2019-20	0.99	0.7	0.41	0.41
2020-21	0.85	0.66	0.2	0.47
2021-22	0.86	0.56	0.33	0.76
Mean	1.0814	0.7663	0.3875	0.4937
SD	0.426	0.2789	0.4938	0.148

Source: Computed from Annual Reports of the Respective Airline Companies.
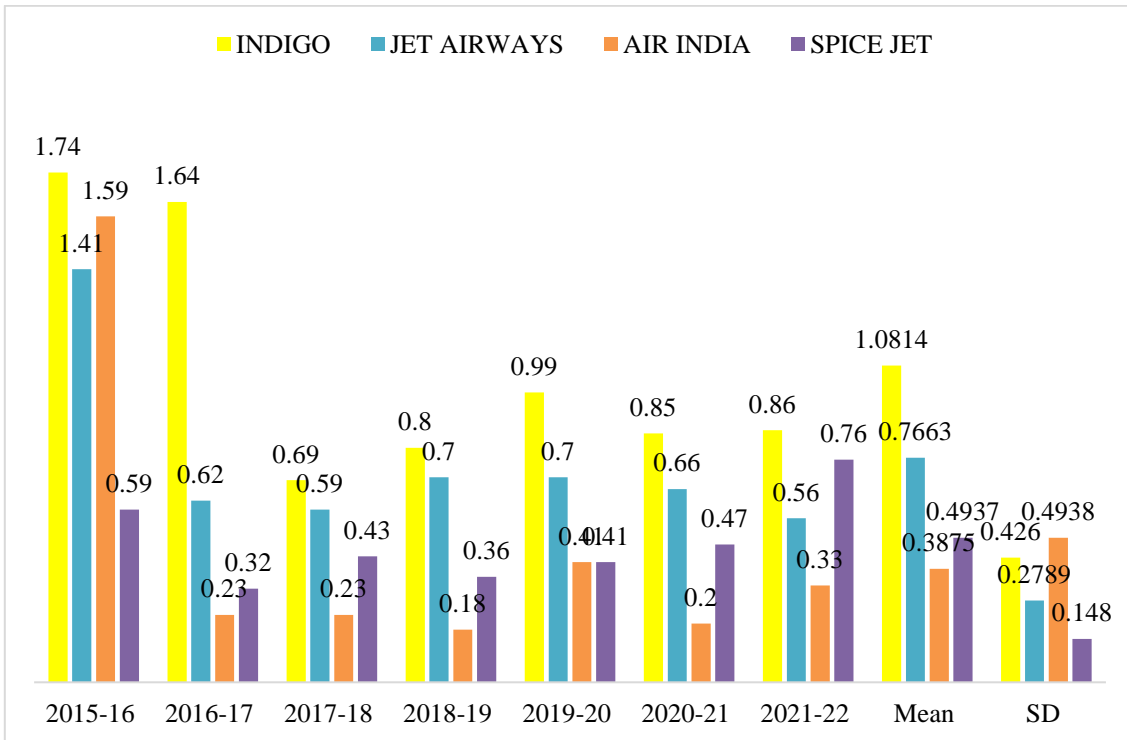
Figure 4.1 Current Ratio of Selected International Airlines

IndiGo- Interglobal Aviation Limited, Jet Airways (India) Limited, Air India Limited, Spice Jet Private Limited.

Jet Airways' average current ratio is 0.7663, while IndiGo Airlines' average current ratio is 1.0814. Air India's average current ratio is 0.3875. The average current ratio for Spice Jet is 0.4937. The International Airlines Current Ratio differences are clearly shown in the above table. IndiGo's standard deviation is 0.4260, Jet Airways' standard deviation is 0.2789, Air India's standard deviation is 0.4938, and Spice Jet's standard deviation is 0.1480 for international airlines. It demonstrates that among the airlines, International Airlines are more dependable. It demonstrates the business' incapacity to use present assets to pay off its short-term liabilities.

4.2.1.1 TEST OF HYPOTHESIS

Details regarding whether the current rates for the four international airlines differ significantly and whether the rates have varied over all seven years are provided in Table 4.1.1. A two-way ANOVA was employed for analysis.

Two sets of Null Hypothesis

Set-1: Ho: The value of the selected international airlines' current ratio shows no discernible variation

Set-2: Ho: Between 2015–2016 and 2021–2022, the Current Ratio's value did not significantly change from year to year.

Table 4.1.1 ANOVA-Current Ratio

	Sum of Square	Degrees of freedom	Mean Square	F-Ratio	P-value	F- crit
Between column	1.8073	3	0.6024	8.7653	0.0008	3.1599
Within Row	2.0649	6	0.3441	5.0072	0.0035	2.6613
Residual	1.2371	18	0.0687			
Total	5.1094	27				

*Sources: Computed * Significant at the 5 % level RESULT*

Set-1: Ho: The hypothesis is not rejected as the estimated value of "F" (8.76530) exceeds the critical value of "F" at the 5% significance level (3.1599). Consequently, significant differences were found in the current ratio values of the four international airlines.

Set-2: Ho: The hypothesis is not rejected as the calculated value of "F" at the 5% significance level (5.0072) exceeds the critical value of "F" (2.6613). Consequently, a substantial difference in the value of the current ratio between the years 2015-16 and 2021-22 is observed.

4.2.2 QUICK RATIO OF SELECTED INTERNATIONAL AIRLINES

The company's liquidity is assessed by the Quick Ratio (QR), also known as the "acid test ratio," which demonstrates its ability to cover short-term liabilities with Quick Assets. Table 4.2 provides information on each company's Quick Ratio from 2015–16 to 2021–22. Prepaid expenses for international airlines are extremely minimal, resulting in somewhat different Quick Ratio statistics compared to the Current Ratio figures.

