DEVELOPING A MODEL TO ASSESS THE FINANCIAL CONDITION OF AIRLINE COMPANIES IN INDIA

By

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Dedicated to my Parents

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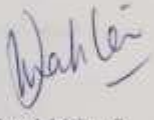

(Umesh Mahtani)

DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

Umesh S Mahtani

April 2019

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THESIS COMPLETION CERTIFICATE

This is to certify that the thesis on "Developing **"A Model To Assess The Financial Condition Of Airline Companies In India"** by Umesh Satyanand Mahtani in Partial completion of the requirements for the award of the Degree of Doctor of Philosophy (Management) is an original work carried out by him under our joint supervision and guidance.

It is certified that the work has not been submitted anywhere else for the award of any other diploma or degree of this or any other University.

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Executive Summary

In India, the aviation industry has been expanding in the last fifteen years with several new airlines established every year. This sector has shown phenomenal growth in passenger travel and “in 2017 more than 158 million passengers flew on domestic and foreign routes of Indian airline companies” as per the IATA report of January 2019. The market size is projected to become the biggest in the world in the next twenty years. However the report also mentions that “domestic journeys undertaken in 2017 represents just 7.3% of India`s total population” signifying a high potential in the future. The revenue passenger kilometer (RPK) has also shown an increase for domestic routes in India by 17.6% in the year 2017-18 (IATA report January 2019).

However, airline companies in India face a number of challenges owing to dynamic conditions prevailing in the passenger market and in the input cost structure. These constantly changing conditions have led to many of these companies undergoing financial distress and even bankruptcy. In this environment, it is extremely important that management is able to identify those factors which have a large impact on their financial performance. As conditions change the identified factors need to be monitored closely to ensure their values do not enhance the risk of financial distress. This study focuses on identifying those factors from financial, operational, performance and external conditions which are a major influence on the financial condition of the airlines. Selected factors are then incorporated into a model which will assess the financial distress of the company.

Distress or bankruptcy predictions models are used worldwide and are generally based on financial factors or ratios alone. These models are standardized in form and can be applied to any industry globally. These standard models which are focused on financial data have poor applicability in many industries, as they do not consider factors which are more relevant to a specific industry or country.

In the first part of this research, fuzzy AHP (analytic hierarchy process) is deployed to prioritize and rank the factors among the categories. The analysis finds that financial factors are the most critical and categorized as a major influence on the commercial viability of the airlines. Among these, operating revenue per air kilometer is the key variable for this sector. "Operational factors, which are an indicator of the capacity and cost structure of the company, are ranked next, with the load factor taking the highest rank in this category. From the external environment, aviation fuel price per liter is ranked highest among all the factors and has a major impact on the profitability of the airline in India".

For the next part of the research, financial and operating data of six airlines in India is compiled from 2006 to 2017. Financial distress prediction models used globally by the airline industry, are tested using the data of six privately owned airlines in India. The results found, are inconsistent when compared with the existing financial condition of the airlines.

The research next builds a model by incorporating selected factors which provide the highest assessment of financial distress. The study tests two models: one which is based on financial ratios only and the other with key factors from various internal and external conditions in which the airline operates.

The research confirms that a logistic regression model designed with performance, operating and financial factors have a higher accuracy in the assessment of financial distress for an airline in India, as compared to a model consisting only of financial factors.

There have been limited studies in India, which have reviewed airline performance or identified the input factors for use in a model to assess the risk of financial distress.

Key Words: Ratio Analysis, Financial distress, Airlines, Fuzzy AHP, India, Sensitivity analysis, Bankruptcy models

List of Abbreviations

Abbreviations	-	Full Name
AAI		Airport Authority of India
ADV		Advanced Economies
AFDA		Airline Financial Distress Assessment
AHP		Analytic Hierarchy Process
ANFIS		Adaptive neuro-fuzzy inference system
ANN		Artificial Neural Network
AUC		Area Under the Curve
BV		Book value of Equity
CA		Current Assets
CAG		Comptroller Auditor General
CAPA		Centre for Aviation
CART		Classification and Regression Trees
CBR		Case Based Reasoning
CEO		Chief Executive Officer
CFO		Chief Financial Office
CL		Current Liabilities
CMIE		Centre for Monitoring Indian Economy
COO		Chief Operating Officer
DEA		Data Envelopment Analysis
DEMATEL		Decision making trial and evaluation laboratory
DGCA		Directorate General of Civil Aviation
EBIT		Earnings before Interest and taxes
EDE		Emerging Economies
ET		Economic Times
EU		European Union
FAHP		Fuzzy Analytic Hierarchy Process
FD		Financial Distress
FDI		Foreign Direct Investment
FSC		Full Service Carrier
FTSE		The Financial Times Stock Exchange
GATS		General Agreement on Trade in Services
GDP		Gross Domestic Product
GZ		Grey Zone
HFSAT		Hybrid Financial Statement Analysis
IATA		International Air Transport Association
ICAO		International Civil Aviation Organization
IMF		International Monetary Fund
KPMG		Klynveld Peat Marwick Goerdeler
LASSO		Least Absolute Shrinkage and Selection Operator

LCC	Low Cost Carrier
LR	Logistic regression
MARS	Multivariate Adaptive Regression Splines
MCDM	Multiple Criteria Decision Making
MDA	Multiple Discriminant Analysis
NFD	Non Financial Distress
NN	Neural Network
PLF	Passenger Load Factor
PLS-LR	Partial Least Squares Logistic Regression
PWC	Price Waterhouse Coopers
RE	Retained Earnings
RPK or RPKM	Revenue passenger kilometer
SVM	Support Vector Machine
TA	Total Assets
TFNs	Triangular fuzzy numbers
TL	Total Liabilities
TOPSIS	Technique for order performance by similarity to ideal solution
VEM	Value Erosion Model
VIF	Vector Inflation Factor
VRS	Variable Returns to Scale
WC	Working Capital
WTO	World Trade Organization

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“Chapter 1
Introduction”

Overview

“This chapter presents the background of the research”, with an introduction to the global and Indian airline industry. The section highlights the current state of the airline industry in India and the key issues that a company in this sector faces. The chapter describes the financial status of the airlines in India and the conditions in which the companies operate. It also explains the motivation behind the study, identifies the research questions, and formulates the research objectives. It further lists the organization of the thesis with brief content of each section.

1.1 Background of the study

Airlines globally are considered a driver for economic growth bringing together people and businesses. This mode of transport is still the fastest and has a great effect on the ease of doing business in a country. A well-developed aviation infrastructure leads to a favorable tourist destination globally.

The airline's sector adds over 3.6% to the global GDP through various activities downstream, including tourism and supplies of services and various goods. (“Aviation benefit beyond borders-Oct 2018”, published by Air Transport Action Group- Geneva).

Airlines around the world carry over 4 billion passengers in a year and also transport around 60 million kilograms of cargo. These activities have led to the addition of over 10 million jobs directly to the global job market (“Aviation benefit beyond borders-Oct 2018”, published by Air Transport Action Group-

Geneva). These contributions to GDP are greater than those provided by the automobile and pharma industry combined together.

This industry also plays a major role in adding to the global GDP through activities which are not direct contributions. This contribution is estimated to be $637.8 billion and is related to the role of infrastructure companies, suppliers of parts, aviation fuel, and providers of goods and services at the airport ("Aviation benefit beyond borders-Oct 2018", published by Air Transport Action Group-Geneva).

The industry, however, has to operate in a dynamic environment where demand and supply parameters change dramatically in a short span of time. Airlines are often left with excess capacity when an event in the external environment occurs, such as the terrorist attack of 9/11. Airlines have to be continuously alert to such shocks and fluctuations in the operating conditions, which could bring a financial crisis in the company.

The airline industry globally has evolved over the last decade with many changes impacting the way the company functions. Low-cost carriers, technology solutions, and fuel-efficient aircraft have been some of the key changes which have brought a transformation in the operating conditions of the airline. In this ever-fluctuating environment with numerous factors, it is very important that management is able to focus on those variables which are critical to the sustained performance of the company.