According to Table 4.2, IndiGo Airlines' Quick Ratio was 1.71 in 2015–16, declining to 0.85 in 2021–22, signifying a 50.29% decrease in growth. For the fiscal years 2015–16 to 2016–17, IndiGo's Quick Ratio dropped from 1.71 to 1.61, marking a 4.09 percent decline. Between 2016–17 and 2017–18, it decreased from 1.61 to 0.68, resulting in a 57.76% reduction in the rise of the Quick Ratio. However, from 2017–18 to 2018–19, the Quick Ratio increased from 0.68 to 0.78, indicating a growth of 26.47%. Subsequently, between 2018–19 and 2019–20, it rose from 0.78 to 0.98, displaying a growth of 25.64%. Conversely, the Quick Ratio dropped from 0.98 to 0.83 in 2019–20 and 2020–21, causing a 15.30% decline in quick ratio growth. From 2020–2021 to 2021–2022, the fast ratio increased from 0.83 to 0.85, resulting in a 2.40 percent growth in Quick Ratio. IndiGo has a mean of 1.062 and a standard deviation of 0.0680. Despite variations in the calculated data, an increase in the Quick Ratio was observed over the study period.

Table 4.2 Quick Ratio of Selected International Airlines

For the years from 2015-2016 to 2017- 2018 (Times)

Company Years	INDIGO	JETAIRWAYS	AIR INDIA	SPICE JET
2015-16	1.71	0.88	0.12	0.52
2016-17	1.61	1.29	0.16	0.67
2017-18	0.68	0.52	0.15	0.43
2018-19	0.78	0.62	0.14	0.36
2019-20	0.98	0.62	0.36	0.41
2020-21	0.83	0.62	0.16	0.47
2021-22	0.85	0.53	0.11	0.76
Mean	1.062	0.7525	0.1625	0.5038
SD	0.4185	0.2663	0.0829	0.1406

Sources: Computed from Annual Reports of the Respective Airline Companies.
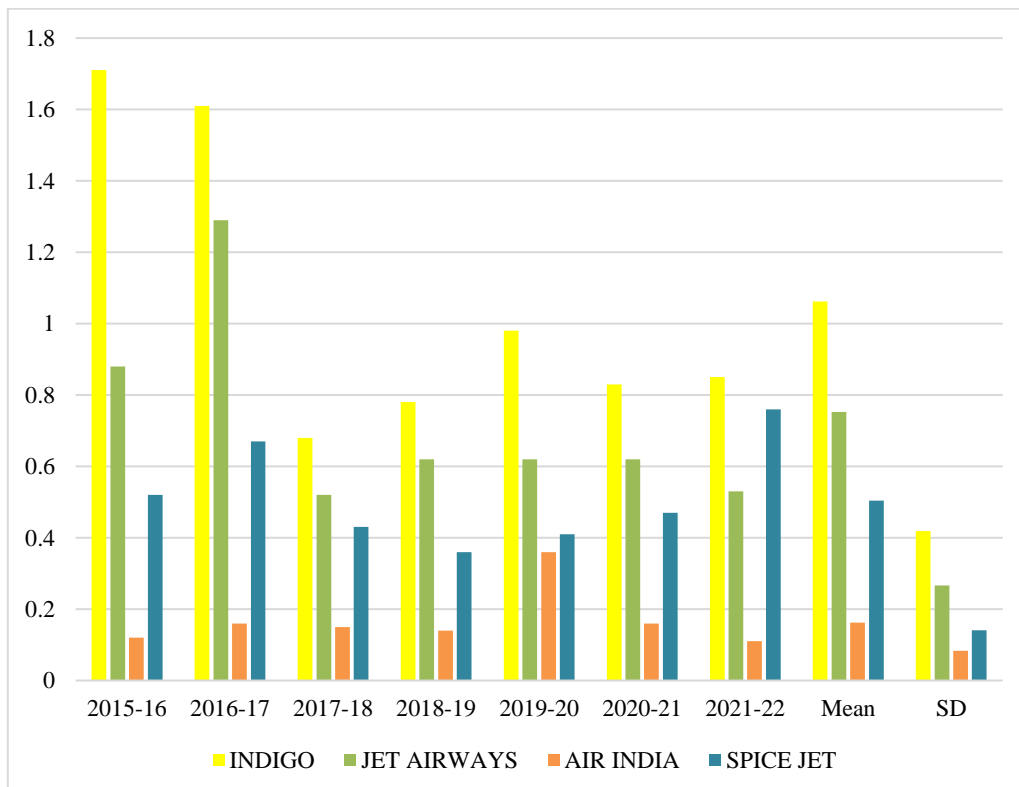
Figure 4.2 Quick Ratio of Selected International Airlines

The International Airlines considered are IndiGo- Interglobal Aviation Limited, Jet Airways (India) Limited, Air India Limited, and Spice Jet Private Limited.

The average Quick Ratio of IndiGo Airlines was 1.062, Jet Airways had an average Quick Ratio of 0.7525, Air India's average Quick Ratio was 0.1625, and Spice Jet's Average Quick Ratio was 0.5038. A slight difference among the Quick Ratios of the International Airlines is evident from the above table. The standard deviations for International Airlines were 0.4185 for IndiGo, 0.2663 for Jet Airways, 0.0829 for Air India, and 0.1406 for Spice Jet. These values demonstrate that the firms have insufficient liquid assets to cover their short-term obligations. It indicates that among the airlines, International Airlines are comparatively more reliable.

4.2.2.1 TEST OF HYPOTHESIS

Table 4.2.1 provides crucial information on whether there is significant variation in the Quick Ratio among the four international airlines and whether these ratios vary over a span of seven years. A two-way ANOVA was utilized for the analysis.

Two sets of Null Hypothesis

Set-1: Ho: The Quick Ratio values of the chosen international airlines do not differ noticeably.

Set-2: Ho: There are no appreciable variations in the Quick Ratio's value between the years 2015–16 and 2021–22.

Table 4.2.1 ANOVA-Quick Ratio

	Sum of Square	Degrees of freedom	Mean Square	F-Ratio	P-value	F-crit
Between Column	2.9336	3	0.9778	19.878	6.0706	3.159
Within Row	0.79408	6	0.1323	2.6904	0.0481	2.6613
Residual	0.88545	18	0.0491			
Total	4.6131	27				

*Sources: Computed * Significant at the 5 % level RESULT*

Set-1: Ho: The null hypothesis is not rejected because the critical value of "F" at the 5% significance level (3.159) is lower than the estimated value of "F" (19,878). Therefore, the values of the express ratio for the four international airlines differ significantly.

Set-2: Ho: The hypothesis is not rejected because the calculated value of "F'" at the 5% significance level (2.6904) is larger than the critical value of "F'" (2.6613). As a result, the values of quick ratios from 2015-2016 to 2021-22 vary significantly from each other.

4.3   PROFITABILITY

The profitability ratios serve as indicators of a company's profitability. They depict the operational efficiency of the unit. It's logical that assessing operational effectiveness would be a priority for the company's management. The calculation of profitability ratios can be executed using either sales or investment data. Comparisons of profitability ratios with the income statement and other benchmarks showcase an organization's ability to generate operational

profits. Consider the return on investment (ROI) regarding your firm's investments in inventory and other assets. These figures illustrate how effectively businesses can translate their efforts into financial gain. Creditors and investors utilize ROI to assess a company's performance relative to others possessing similar resources and assets. This implies that institutions may employ their rates of return to determine if they are achieving adequate operational returns on their assets. Similar to efficiency ratios, profitability ratios highlight how efficiently companies utilize their assets to generate profits. Profitability significantly intertwines with the concepts of solvency and other related ideas. The crucial ratios are as follows:

- Gross profit Ratio
- Net profit Ratio
- Operating Profit Ratio
- Return on Equity
- Return on Assets

4.3.1 GROSS PROFIT MARGIN OF SELECTED INTERNATIONAL AIRLINES

Table 4.3 below provides the Gross Profit Margin for International Airlines during the seven-year study period.

In 2015–16, IndiGo's gross profit ratio was 31.85; by 2017–18, it had decreased to 20.94. Consequently, the rise of the Gross Profit Ratio was reduced by -34.25 percent. Between 2015–16 and 2016–17, IndiGo's gross profit ratio improved from 31.85 to 33.89, indicating a 6.40 percent rise in growth. However, the rise of the gross profit ratio decreased by 69.58% between 2016–17 and 2017–18, as it dropped from 33.89 to 10.31.

During the years 2017–18 and 2018–19, it increased from -10.31 to 19.25, signifying an 85.29 percent rise in the growth of the gross profit ratio. Between 2018–19 and 2019–20, there was a 5% growth in the gross profit ratio, moving from 19.25 to 20.18. However, in 2019–20 and 2020–21, the gross profit ratio declined from 20.18 to 19.07, reducing the rise of the Gross

Profit Ratio by 5%. Between 2020–21 and 2021–22, the Gross Profit Ratio increased from 19.07 to 20.94, reflecting a 10 percent growth.

The mean value of IndiGo was 22.212, with a standard deviation of 4.181 and a coefficient of variation of 33.82. Despite fluctuations within the data, the Gross Profit Ratio experienced a decline throughout the study period.

Table 4.3 Gross Profit Margin of selected International Airlines

During the year from 2015-2016 to 2021-2022 (In. Percentage)

Company Years	INDIGO	JET AIRWAYS	AIR INDIA	SPICE JET
2015-16	31.85	12.08	-29.84	20.19
2016-17	33.89	4.38	-16.12	12.01
2017-18	10.31	-0.59	-14.36	-15.85
2018-19	19.25	-1.44	-9.23	-15.08
2019-20	20.18	9.54	0.97	17.02
2020-21	19.07	5.91	0.7	15.56
2021-22	20.94	-0.61	-7.9	16.69
Mean	22.212	4.181	-10.825	7.22
SD	7.514	4.94	9.893	14.52
CV%	33.82	118	92.7	201

Source: Computed from Annual Reports of the Respective Airline Companies
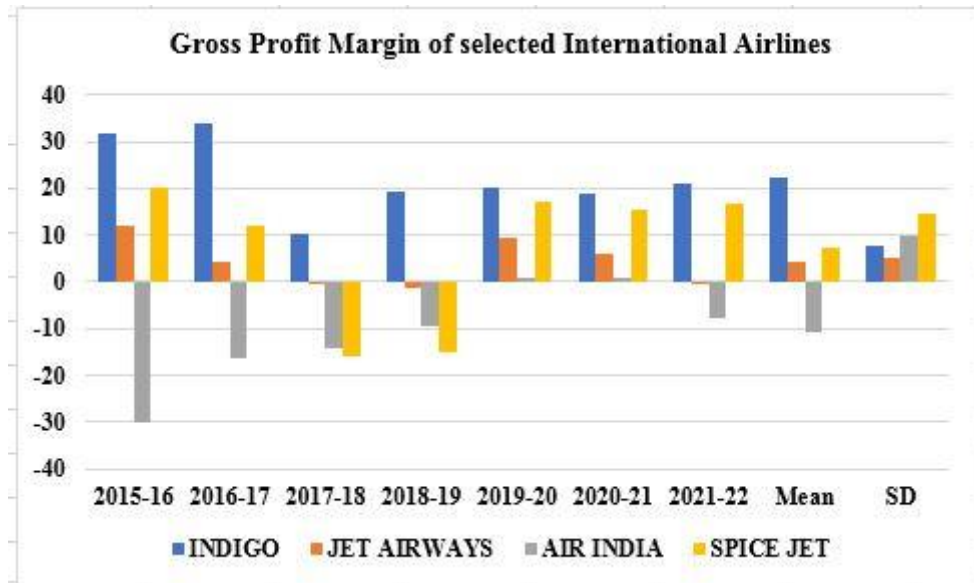
Figure 4.3 Gross Profit Margin of selected International Airlines

The Average Gross Profit Ratio of IndiGo Airlines was 22.21, Jet Airways had an average Gross Profit Ratio of 4.181, Air India's average Gross Profit Ratio was -10.825, and SpiceJet's Average Gross Profit Ratio was 7.22. The above table clearly indicates a slight difference between the Gross Profit Ratios of the International Airlines.