In India, the air transport industry employs more than 400,000 persons directly and supports more than 900,000 persons in indirect employment. The industry is estimated to contribute "US$35 billion annually to India`s GDP" as per the IATA Report Jan 2019.

The growth in the passenger volume has led to several companies venturing into the airline businesses. These new airlines are often set up with little understanding of the aviation business, and within a short period of two years, face a financial crisis as markets as input costs change dynamically. If the

management of the company is not alert to these varying factors, the financial stability of the company is invariably threatened. They need to be alert to these changing conditions and focus on those factors which could have the potential of creating a financial distress condition.

Prior studies have analyzed the cause of the financial distress condition in airlines. These studies have been focused on individual companies and identified the specific reasons that the individual company failed or was facing a financial distress situation ("Chow and Tsui, 2017; Rothmeier, 2017; Zou et al., 2016; Bitzan and Peoples, 2016; Wang et al., 2016").

Management needs to be alert to the critical factors, and ensure they are monitored regularly so that they are within the boundaries defined. Other stakeholders such as lenders and shareholders can also periodically review these key factors and make sure management is taking appropriate steps to insulate the company from the effects of these changing variables.

A study and analysis of financial distress issues in the airline industry thus becomes very important and has been selected as a key theme of this research.

This study is focused on identifying those main factors which are a major influencer on the financial stability of the airline. These factors are part of the external and internal conditions in which the airline is operating, and are related to the financial, operating, economic, government, market, and performance environment. Each of these conditions has a number of these factors which have the potential of impacting the financial condition of the airline. The study incorporates the identified key factors into a model, which can then be used to assess the financial stability of the airline company. The model can alert the management of a developing financial distress condition, which can thus make changes in future strategies.

1.2 Global Airline Industry

The global airline industry has been on an expansion phase during the last 10 years with economic growth being the highest in this period as compared to the previous ten years.

Passenger and freight volumes have been increasing and are at a record high. The global airline share prices have also been at a high, with 29% increase in 2017 which is higher than the FTSE (The Financial Times-Stock Exchange 100 Index, also called FTSE), or the all-world Dollar index which grew at 22% (Price Waterhouse Coopers (PWC) Report 2018). The share price of European airlines has grown by 68% during this period, led by the strong European economy and high passenger demand during the period.

The profit margins in 2017, reported globally have been much higher than the forecast with an estimate of US$ 29.8 billion (10% higher than projected). The net margin reached a high of 4.1% in 2017 and the passenger yield was projected to increase to 3% in 2018.

Moody`s (Moody's investor services 11 Dec 2017; “Stable 2018 outlooks for global airlines, aircraft leasing, global shipping, and North American railroads”) in their report has projected global operating margins of 8.5 to 10% for 2019 with the airlines in the USA being the most profitable. The industry revenue is also expected to grow by 4% in 2019. This is an outcome of the global economic growth and demand for air travel expected in the next 2 years. The growth is expected to be higher in the developing nations, with China and India leading among the countries. Net margin projections in 2019 are expected to reach 8 to 9% as indicated by the aircraft leasing industry.

The growing industry is also expected to face several challenges in the coming years. Oil and labor costs are projected to increase and competition will be higher with new airlines starting their operations. Low-cost airlines (LCC) introduced in several countries are expected to impact profit margins.

Analysts at KPMG (Klynveld Peat Marwick Goerdeler a consulting firm) in their report "Global Leaders in Aviation Finance, 2018" are projecting the aviation growth to continue for the next few years. This is based on the aviation growth cycles lasting for around 8 years in the past. Low-interest rates and high demand for air travel fueled passenger growth during the period 2015 to 2018 (KPMG, 2018).

With the high GDP growth rates, average RPK (Revenue passenger kilometer), which is a measure of revenue per passenger flown for an airlines, is expected to grow at 6.2% as shown in Fig 1.1 (Global Aviation Financial Outlook 2018: CAPA).

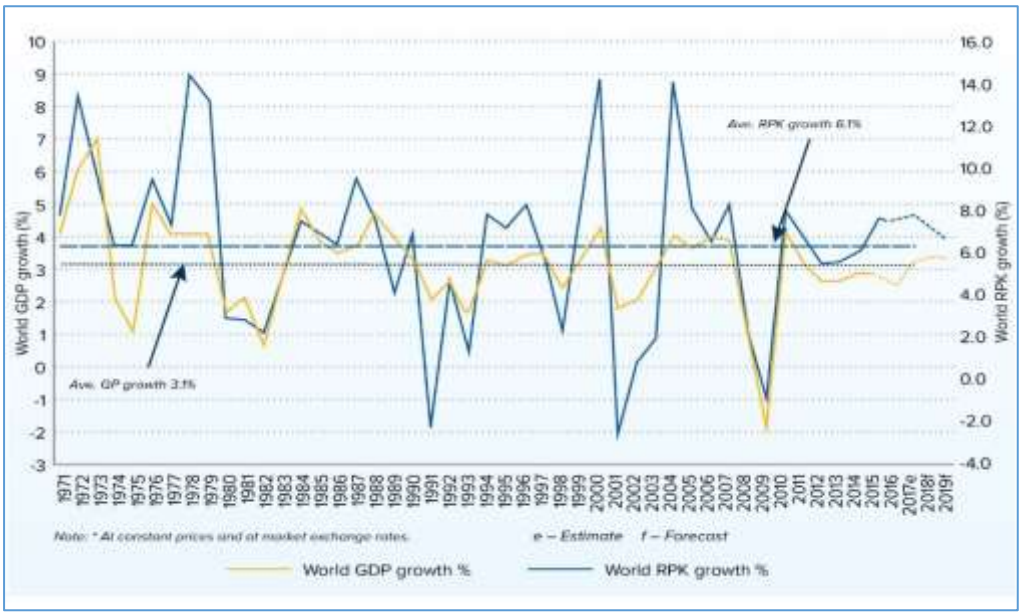

Figure 1.1: "World GDP growth and world airline RPK growth: 1971 to 2019" Source: CAPA - Centre for Aviation, Airline Monitor.

CAPA reports that the growth of aircraft fleet in the period 2016-2019 will be highest at 5.6% in the period up to 2001. With lower fuel price the world airline operating margin has shown an increasing trend to 8.5% in 2017 (Fig 1.2). However, in 2018, it was projected to be lower at 8% as a result of higher fuel prices.

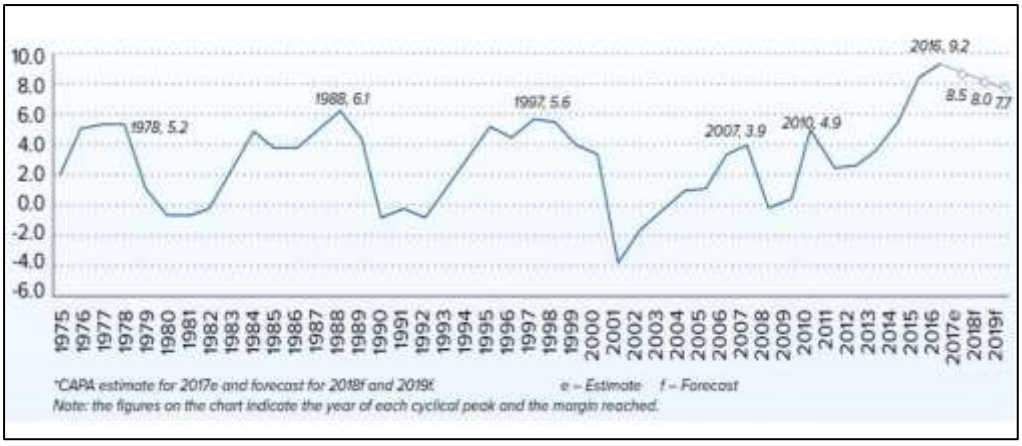

Figure 1.2: World airline industry operating margin (% of revenue): 1975 to 2019f Source: CAPA - Centre for Aviation.