The standard deviation values were 7.514 for IndiGo, 4.94 for Jet Airways, 9.893 for Air India, and 14.520 for Spice Jet. The Coefficient of Variation values were 33.82 for IndiGo, 118 for Jet Airways, -92.7 for Air India, and 201 for Spice Jet. These values reveal that among the airline companies, the International Airlines are more reliable in terms of their inability to maintain consistent Gross Profit.

4.3.1.1 TEST OF SIGNIFICANCE OF GROSS PROFIT RATIO

The pertinent information regarding whether and for how long the Gross Profit Ratios of four international airlines varied is provided in Table 4.3.1. The two-way ANOVA was employed. *Two sets of null Hypothesis.*

Set-1: Ho: The Gross Profit Ratio of a few international airlines is not significantly different.

Set-2: Ho: There is no correlation between the Gross Profit Ratio values from 2015–16 to 2021–22.

Table 4.3.1 ANOVA- Gross Profit Ratio

	Sum of Square	Degree of Freedom	Mean Square	F-Ratio	P-value	F crit
Between Column	2561.38	3	853.79	6.7253	0.003	3.1599
Within Row	1046.73	6	174.45	1.3741	0.2776	2.6613
Residual	2285.14	18	126.95			
Total	5893.26	27				

*Source: Computed * Significant at the 5 % level RESULT*

Set-1: Ho: The hypothesis is not rejected because the estimated value of "F'" (6.7253) is greater than the significant value of "F'" at the 5% significance level (3.1599). Therefore, there is a significant difference in the gross profit margin of the 4 international airlines.

Set-2: Ho: The hypothesis is not accepted because the calculated value of "F'" at 5% significance level (1.3741) is less than the critical value of "F'" (2.6613). Therefore, there is no discernible change between gross margin values for 2015-16 and 2021-22.

4.3.2 NET PROFIT RATIO OF SELECTED INTERNATIONAL AIRLINES

The Net Profit Ratio of a few international airline businesses for the past seven years is provided in Table 4.4.

Table 4.4 Net Profit Margin of selected International Airlines

During the years from 2015-2016 to 2021-2022 (In. Percentage)

Company Years	INDIGO	JET AIRWAYS	AIR INDIA	SPICE JET
2015-16	2.52	8.34	-52.51	9.34
2016-17	8.51	-4.15	-34.25	4.68
2017-18	2.52	-20.71	-34.18	-15.67
2018-19	9.36	-8.94	-34.08	-13.2
2019-20	12.3	5.54	-13.28	8.84
2020-21	8.92	6.87	-40.27	6.95
2021-22	9.74	-3.2	-32.05	7.26
Mean	7.6957	-2.321	-36.305	1.9175
SD	3.7391	9.606	12.088	10.209
CV	13.981	728	146.13	104.23

Source: Computed from Annual Reports of the Respective Airline Companies.
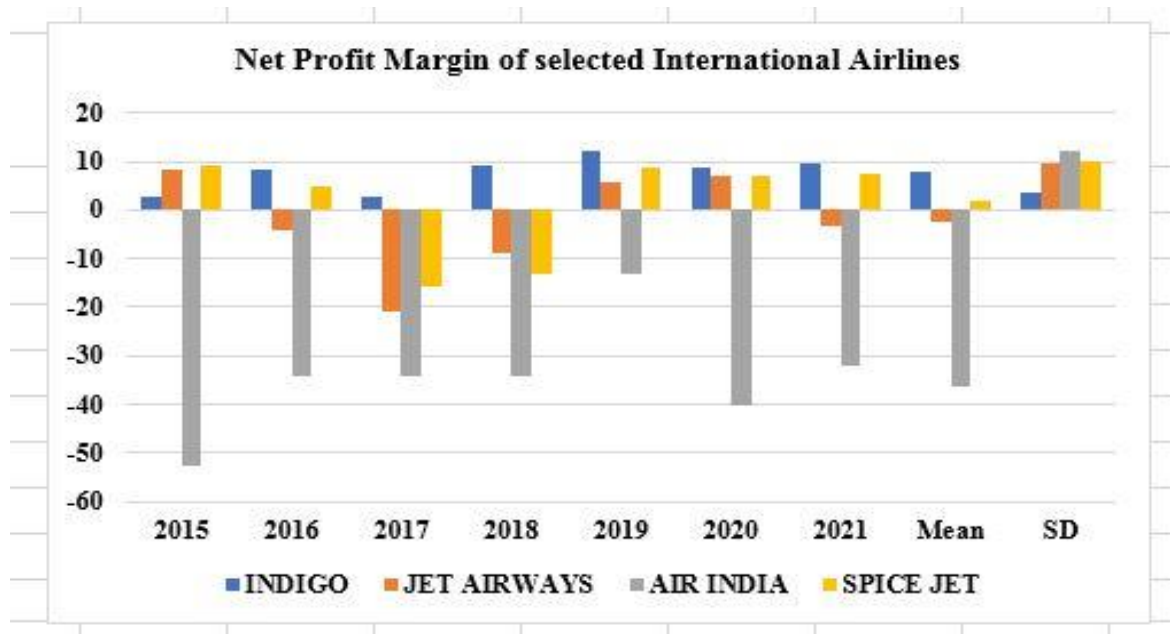
Figure 4.4 Net Profit Margin of selected International Airlines

The variations in Net Profit Ratios of the four major international airline firms across several study years are illustrated by the aforementioned details. The overall high and low values of the Net Profit Ratio for the relevant companies and years are described by the researcher. The highest overall Net Profit Ratio for IndiGo was 12.30 in the fiscal year 2019–20. Conversely, Air India displayed a generally poor Net Profit Ratio of -52.51 in the fiscal year 2015–16.