1.3 Airline industry in India

India's civil aviation industry is following the global trend and is also on a growing phase. India is projected to become the third-largest aviation market by 2020 and a major global industry by 2030. In 2017, India was ninth in terms of market size globally with a value of around US$ 16 billion. In the year ending March 2018, the growth in passenger traffic touched 18% over the previous year with more than 120 million passengers using air travel. In 2011 this was only 51 million passengers in the country. The projection for 2018-19 is passenger traffic of over 140 million passengers (CAPA report 2017).

Figure 1.3: Passenger Traffic 2009 to 2019 (projected)
Source: CAPA - Centre for Aviation (forecast), Airports Authority of India

The civil aviation ministry in India has launched several avenues for expansion, with the approval of low-cost carriers (LCCs), setting up of new airports with private sector participation, approval of foreign investment in the sector, usage of technology at the airports to drive efficiency, and increased connectivity between smaller cities.

1.3.1 Growth Parameters

With Indian demography changing and the middle-class increasing, demand for air travel is expected to rise in the next five years. Government is also aiding the growth through an increase in the number of airports to 250 by the year 2030. Several models based on the Public - Private Partnership (PPP) route have been planned during the period. Investment from foreign companies in this sector has been approved by the government and an investment below 49 percent gets automatic approval by the ministry.

By 2036, the number of flyers will increase to 480 million, which will be higher than the combined passengers of Japan and Germany. In May 2018, the passenger growth at 13.3 percent was the highest in the region.

The Indian domestic passenger traffic grew by 13.91 percent CAGR (compound annual growth rate) from the period FY2006 to FY2017 while the international passenger traffic in India was 9.36 percent during the same period (IATA report 2018).

The airline industry has a significant impact on the economy of India. The industry directly and indirectly combined, contributes over US$35 billion to the GDP in India. The industry provides over 7.5 million jobs which consist of direct employment of 400,000 persons, and rest through the supplier chain and the tourism industry. The current growth phase has led to load factors reaching 90% in February 2018. There is still a large market to be developed since the domestic passengers traveling in 2017, account for only 7.3% of India`s population (IATA report Aug 2018).

The future also shows consistent growth with India`s middle class expected to reach 20% of the projected population of 1.6 billion. This growing class will add further 228 million domestic passengers and 131 million international passengers reaching a total of over 520 million passengers traveling within and from/to India.

As per the IATA report of Aug 2018, "India`s position in the World Economic Forum's Travel and Tourism Competitiveness Index has improved to the 40th place in 2017 against the 52nd place in 2015". This rise in the ranking has been triggered by revised visa policies, improved infrastructure, and preservation of monuments. "The India domestic market since 2014 accounts for around 1.5% of total industry-wide RPK (Revenue Passenger Kilometer) worldwide and is larger than all of the domestic markets with the exception of China and the US".

Over the last decade, the growth of revenue passenger kilometer (RPK) in the airline industry has remained at an annual rate of about 5% among the advanced economies (ADVs), such as the US, Australia, Canada, and the European Union.

The emerging and developing economies (EDEs), such as Russia, Brazil, China, and India, have shown a higher RPK growth rate of 10% annually.

An overview of the profile of the eight economies and their respective shares in the world's RPK in 2017 is shown in Table 1.1. (These eight economies are also the world's top 8 in terms of territory size.)

As a whole, these eight economies accounted for 70.88% of the world's RPK in 2017. Of the 70.88%, the four ADVs (the US, Australia, Canada, and the EU) accounted for 51.72%, whereas the four EDEs (Russia, Brazil, China, and India) 19.16%. China's RPK share was far greater than that of India in 2017 (Table 1.1).

Table 1.1: An overview of the profile of eight economies and their respective shares in global RPK in 2017.

Parameter	USA	Australia	Canada	European Union	Russia	Brazil	China	India
Population (million)	326	25	37	739	144	208	1,390	1,320
Territory (million square kilometers)	9.86	7.69	9.98	4.32	17.1	8.52	9.6	3.29
GDP per capita (current international dollar)	59,790	55,690	45,090	27,430	10,960	9,900	8,640	1,980
RPK (million)	1,551,965	155,093	216,780	2,042,727	205,407	123,096	950,425	190,402
% of global RPK	20.24	2.02	2.83	26.63	2.68	1.61	12.39	2.48

Source: IMF and International Civil Aviation Organization (ICAO).

1.3.2 Market Share

In the year ending 2016-17, there were 15 airlines operating in India on domestic routes. These were Air India, Jet Airways, Indigo, GoAir, Air Asia, Jetlite, Spicejet, Vistara, Air Pegasus, Air Costa, TrueJet, Air India Express, Air Carnival, Alliance Air, and Zoom Air.

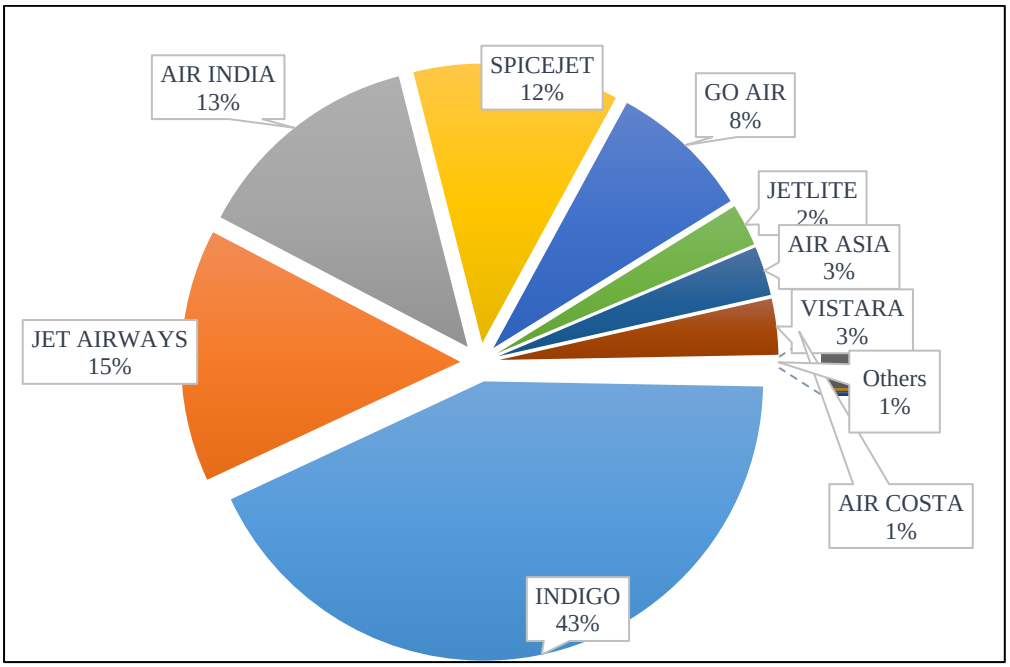

Figure 1.4: Market share of Airlines in India in 2016-17.
Source: Directorate General of Civil Aviation, Govt. of India (DGCA)

Indigo was the leading airlines with a market share of 43% and carrying 41.60 lakh passengers annually (Table 1.4).

Jet Airways market share in 2016-17 was estimated to be at 15% which was lower than the earlier 17% in 2015-16. Air India's market share was 13% while Spice jet was estimated to be 12% when compared to 11.5% in the previous year (DGCA).

The market share gains have been for Indigo, Air Asia and Vistara, while GoAir has seen a reduction of 20 basis points over the previous year.

AirAsia and Vistara, which debuted in 2015, have grown consistently and reached a market share at 3% each.

Centre for Aviation (CAPA) report – "Indian Aviation: A Strategic Review of FY2017 & Outlook for FY2018" – (February 8, 2017), predicts that IndiGo Airlines will have a market share of 55%-60% within the next two years. Indigo will increase its capacity by adding two aircraft every month up to March 2018. IndiGo's fleet size will reach 160 aircraft by March 2018, and will further propel domestic air traffic growth in India.