Comparatively, Jet Airways' average Net Profit Ratio was -2.321, Air India's average Net Profit Ratio was -36.305, and Spice Jet's average Net Profit Ratio was 1.9175. The average for IndiGo firms was 7.6957. The slight variations in net profit ratios among the four international airlines are visible in the above table.

IndiGo had a standard deviation of 3.7391, Jet Airways had a standard deviation of 9.606, Air India's standard deviation was 12.088, and Spice Jet's was 10.209. These figures represent the standard deviations for international airlines. IndiGo had a coefficient of variation value of 13.981, Jet Airways had a coefficient of variation value of 728, Air India had a coefficient of variation value of 146.13, and Spice Jet's coefficient of variation value was 104.23. These values indicate that International Airlines were more dependable than other airline firms in terms of their capacity to generate Net Profit.

4.3.2.1 TEST FOR SIGNIFICANCE OF NET PROFIT MARGIN

The pertinent information about whether the four international airline firms' Net Profit Margin Ratios varied noticeably and whether those ratios varied over the course of seven years is provided in Table 4.4.1. The two-way ANOVA was employed.

Two sets of null hypotheses

Set-1: Ho: The values of the Net Profit Margin of a few International Airlines do not differ noticeably.

Set-2: Ho: There are no appreciable variations in the Net Profit Margin numbers between 2015–16 and 2021–22.

Table 4.4.1 ANOVA –Net Profit Margin Ratio

	Sum of Square	Degree ofFreedom	MeanSquare	F-Ratio	P-value	F-crit
BetweenColumn	7387.92	3	2462.6	36.69	7.04	3.1599
Within Row	993.209	6	165.53	2.466	0.064	2.6613
Residual	1208.02	18	67.112			
Total	9589.15	27				

*Source: Computed * Significant at the 5 % level RESULT*

Set-1: Ho: The hypothesis is not rejected because the estimated value of "F" (36.69) is greater than the critical value of "F" at the 5% significance level (3.1599). Consequently, the values of the net profit ratios of the four international airlines differ significantly.

Set-2: Ho: The hypothesis is not accepted because the estimated value of "F" at 5% significance level (2.466) is less than the critical value of "F" (2.6613). Therefore, there is little change in the value of net profit margin between the years 2015-16 and 2021-22.

4.3.3 OPERATING PROFIT MARGIN RATIO OF INTERNATIONAL AIRLINES

The table 4.5 gives the data of Operating Profit Ratio of the selected International Airlines for the year from 2015-16 to 2021-22.

Table 4.5 Operating Profit Ratio of selected International Airlines

During the year from 2015-2016 to 2021-2022 (In. Percentage)

Company Years	INDIGO	JET AIRWAYS	AIR INDIA	SPICE JET
2015-16	12.21	4.57	-25.26	-13.98
2016-17	10.94	0.21	-23.73	-2.11
2017-18	4.55	-8.59	-38.21	13.5
2018-19	13.42	-0.59	-38.15	12.65
2019-20	19.31	-10.94	0.92	10.56
2020-21	11.53	-5.34	-9.22	8.77
2021-22	12.84	-0.1	9.88	9.65
Mean	12.1143	-2.96	-27.4138	9.4387
SD	4.33893	5.093	17.9442	10.9025
CV	18.826	213	321.996	118.866

Source: Computed from Annual Reports of the Respective Airline Companies.

The average Operating Profit Ratio of Air India is 27.4138, Jet Airways' average Operating Profit Ratio is -2.96, Spice Jet's average Operating Profit Ratio is 9.4387, and IndiGo Airlines'

average Operating Profit Ratio is 12.1143. The Operating Profit Ratio among International Airlines shows slight differences, as depicted in the above table.

IndiGo had a standard deviation of 4.3389, Jet Airways had a standard deviation of 5.093, Air India had a standard deviation of 17.9442, and Spice Jet had a standard deviation of 10.2025 for international airlines. Coefficient of variation values were 18.826 for IndiGo, 213 for Jet Airways, 321.99 for Air India, and 118.366 for Spice Jet, indicating that among airline companies' inability to operate profitably, international airlines are considered more reliable.

4.3.3.1 TEST FOR SIGNIFICANCE OF OPERATING PROFIT RATIO

Table 3.5.1 provides pertinent information about whether there were substantial differences in the operating profit ratios of the four international airline businesses and whether those differences persisted over the course of seven years. A two-way ANOVA was employed.

Two sets of null hypotheses

Set-1: Ho: The Operating Profit Ratio values of the chosen International Airlines do not differ noticeably.

Set2: Ho: The Operating Profit Ratio's value does not significantly change between the years 2015–16 and 2021–22.

Table 4.5.1 ANOVA- Operating Profit Ratio

	Sum of Degree of Square	Degree of Freedom	Mean Square	F-Ratio	P-value	F-crit
Between Column	529.25	3	176.41	85.23	0.4834	3.159
Within Row	1415.18	6	235.86	1.1395	0.3798	2.661
Residual	3725.63	18	206.97			
Total	5670.07	27				

*Source: Computed * Significant at the 5 % level RESULT*

Set-1: Ho: We do not reject the hypothesis since the calculated value of F (85,230) is larger than the value of F required to do so at the 5% level of significance (3.159). As a result, the four major international airlines show vastly different operating profit ratio values.

Set-2: Ho: With a 5% level of confidence, the computed value of F (2.661) is lower than the crucial value of F (1.1395), hence the hypothesis is rejected. There is, therefore, no meaningful change in operating margin from 2015–16 through 2021–22.