CAPA sees AirAsia and Vistara also being aggressive in increasing their capacity, with AirAsia adding 10 aircraft in the next 10 months and advancing deliveries of six other aircraft in 2018.

1.3.3 Cost Structure and Airline Fares:

The aviation industry is characterized by huge capital investments with outflow consisting of operating costs and fixed lease charges for the aircraft.

The industry in India operates in a very competitive scenario where fares are reduced to attract customers and fill the seats. Even small fare differences often lead to shifting of market share making the industry highly competitive.

A pricing strategy which does not pull passengers often leads to a spiraling effect leading to dwindling market share and high unused capacity. The situation becomes critical when the operating income of an airline is unable to recover the fixed and variable costs and ends up with huge losses resulting in insolvencies.,

A review of the average fare and the fuel prices in 2016 shows that airlines were lowering fares in spite of the increase in fuel prices every quarter to increase market share (Fig 1.3). This strategy was to pull customers to their airlines.

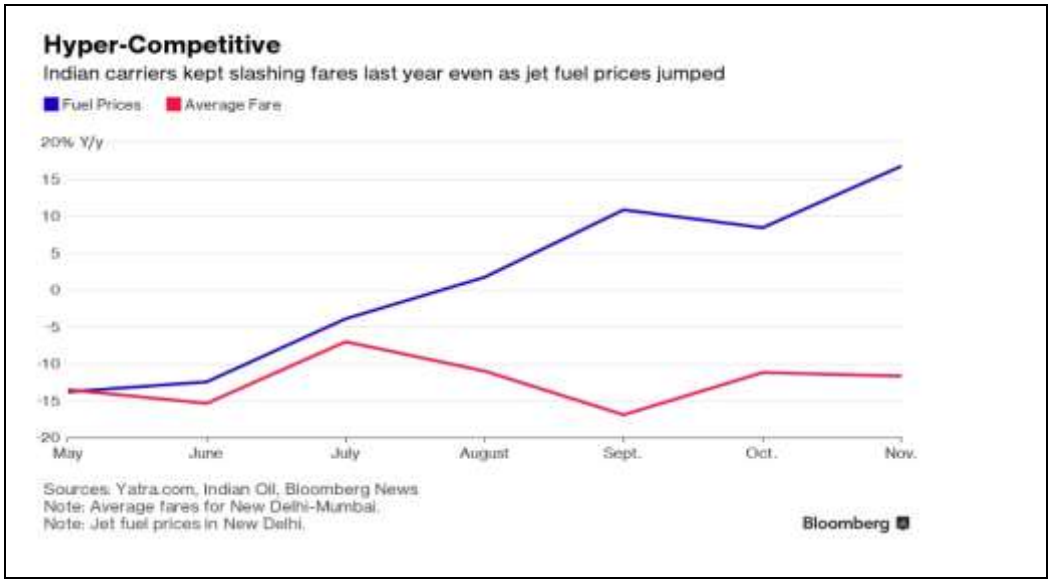

Figure 1.5: Fares and Fuel Prices in 2016 Source: Bloomberg 2016

A study of the operating expenses for an airline shows that fuel costs are around 31% of the overall cost structure (DGCA). An increase in this component would necessitate that airlines reduce costs of other components, to ensure margins do not drop while maintaining constant fares.

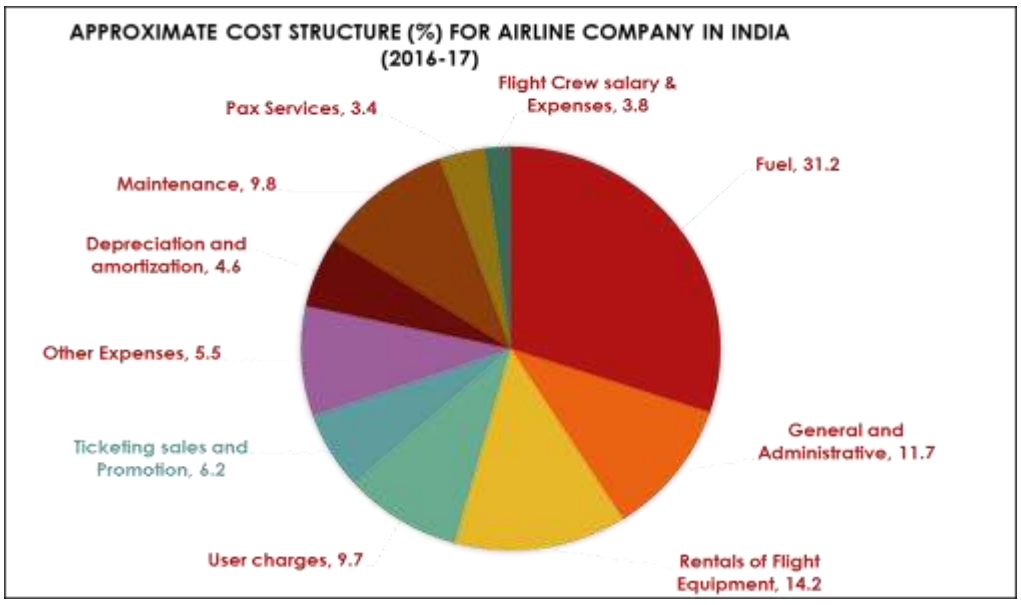

Figure 1.6: Cost structure of Airlines in India 2016-17 (DGCA).

The increased cost structure with high fuel costs combined with the downward trend of airline fares owing to the competitive landscape, has led to several airlines finding it difficult to operate in the environment.

A study of operating revenues per RPK (Revenue Passenger Kilometer) compared to Operating expenses per RPK shows that the revenue per RPK has been less than the operating expenses per RPK combined for all the airlines during the period 2008 to 2015 (Table 1.2). The years 2016 to 2017 have shown a reversal in this trend when fuel prices showed a downward trend.

Table 1.2: "Operating Revenue and Expenses Per Revenue Passenger Kilometer (RPK) Performance of Scheduled Private Airlines of India (2007-08 to 2016-17)".

Years	**"Operating Revenue Per Revenue Passenger Kilometers Performed (Rs)"**	**"Operating Expenses per Revenue Passenger Kilometers Performed (Rs)"**
2007-08	3.13	3.51
2008-09	3.82	3.99
2009-10	3.27	3.13
2010-11	3.36	3.15
2011-12	3.66	3.89
2012-13	5.20	5.13
2013-14	5.34	5.87
2014-15	5.27	5.48
2015-16	4.88	4.53
2016-17	4.51	4.37

Note; 2016-17 excludes data of Air Carnival, Air Costa & Air Pegasus which stopped their operations in the year. Source: DGCA

1.4 Airlines in Financial Distress

The companies in this industry have struggled in this competitive landscape with many of them facing frequent financial distress.

Airlines in India which faced a financial crisis in the past ten years are listed below:

1. Air Asia, a relatively new airline in India, faced a cash crunch in 2016 putting its expansion plans in India on hold. (Livemint 4th Jan 2016). AirAsia posted a net loss of Rs 140 crores (Rs 1,400 million) for 2017 fiscal year, and Rs.182 crores (Rs 1,820 million) in the fiscal year 2016 with accumulated losses of around Rs 485.58 crores (Rs 4,855.80 million) (Aug 25, 2017, ET markets.com)

2. Jet Airways has been reporting losses for the last 8 years (2008 to 2015) and had accumulated losses of Rs 8,316 crores (Rs 83,160 million) in 2015. In Aug 2018 Jet Airways announced that it had cash just enough for 60 days of operations. The cost of selling tickets had risen by 84% in the last five years while its average fares per passenger declined by 17%. The airlines had lost around 2% of market share in 2017 (from 17% in 2015-16 to approximately 15% in 2016-17). (ET Bureau: Aug 08, 2018). Jet Airways posted a loss of Rs. 1,297 crores (Rs 12,970 million) for the three months ended September 30, 2018, compared with a profit of Rs. 49.63 crore (Rs 496.30 million) in the previous year.