4.3.4 RETURN ON ASSETS OF INTERNATIONAL AIRLINES

Return on Assets of the selected International Airlines for the years from 2015-16 to 2021-22 is depicted in Table 4.6. In 2015-16, IndiGo had a Return on Assets of 2.05, which escalated to 14.79 in 2021-22. Consequently, there was a 6.21% increase in return on assets. Between

2015-16 and 2016-17, IndiGo's return on assets declined from 2.05 to 16.86, resulting in a 76.224% increase in return on asset growth. Subsequently, between 2016-17 and 2017-18, IndiGo's return on assets decreased from 16.86 to 5.20, leading to a 68.97% drop in return on asset growth. However, from 2017-18 to 2018-19, it increased from 5.20 to 17.14, reflecting a 69.66% increase in return on asset growth. From 2018-19 to 2019-20, the Return on Assets increased from 17.14 to 22.37.

Despite fluctuations within the determined information, the Return on Assets witnessed a decrease throughout the seven years' study period.

Table 4.6 Return on Assets of selected International Airlines

During the year from 2015-2016 to 2021-2022 (In. Percentage)

Company Years	INDIGO	JET AIRWAYS	AIR INDIA	SPICE JET
2015-16	2.05	6.36	0.95	30.74
2016-17	16.86	0.325	41.51	7.611
2017-18	5.2	16.03	1.51	34.19
2018-19	17.14	5.598	1.14	28.71
2019-20	22.37	5.71	0.66	13.56
2020-21	14.09	11.71	0.69	13.112
2021-22	14.79	6.14	1.52	0.135
Mean	13.2143	6.5703	6.0238	16.211
SD	7.12565	5.2291	14.3454	13.3748
CV	50.775	27.34	205.79	178.88

Source: Computed from Annual Reports of the Respective Airline Companies.
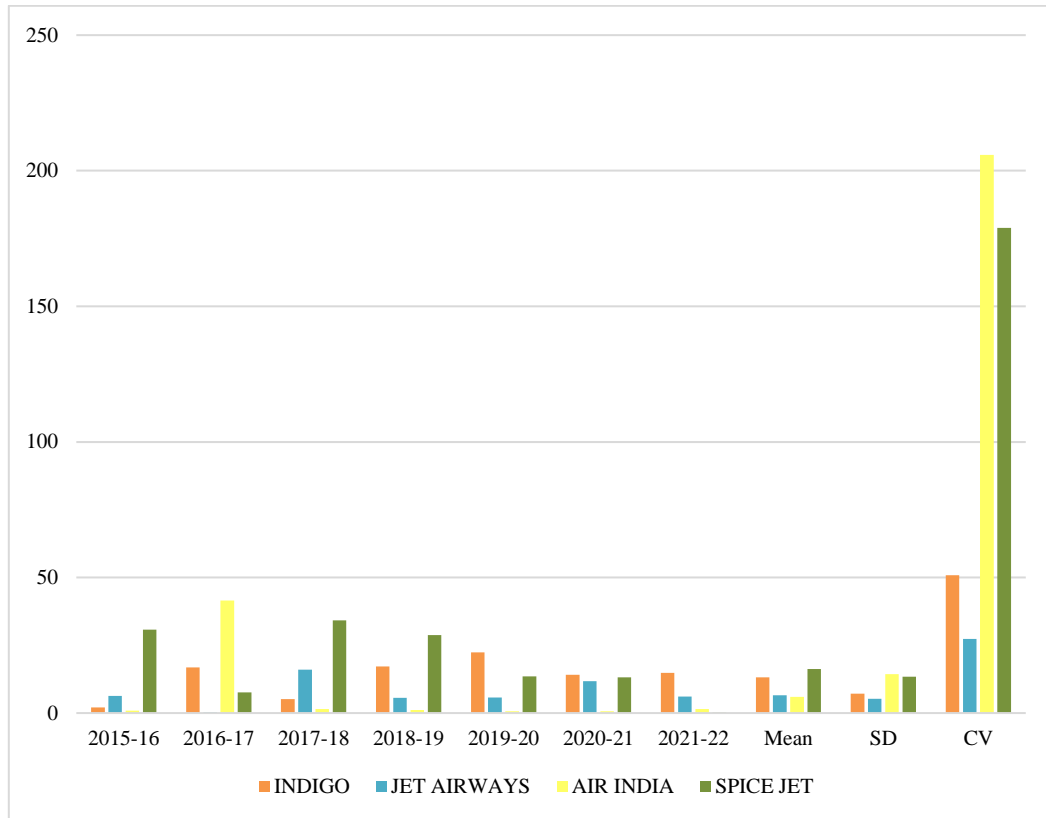
Figure 4.6 Return on Assets of selected International Airlines

4.3.4.1 TEST FOR SIGNIFICANCE OF RETURN ON ASSETS

Table 4.6.1 gives relevant details if the asset performance of the four international airlines differs significantly and if the values differ over seven years. A two-way ANOVA was used.

Two sets of null hypotheses

Set-1: Ho: The Return on Assets values of the chosen international airlines do not differ noticeably.

Set-2: Ho: There are no appreciable variations in the Return on Assets figure between 2015–16 and 2021–22.

Table 4.6.1 ANOVA-Return on Assets

	Sum of Degree of Square	Degree of Freedom	Mean Square	F-Ratio	P-value	F-crit
Between Column	611.741	3	203.91	1.4312	0.2665	3.1599
Within Row	303.134	6	50.522	0.3546	0.8978	2.6613
Residual	2564.53	18	142.47			
Total	3479.4	27				

*Source: Computed * Significant at the 5 % level Result:*

Set-1: Ho: Null hypothesis accepted because critical value of "F" at 5% significance level (3.1599) is greater than computed value of "F" (1.4312). As a result, there is little difference between the four international airlines in terms of the return value of their assets.