3. Air India, a government-owned airlines, had accumulated losses of Rs 53,583.92 crores (Rs 535.8392 billion) at the end of March 2018. The airlines has been bailed out with Rs 27,000 crores (Rs 270 billion) loans given by the government till Aug 2018 (Aug 31st 2018, Economic Times,). The airlines was reported to have published lower losses than the actual, by over Rs 6,415 crore (Rs 64,150 million) in the reports from 2012 to 2015 as per the Comptroller Auditor General (CAG) Report presented in Indian Parliament (Mar 11, 2017, Hindustan Times).

4. Spicejet, a low cost airlines, reported a loss of Rs 1,003 crores (Rs 10,030 million) for the financial year ending March`14 and had canceled over 2000 flights by the end of the year (Economic Time Jan 4, 2015).

In 2015, the airlines faced a financial crisis reporting accumulated losses amounting to Rs 2487 crores (Rs 24,870 million) for the period (2012 to 2015). The airlines had to be bailed out with additional funding of Rs 500 crores (Rs 5,000 million) from its promoters.

During the last decade, the aviation industry has seen seven companies closing down their operations:

1. Air Carnival: This airline which was based in the southern part of India, closed down in April 2017.

2. Air Costa: This regional airline, operating in Eastern India, started operations in Oct 2013 and flew to eight destinations in India: Chennai, Bengaluru, Hyderabad, Jaipur, Ahmedabad, Tirupati, Visakhapatnam, and Vijayawada. The airline ran 16 daily flights but had to stop its operations in March 2017 due to cash flow shortages.

3. Air Pegasus: This airline was based in Bengaluru and had to cease operations in March 2017, owing to cash flow difficulties.

4. Kingfisher Airlines: This airline was one of the major airlines in India and closed its operations in October 2012. The airline had accumulated losses of Rs 14,281 crores (Rs142,810 million) at the end of the financial year 2012-13. It had shown continuous losses from 2005 onwards, during which period banks and other institutions continued to lend Kingfisher around Rs 6,900 crores (Rs 69 billion) to run its operations.

5. MDLR Airlines: A small airlines based in North India operated flights from Delhi to regional locations. It stopped operating in 2009 with losses and deficiencies in cash flow.

6. Kingfisher Red (earlier “Air Deccan”), was “India's first budget airline” which started operations in 2003, and was acquired later by Kingfisher Airlines in 2007. The airline closed down its operations in 2012, after it was unable to fund its operations.

7. Paramount Airways: A South India based airline, closed operation in 2010, owing to cash shortages required to run its operations. The airline flew around 50 daily flights to cities in the region before closing down.

The above research, reports, and articles show that companies in this sector in India, are continuously facing a financial crisis. The airlines are distressed, over different stages of their existence, and ultimately close their operations and file for bankruptcy.

Shareholders and investors of airlines, with varying degree of influence, become aware of the distressed situation when it is too late. The condition becomes very critical and often requires financial bailouts to prevent bankruptcy. There is an urgent need for shareholders and investors, to be alerted on the risk of financial distress occurring in the future, so that it can be corrected before it becomes acute and leads to insolvency.

1.5 Motivation/need for the research

If a company is able to predict the financially distressed condition early on, shareholders and investors, can become aware of the situation and take corrective action to avoid bankruptcy in the future.

The financial failure of a company often occurs over a period of time and is the impact of several factors and strategic decisions taken.

An analysis of the financial distress situation in a company will show that key factors from different conditions have a major influence on the sustainability of the company. These key parameters when incorporated into a distress assessment model will provide a tool to assess the future financial distress condition of the company. This can be used as a guide to better financial management, optimum utilization of resources and relevant strategies with a focus on the critical factors.

Various stakeholders such as investors and creditors could use the model to test the financial viability of the company before taking any financing decision.

Company management could monitor these important variables and take remedial action or change strategic course where necessary.

1.6 Theoretical Premise of the research

1.6.1 Agency Theory

Agency theory describes "the relationships between two parties" where one is responsible to decide on the work to be done, while the other executes the task. In this bond, one party who decides the work acts as the principal and he/she appoints an agent to carry out the specified task (Eisenhardt, 1989).

In companies, the role of the principal is played by the shareholders of the firm who decide on the tasks which are assigned to the agent, played by the management of the company.

It is important for management (the agent) to monitor and keep the principal (shareholders/ investors) informed on the future financial condition of the company (Sharma et al., 2012).

The agent has to take necessary steps to ensure that the investment of the shareholder has value added to it and is not lost in the future (Shareholder Value Theory). Shareholder value theory advocates that the main responsibility of management is to ensure returns for the shareholder are maximized.

1.6.2 Stakeholder Theory

The traditional definition of a stakeholder is "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984). The stakeholder theory is about how the relationship should be maintained with the various entities interacting with the organization. Friedman (2006) proposed that a firm should be considered as a collection of stakeholders where the managers ensure that the interests of the stakeholders are protected. Management should safeguard the survival of the company and maintain the long term welfare of each group.

The stakeholder theory expounds that a Manager has a responsibility to ensure financial distress does not occur. The main groups of stakeholders identified by this theory are:

• Employees
• Customers
• Local communities
• Shareholders
• Suppliers and distributors

In the event of financial distress, the above stakeholders are often negatively impacted.

The theory proposes that maintaining the interests of non-financial key stakeholders has a direct impact on the firm's capability to build value in the future ("Becchetti et al., 2012; Freeman, 1984, 1994, 1999; Hillman & Keim, 2001; Platt et al., 2012"). Corporate failures (e.g., Tyco International, Enron) which occurred in the past, have shown that these bankruptcies occurred even though these companies were focusing on maximizing shareholder value. This clearly shows that emphasis only on shareholders as the most important stakeholder class does not generate the results expected (as proposed by the shareholder maximization theory). Hillman and Keim (2001) have shown that developing better relationships with primary non-financial stakeholders, assists a firm in building valuable resources.

1.6.3 Porter`s Five forces Theory

Bankruptcy in the airline industry in India can be also studied from the perspective of Porter`s five forces theory (Porter, 1979). This theory states that the financial profitability of the industry is dependent on five forces:

"These forces are:
1. Competition in the industry;
2. Potential of new entrants into the industry;
3. Power of suppliers;

4. Power of customers;
5. The threat of substitute products".

Prior studies have used Porter's Five Forces theory to explain reasons for the varying levels of profitability in different industries. Evaluating these forces, one gets a measure of the level of competition in the industry, attraction of the sector and lucrativeness of a market.

The airline industry in India has specific characteristics which periodically lead to financial distress and can be explained using Porter`s five forces theory. The five forces which can be identified for this sector are:

Power of Competition: Airlines have limited control over the revenue due to extensive competition in the industry.
Potential of new entrants into the industry: As the economy grows and the demand for airline travel increases, there are often a large number of existing companies who wish to diversify into this business.
Power of Suppliers: Limited control on key costs charged by suppliers (fuel, airport charges, aircraft manufacturers, etc).
Power of Customers: Limited scope for differentiated strategy due to the power of the customer.
The threat of Substitute Products: Advanced modes of transport such as fast and comfortable trains are being introduced on some routes which provide a direct threat to the airline industry.

1.6.4 "Identified gap from a literature review on the theoretical premise".

The study builds on the underpinning theory of Porters five forces and identifies factors from these forces to include them in the design of the financial distress assessment model.

Prior studies in many countries on the airline industry (Adler and Gellman, 2012; Demirtas, 2013; Akbar et al., 2014; Sengpoh, 2015; Akamavi et al., 2015, Pearson et al., 2015, Corbo, 2017) have shown that evaluation of the financial

condition of the airline industry should be taken considering all the external and internal factors. Every industry will have key variables from the external and internal conditions, which impacts it in a major way and these need to be identified using a systematic technique before any analysis of the industry can be made. This detailed and systematic analysis of the airline industry in India and the variables that impact its financial performance is absent in the studies conducted.

This research is different from previous studies conducted, as it incorporates various factors, which are first identified and ranked through a formal process of selection, into a model for assessment of financial distress.

The model focuses on the requirement of the agent (here management of the organization) to identify methods, to safeguard the investment of the stakeholder and ensure he/she is informed in time about the true picture of the company and the risk of financial distress.

Management, who are directing the business of airlines in India, has a responsibility to all its stakeholders, to ensure that the company does not face financial distress in the future. This will prevent any serious consequences for the firm and also for its stakeholders. This view is absent in the extant literature wherever the financial failure of the airlines has been discussed.

1.7 Research Problem

Financial distress situation in Airline companies in India occurs periodically owing to the dynamic nature of the sector. Analysis of the reasons for the financial distress condition needs to focus on all the relevant factors (as defined by Porters theory), which impact the airline industry.

The system should identify the combination of internal and external factors from financial, operational, regulatory, market, economic and other conditions. This combination when used in a methodology, should be able to evaluate the future condition of the airline.

Corporate failures are highly impacted by major changes in the external environment (Porter theory, 1980). Industry factors such as competition changes, reduction of entry barriers, and industry and market growth were often parameters when ignored led to poor organizational performance and ultimately to financial failure (Heracleous and Werres, 2016). This approach appears to have been disregarded in the airline industry in India leading to multiple failures. Management of companies in this sector, have been unable to identify and focus on those specific external and internal factors, which highly impact and influence the industry`s sustainability periodically.

The theoretical gap shows that there is inadequacy on the part of the agent in the form of steps taken to safeguard the investment of all the stakeholders in the airline industry. This is evident from a large number of bankruptcies occurring in this sector in the last ten years, leading to stakeholders losing their wealth and investments.

1.8 Research Question (RQ):

RQ1. "What are the key relevant, internal and external factors, which have a major impact on the financial condition of privately owned airline companies in India?"

RQ2. How can the identified factors be evaluated and ranked to determine their criticality?

RQ3. What will be a suitable econometric model using identified factors to provide an assessment of financial distress in privately owned airline companies in India?

RQ4. How will the developed model be evaluated and validated for suitability of assessment of financial distress?

1.9 Research Objective:

Objective 1: To identify, analyze and prioritize the relevant factors from internal and external sources which impact the financial condition of airline companies in India.

Objective 2: To develop a model for the assessment of financial distress in airline companies in India with the identified factors.

Objective 3: To test the models developed in step 2 with different factors, and select the one which has the highest assessment accuracy.

1.10 Organization of the Thesis

The organization of the present research work has been spread across seven chapters as shown in Figure 1.7.

Details of each chapter are given below:

Chapter 1

This chapter provides the introduction to the Airline industry globally and in India. The chapter outlines the current phase of the industry and the challenges it faces in India. The chapter explains the gaps in the literature and the motivation behind the study. This section covers the research problem, research questions and the research objective to address these gaps. The chapter also gives details of the contents of each section of the thesis.

Chapter 2

This chapter reviews the literature in detail under two segments:

1. Airline industry issues and challenges
2. Financial distress assessment and prediction models.

The chapter provides information on the themes under which prior studies have been made globally on the airline companies and their issues. The review also studies the different types of financial prediction models developed worldwide. These models are mainly generic in nature while some are specific to a particular industry. The review of global studies, on the two themes, is made to

provide the direction of the research, and highlight the prevalent gap in the studies made to date.

Chapter 3

This chapter details out the research methodology used in the study of ranking of factors and for building the model to assess financial status of an airline. The section explains the details of the data collection procedures, sample design, analysis of data, research methods and the research techniques used.

Chapter 4

This chapter provides details about the factors which are shortlisted for prioritization. The chapter describes the steps adopted for the Fuzzy-AHP process of ranking. The section also explains the significance of the final ranked list of categories and factors.

Chapter 5

This chapter examines the existing financial distress or bankruptcy assessment models and tests them using data from six airlines in India. The results for each airline as assessed by each model are highlighted and discussed.

Chapter 6

In this chapter, the airline financial distress assessment econometric model based on logistic regression is developed. The factors highlighted in chapter 4 are reviewed and tested for use in the model.

Chapter 7

This chapter provides a comprehensive overview of the research work conducted and the major findings. It also describes the contribution of the present study to the existing literature. The chapter further discusses the practical implications of the findings and the benefit the airline industry can obtain from the study. The section also explains the limitations of the study and provides areas for future research.

1.11 Chapter summary

This chapter provides basic information on the airline industry globally and in India. The chapter explains the growth in the industry and reviews the challenges which airlines face in India. The chapter also discusses the gap in

prior studies and describes the proposed research problem. The research questions and objectives addressing these questions are described in detail. In the end, there is a list of the chapters which form the present study with details of the topics covered in each chapter.

The next chapter reviews the existing global literature focused on issues faced by airlines. It also analyses distress prediction or assessment models developed globally for various industries.

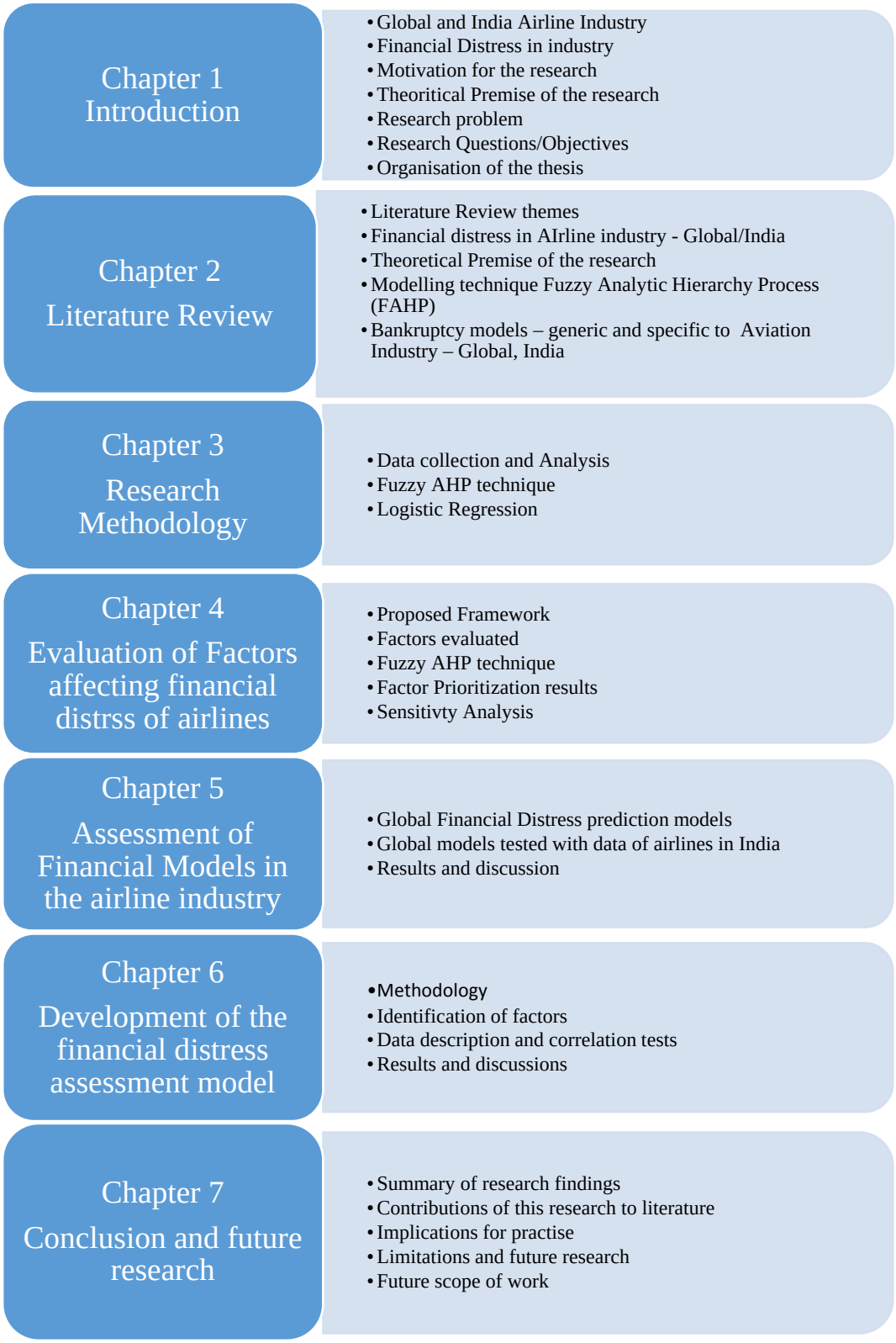

Figure 1.7 Organization of the thesis

Chapter 2
Literature Review

Overview

This chapter reviews the literature and the studies conducted on the airline industry in India and globally with a focus on the issues and challenges it faces, and further highlights the studies made so far on causes of financial distress in airline companies. It also examines the literature on the underlying theory identified for this research. The literature review also covers the studies on the identification and prioritization of critical factors using MCDM (Multiple Criteria Decision Making) analysis such as Fuzzy AHP and other techniques. The chapter then explores the various financial distress assessment models developed globally for a generic industry and those specifically for the airline industry and further evaluates the applicability of these models to Indian conditions.