Set-2: Ho: The value of "F" at the 5% level of significance (0.3546), as computed, is less than the critical value of "F" (2.6613), hence the hypothesis is rejected. Thus, the value of return on assets between 2015–2016 and 2021–22 does not fluctuate much.

4.3.5 RETURN ON EQUITY OF SELECTED INTERNATIONAL AIRLINES

Table 4.7 shows the return on equity of a selected number of international airlines for the year from 2011-2012 to 2021-22 over a 7-year period

Table 4.7 Return on Equity of selected International Airlines

During the year from 2015-16 to 2021-22 (In. Percentage)

Company Years	INDIGO	JET AIRWAYS	AIR INDIA	SPICE JET
2015-16	2.43	-15.38	1.15	-1.372
2016-17	32.15	-6.857	0.47	-0.482
2017-18	15.42	-25.93	5.03	-1.874
2018-19	60.14	-9.288	3.22	-1.248
2019-20	7.835	9.636	0.65	0.644
2020-21	5.932	13.04	0.71	0.654
2021-22	8.133	6.757	0.02	0.928
Mean	18.862	-3.709	1.4113	-0.3043
SD	20.68	13.327	1.7811	1.0854
CV	427.69	177.62	3.173	1.178

4.3.5.1 TEST FOR SIGNIFICANCE OF RETURN ON EQUITY

Table 4.7.1 provides detailed information regarding whether the return on equity of the four international airlines differs significantly and whether the ratio does vary over seven years. A two-way ANOVA was used.

Two sets of null hypotheses

Set-1: Ho: The Return on Equity values of a few international airlines operating in India do not significantly differ from one another

Set-2: Ho: The Return on Equity numbers throughout the course of different years don't differ noticeably

Table 4.7.1 ANOVA-Return on Equity

	Sum of Degree of Square	Degree of Freedom	Mean Square	**F-Ratio**	**P-value**	**F crit**
Between Column	2169.83	3	723.27	4.1776	0.0207	3.1599
Within Row	716.24	6	119.37	4.6965	0.6608	2.6613
Residual	3116.38	18	173.13	-	-	-
Total	6002.46	27	-	-	-	-

*Source: Computed * Significant at the 5 % level RESULT*

Set-1: HoThe computed value of "F" (4.1776) is less than the crucial value of "F" (3.1599) at the 5% significance level, hence the hypothesis is not rejected. Hence, the four major international airlines have vastly different returns on equity.

Set-2: The estimated value of F at the 5% level of significance (4.6965), when compared to the critical value of F (2.6613), indicates that the null hypothesis should be rejected. Hence, the rate of return on equity value varies greatly between fiscal years 2015–2016 and 2021–2022.

4.4 CORRELATION

Correlation analysis quantifies the strength and development of a connection between two or more variables. The correlation matrix, a table showcasing the statistical relationship closeness between two variables, is utilized in this analysis. The significance of the observed relationships between the selected factors during the research period and the overall performance of each airline is displayed in each airline's correlation matrix.

Dependent variable

Y = Return on Equity

Independent Variable

X_1 = Gross Profit Ratio

X_2 = Net Profit Ratio

X_3 = Operating Profit Ratio

X_4 = Return on Assets

During the years 2015–2016 through 2021–22, the following table displays the results of a correlation and multiple regression study of chosen international airlines operating out of India.

4.4.1 CORRELATION MATRIX OF INTERGLOBAL AVIATION LIMITED (INDIGO)

Ho: There is no correlation between the IndiGo's independent variables (GPR, NPR, OPR, and ROA) and the dependent variable (ROE).

Table 4.8 Correlation Matrix-IndiGo

Gross Profit Ratio		Net Profit Ratio	Operating Profit Ratio	Return on Assets	Return on Equity
Gross Profit Ratio	1				
Net Profit Ratio	-0.166	1			
Operating Profit Ratio	0.369	0.289	1		
Return on Assets	-0.032	0.21	-0.063	1	
Return on Equity	-0.14	.975[**]	0.309	0.324	1

Source: Computed (version 23 SPSS)

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.8 above shows the correlation coefficient of IndiGo. It is observed that NPR is the significant positively correlated with ROE. The GPR is insignificant and negatively correlated with ROE. The other independent variables OPR and ROA are insignificant and positively correlated with ROE.

4.5 MULTIPLE REGRESSION ANALYSIS

The percentage changes in gross margin, net profit margin, operational profit margin, and return on assets were utilized as independent variables in a multiple regression study to explain the dependent variable of return on equity. Hence, the equation for multiple regression is

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$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Dependent variable Y = Return on Equity

Independent Variable X_1 = Gross Profit Ratio

X_2 = Net Profit Ratio

X_3 = Operating Profit Ratio

X_4 = Return on Assets

β_0 = Constant

ε = The error term

The following table shows the multiple regression analysis of International Airlines in India for the period from 2015-16 to 2021-22.

4.5.1 MULTIPLE REGRESSION ANALYSIS OF INDIGO

Ho: The four independent IndiGo variables, Gross Profit Ratio (X1), Net Profit Ratio (X2), Operating Profit Ratio (X3), and Return on Assets (X4), do not significantly affect Return on Equity.