2.1 Literature review at a glance

Easterby-Smith et al. (2002) suggested that review of literature is a systematic, clear and valid approach for identifying, reviewing and analyzing explicitly, the existing body of knowledge in the particular area. A review of literature assists in recognizing the conceptual and theoretical content of the recorded documents (Meredith, 1993) and helps in the theoretical development of the research area. The following objectives have been accomplished with the help of systematic review and analysis of literature:

1. Specific and relevant topics, themes, methods, approaches, and issues have been identified and summarized.
2. A conceptual outline and corresponding theory; framework and models for financial distress condition, issues and challenges have been developed.

There is a huge amount of literature available on financial distress of the firm/s and it is difficult and also not feasible to explore all research articles and papers. In order to obtain maximum output, only recent and specific topics and issues are included in the review. The literature review considered both qualitative and quantitative aspects for a better understanding of the content and relevancy of the research area.

2.2 Financial distress status in the firm

Financial distress condition in companies has been analyzed in prior literature and based on the author's definitions, the company is assumed to be financially distressed. A company is often considered insolvent or in distress when its total liabilities surpass the fair value of its assets (Altman, 1968). A company is also considered to be in financial distress if it has three consecutive years of negative net income or is unable to pay its debts or has cash shortages to run its operation (Altman, 1993; Gudmundsson, 2002; Lin et al., 2016).

Negative net worth on account of continuous losses is a financial distress condition even if the company is operational, as its existence is funded by its investors and shareholders. This is evident in the e-commerce startup companies which have huge losses in their initial years but continue to operate with support from various investors and shareholders (Tiruwa et al.,2018; Madan and Yadav, 2018; Yadav et al., 2016; Sukumar et al., 2011; Sukumar and Edgar, 2009; Grant et al., 2014; Selli et al., 2010).

In general bankruptcy prediction models, focus on the complete financial failure of the company and which have closed down. This study, however, focuses on those conditions which pre-exist the closure of the company. The study tests the potential prediction power of a blend of operating, accounting and other

variables which assesses the possibility of financial distress occurring in airlines in India.

The study assumes that three years of continuous losses are a distress condition and tests the model for the existence of such a condition in the company.

2.3 Literature collection, major themes, and analysis

A theme based approach is used to search various sources of literature conducted in the past. Sources which were reviewed are research articles and papers, newspaper articles, and industry reports.

The following table shows details of the same:

Table 2.1: Keywords in the Literature Review

Key Words Used	Databases/Publishers
1. Financial issues of Airline Industry globally 2. Financial issues of Airline Industry in India 3. Regulatory Issues in the Airline Industry 4. Impact of bankruptcy or financial distress on the airline's industry 5. Bankruptcy or financial distress assessment/ prediction models which are generic in nature. 6. Bankruptcy or financial distress assessment/ prediction models in India which are generic in nature 7. Bankruptcy or financial distress assessment/prediction models for the Global Airline Industry. 8. Bankruptcy or financial distress assessment/prediction models for the Airline Industry in India. 9. Assessment of the factors using various MCDM (Multi-criteria decision-making methods) techniques	Google scholar Web of Science Scopus Taylor & Francis Elsevier Google-scholar Science Direct, Web of science, Emerald, Inderscience, Springer Wiley Journals, Conferences, research reports and books IATA

2.3.1 Theme based literature review:

Theme-wise Literature Review can be classified as follows:

1. Financial issues in the Airline Industry – Global, India
2. Literature review on Agency Theory, Stakeholder Theory and Porters Theory
3. MCDM techniques for ranking of factors
4. Financial distress assessment/prediction models – generic/specific to Airlines Industry – Global, India

2.4 Financial distress in Airlines – Global and India

Financial distress is a condition, which occurs frequently in many companies. Management needs to be alert when such a condition arises, so that it can take corrective action before it becomes severe, leading to bankruptcy and closure of the company.

Agency theory postulates that management as an agent of the investors, shareholders, and promoters has a duty to ensure that the company continues to function profitably and provide the expected return to its investors (Gomez-Mejia and Wiseman, 2007; Hasnas, 2013). It is important that managers use different tools and methods to monitor the financial health of the company and report it to the investors and shareholders periodically.

Companies publish quarterly and annual reports, which help management and stakeholders to track the financial condition of the company. Financial ratio analysis and distress prediction models are also used to give an insight into the trend of the company`s financial condition. These tools, however, become ineffective if the set of key variables monitored are not correctly selected.

Financial statement scrutiny using ratio analysis is a often used to review the status of the company. The variables are focused on leverage, solvency, liquidity and profitability. Each ratio reviews these aspects and provide the

condition of the company on the basis of the extent of liabilities, its profits, long-term sustainability and the cash-flow status. These ratios are internally focused and show misleading results in an inflationary economy. Similarly, where companies adopt different accounting principles, the results are not comparable. Establishing generic benchmarks for comparing the ratios is difficult as every industry has its own specific operating and financial conditions. Similarly, the size of the company in the same industry will show different ratios which may not be comparable. Changes in the exchange rates will impact the ratios when compared over the years.

Financial distress prediction models have been built globally using mainly financial ratios. Beaver (1966) proposed the use of cash flow to total debt ratio to predict bankruptcies. Altman (1968) was the first to use multiple discriminant analysis (MDA) and built a generic bankruptcy prediction model using accounting ratios (Z score model). Later Altman et al. (1977) developed a revised model called ZETA, which was able to perform better than the earlier Z score model. Springate (1978) developed a model selecting four accounting ratios which were used to distinguish between stable business and those that actually failed.

In India, the focus of research has been to use globally developed generic models using mainly accounting data and applying it to companies from the textile, cement, pharmaceutical and other industries (Barki and Halageri, 2014; Vimala and Saranya, 2014; Bapat, and Nagale, 2014).

The accuracy of these generic models has been found to be low, specifically when predicting more than two years before distress occurs.

Current studies have found, that models when designed with the combination of market, company ownership, and accounting ratios, which are specific to an industry lead to higher prediction accuracy than generic prediction models (Tinoco and Wilson, 2013; Colff and Vermaak, 2014; Nanayakkara and Azeez, 2015; Altman et al., 2014).

Studies in different countries found that country-specific variables related to macroeconomic conditions and specific market variables improved the predictive accuracy as compared to a model using only financial or accounting variables (Madrid-Guijarro et al., 2011; Xie et al., 2011).

Factor analysis and other tools have been used to identify and rank the different ratios in such industry-specific financial distress models (Sayari and Mugan, 2017).

For the aviation industry global studies carried out by Gritta and Bahram, (2006), analyzed two generic and six aviation specific bankruptcy models and found that those using industry-specific factors were better predictors of financial distress in airlines.

Airline specific models incorporating factors related to the airline industry have been found to provide greater accuracy in the prediction of financial distress (Chow et al., 1991; Pilarski, and Dinh, 1999; Gudmundsson, 2002; Silva et al., 2005). Integrated models have been built using data mining and MCDM tools to rank influencing factors for airlines (Pineda et al., 2017).