Table 4.9 Multiple Regression Analysis of Indigo

Model	Unstandardized Coefficients		T	Sig.	Collinearity Statistics	
	B	Std. Error			Tolerance	VIF
(Constant)	20.712	27.864	0.743	0.511		
Gross Profit Ratio	0.073	0.838	0.087	0.936	0.781	1.281
Net Profit Ratio	-9.516	9.135	-1.042	0.017	0.049	20.351
Operating Profit Ratio	-0.996	2.315	-0.43	0.696	0.731	1.368
Return on Assets	6.227	5.15	1.209	0.013	0.049	20.367
R					.609[a]	
R Square					0.371	
Adjusted R Square					-0.467	
F					0.443	
Durbin –Waston					2.932	

Source: Computed (version 23 SPSS)

a. Predictors: (Constant), ROA, GPR, OPR, NPR

b. Dependent Variable: ROE

In the preceding Table 4.9, a positive correlation between the dependent variable and the gross profit ratio and return on assets is indicated. Conversely, both the net profit margin and operational profit margin show adverse correlations with ROE. This signifies that an increase in IndiGo's gross margin, net margin, or operating margin by 1 unit would lead to a decrease in the company's return on equity from 0.073 to -9.516 to 0.996, respectively. The independent factors of return on equity exhibit a positive correlation with the dependent variable, as illustrated by the regression coefficients. This implies that a 1-percentage-point rise in profit margin would result in a return on equity of Rs 6,227.

According to Table 4.13, using regression analysis, 37% of the variance in return on equity can be accounted for. This is denoted by the multiple regression coefficient (R) of R.609 and the R2 of 0.371. The coefficient of determination in the regression equation exhibits an inverse relationship, as indicated by the adjusted R squared value of -0.467. To ensure that the array value of all common variables in the regression function is smaller than F, it is found that F equals 0.443. The Durbin-Waston statistics determine the acceptability of the assumption-free error. The optimal range for this variable is 2-4, and a value of 2.932 is obtained. Results from output collinearity statistics indicate that VIF values obtained fall between 1 and 10, ruling out multicollinearity symptoms except those related to net profit and return on investment asset. This leads to the conclusion that IndiGo's independent factors significantly impact ROE.

5   RESULTS AND DISCUSSION
5.3 FINDINGS OF THE STUDY

1. The overall high and low values of the current ratio in the respective International airlines have been explained by the researcher. An overall high current payout ratio of 1.74 in 2015-16 was noted for IndiGo, while Air India had an overall low current ratio of 0.13 in both 2015-16 and 2021-22.

2. The overall high and low values of Quick Ratio in the respective international airlines during the study period were elucidated. IndiGo's high overall quick rate of 1.71 in 2015-16 and Air India's low overall quick ratio of 0.10 in 2015-16 were revealed. It

was indicated that International Airline is considered the most reliable among airlines in their ability to repay short-term debts with Fast assets.

3. The overall high and low values of Gross Profit Ratio in the respective airlines and years were analyzed. The overall high Gross Profit Ratio was 33.89 in the year 2012-13 for IndiGo, and Spice Jet also achieved a high Gross Profit Ratio. The overall low Gross Profit Ratio was -29.84 in the years 2015-16 for Air India. It was revealed that the International Airlines are considered more reliable than others among the airlines concerning Gross Profit capability.

4. Fluctuations in the net profit margin of several international airlines in different years during the study period were found. IndiGo's high overall net profit margin was 12.30 in 2015-16, whereas Air India had a low overall net profit margin of -52.51 in FY2015-2016.

5. Variations in the Operating Profit Ratio of selected international airlines in different years during the study period were observed by the researcher. The researcher also detailed the overall high and low values of Operating Profit Ratio in respective airlines and years. The overall high Operating Profit Ratio was 19.31 in the year 2015-16 for IndiGo, while the overall low Operating Profit Ratio was -38.21 in the year 2015-16 for Air India.

6. The variation in Return on Equity of different International airline companies and different years in the study period was explained by the researcher. The overall high Return on Equity was 60.14 in the year 2014-15 for IndiGo, and the overall low Return on Equity was 0.02 in the year 2021-22 for Air India. The average Return on Equity for IndiGo was 18.862, Jet Airways' was 3.709, Air India's was 1.4113, and Spice Jet's was 0.3043. The slight difference between the International Airlines' Return on Equity was explained, indicating that International Airlines are more reliable in their ability to maintain assets.

7. The productivity of IndiGo is not stagnant. Volatility in the operational productivity was observed by the researcher. The productivity performance ranged from 9.97 million in 2011-2012 to an all-time low of 3.05 million in 2014-2015. Slight positive movements were observed in 2015-16, 2016-17, and 2021-22, indicating fluctuations in IndiGo's productivity.

8. A massive decline in the productivity of Jet Airways, lesser than IndiGo, was noted by the researcher. Slight changes in operational productivity were observed. Productivity

performance ranged from 0.55 million in 2011-2012 to a positive growth of 0.71 million in 2014-2015, followed by minimal differences in the next two consecutive years.

9. To determine the productivity of Air India, the researcher studied the period from 2011-2012 to 2017-2018. Productivity ranged from 1.74 million in 2011-2012 to an unexpected decrease of 1.94 million in 2016-2017, followed by a rapid increase to 2.23 million in 2017-2018.

10. The researcher examined the productivity percentage of Spice Jet during the seven-year period from 2011-2012 to 2017-2018. Productivity ranged from 2.51 million in 2011-2012 to a massive decrease of 0.37 million in 2015-2016, followed by a substantial growth to 2.88 million in 2017-2018.

6   CONCLUSION

In this study, the primary objectives revolved around identifying the most effective approach for discerning international corporate business and direct foreign investments within multinational enterprises (MNEs). The research encompassed an extensive review of current international business resources and an overview of data analysis methodologies. The comparative analysis of various online data visualization methods through a detailed case study involving different airlines operating in India was a pivotal aspect. Through an in-depth analysis of financial metrics like the current ratio, quick ratio, gross profit ratio, net profit margin, operating profit ratio, return on equity, and productivity measures of these airlines, the study illuminated distinct patterns and fluctuations within their operational capacities and financial performance. The insights gleaned from these metrics not only highlighted the disparities among the airlines but also underscored the reliability of International Airlines in terms of their financial capability, debt repayment abilities, and asset maintenance. This comprehensive investigation underscores the importance of employing robust data visualization tools to evaluate and comprehend the intricate landscape of international business operations and financial performance within the aviation industry.

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