Prior studies in India on the identification of the key components influencing the financial status of airline's industry in India have been carried out without using any technique or framework (Krishnan, 2008; Pathak, 2015; Behera, 2016). These studies have selected critical factors for an industry, solely on the basis of their own perspective or from prior studies.

This study focuses on the identification of key factors using fuzzy AHP technique thereby reducing subjective bias. This process of accurately identifying variables provides management with the key factors to monitor for signs of future financial distress. These identified factors when used in different tracking methods, such as ratio analysis and distress assessment or prediction models, provide higher accuracy in the assessment of financial distress.

Global research on the airline industry has been focused on two major areas:

1. Study of the financial situation of the airline industry

   These studies are focused on issues and challenges facing the entire industry on account of external conditions, government regulations, and industry trends.

2. Studies focused on a particular airline and its performance.

   These studies are focused on particular airlines and the factors which impacted its performance. These factors could be a single or a combination of both internal and external conditions such as financial, operational, market, economic, regulatory and others.

Many of the global studies have focused on the internal conditions that airlines operated. Northwest Airlines in the USA was found to be profitable as it focused on controlling costs and ensured that the breakeven was achieved such that the gross margins were able to recoup the variable costs (Gritta, 1979). Other studies have focused on the measurement of financial performance through various financial variables and ratios (Teker et al., 2016). Some of the studies have focused on the operational factors which can be modified to get better efficiency and thereby higher financial stability (Trapote-Barreira et al., 2016). Mergers and alliances between airlines in China and the USA led to having mixed results on the financial performance of the companies (Chow and Tsui, 2017; Helleloid and Dakota, 2015).

Several authors have focused on the factors impacting profitability. This was studied by Lopes et al. (2016) for thirty airlines globally. The focus here was to find out how the airline profitability was impacted by human and structural capital. The study also examined whether the region, capital ownership and control/ strategic alliance had on profitability of the company. The composition of the airline market in the USA has been reviewed in a case (Helleloid and Dakota, 2015) which highlighted that the US airline industry was a highly competitive industry with high fixed costs and multiple competitors. These

factors were a major contributor to the distressed financial condition of an airline in the USA.

Alliances between airline companies have been reviewed in some studies (Kuzminykh and Zufan, 2014) and the impact on profitability has been examined using various financial ratios and variables. These studies have confirmed that an airline has a higher company turnover when it joins an alliance.

Several reviews have been carried out as case studies for individual airlines such as Nigeria Airways (Oghojafor and Alaneme, 2014), Emirate Airlines (Nataraja and Al-Aali, 2011) and Air Baltic, SAS (Huettinger, 2006). These studies focused on the various strategies adopted by these airlines and analyzed the cause and effect of the individual airline decisions which led to the financial performance of the airline.

Lee and Park (2014) reviewed the relationship between operating leverage and risk. The authors focused on ten airlines and the data was studied for the period 2002 to 2007. The results based on the empirical tests showed that the overall and systematic risk varied accordingly to the average variable cost and this relationship was inversely proportional for the airline industry. Between the operating leverage and returns and operating leverage and book-to-market equity ratio, the relationship was mainly positive. Hence managing the operating leverage for airlines is very key for its financial stability.

Studies have also been made on the value of the airline and how it changes as it hedges against increasing fuel prices (Treanor et al., 2014).

Several authors have shown that increased borrowing and higher leverage by airlines in the USA leads to lower profitability and EPS (Earnings per share) values. This increased leverage leads to earnings variability and which in the long run ends up in financial distress (Gritta, 1979; Tolkin, 2010). Overinvesting in the form of purchasing aircraft when the market demand is rising is a common phenomenon in Low-cost airlines (Wojahn, 2012) This often

leads to excess borrowing and hence lower valuation. Research on the strategy adopted by highly leveraged airlines showed that legacy airline when in high debt, are more conservative and defer entering new markets, unlike a low-cost airline which continues expansion even when it is facing a financially unstable situation (Liu, 2009). The main reason for a reduction in its expansion plan is as given in Kovenock and Phillips (1995) theory that a highly leveraged firm does not invest owing to internal shortage of free cash. This reduction of cash was arising due to high debt repayments.

A study of the airlines filing for bankruptcy under Chapter 11 regulation in the USA found that there is a substantial improvement in the financial condition of the airlines operating under bankruptcy protection. The research further highlights that the rivals also benefit with higher share prices when an airline company files for bankruptcy (Gong, 2007).

Analysis of the airline industry in 2009 in the USA showed that increasing costs due to the high fuel prices airlines needed to maintain the load factors and ensure the other costs do not increase to maintain the margins. Airlines which were able to hedge against the high fuel prices were able to withstand the higher fuel costs (Morrell, 2011) more cost-effectively.

A study with a focus on the airlines which went bankrupt showed that as some airlines went bankrupt, rival firms market share and value effect increased substantially (Jayanti and Jayanti, 2011). Analysis has also shown that airlines on average lower their fares by 5-6 percent before a bankruptcy filing, but generally do not continue reducing fares when signing up for Chapter 11 bankruptcy. This behavior is found to be a rational business response to lower demand by an airline which is facing financial distress, as passengers are worried that the airline may close down and cancel flights suddenly (Borenstein and Rose, 1995).

Studies have also been conducted on fare pricing trends while facing financial distress. Data shows that as an airline faces financial distress the airfares start

dropping as these airlines start a price war. However the reduced prices are not occurring for all distressed companies and often depend on the individual firm`s operating costs, size and market shares and market concentration (Hofer et al., 2009; Ciliberto and Schenone, 2012; Busse, 2002).

Research by Banker and Johnston (1993), has shown that various strategies deployed by U.S. airlines after deregulation in the USA, had a direct impact on the direct costs. Several companies during the transition stage, adopted strategies to reduce operations-based cost drivers with a focus on improving aircraft size and average stage length, and on diversification of routes and distances covered.

A review of the future of the airlines has been made by several authors with a recommendation to move to low-cost carriers as the most viable strategy for long term sustenance (Rubin and Joy, 2005; Cobb, 2013).

Studies on airline companies in India have focused on specific airlines and the issues they face. A review of the airline industry was made by Behera (2016), on the performance of the airlines as compared to the opportunities and challenges faced by the sector. Specific focus was on the investment made by companies in other countries in aviation and the impact it had on the local companies.

The study concludes that India's aviation industry is having huge growth opportunities, with airline fares still expensive for the majority of the population. The authors propose that there should be a collaboration with the industry stakeholders and policymakers, so that policy decisions taken are beneficial to the growth of India's civil aviation industry.

The growth of the aviation industry has been found to occur when liberalization is implemented as recommended by the World Trade Organization (WTO)/General Agreement on Trade in Services (GATS). Competition has led to better quality of services, lower fares, and higher customer satisfaction.

Liberalization has also led to the entry of low-cost carriers in these open markets (Amana, 2015).

Productivity and efficiency of the airlines in India has been evaluated based on the variable returns to scale (VRS) model of Data Envelopment Analysis (DEA) using data from the financial reports and the Directorate General of Civil Aviation (DGCA) published operation information. The results show that low-"cost airlines have higher efficiency as compared to full-service airlines". Larger and are publicly owned airlines are found to be more efficient in the VRS model. The study further confirmed that size for an airline was a key factor in the efficiency scores (Jain and Natarajan, 2015).

A similar study using DEA was carried out for the airline companies in India in 2016. This study found that higher technical efficiencies lead to higher fares and are accepted by consumers. The passenger of these airlines perceives that the services offered are of higher value and hence higher fares are justified. The authors have concluded that airlines operating in India should ensure their strategies are in line with the regulations and other structural factors prevailing in the industry. Such strategies would lead to operations which are more effective and efficient on a day to day basis (Saranga and Nagpal, 2016).

A detailed evaluation of bankruptcy of Kingfisher Airline found that the company failed on account of the high level of debt and the operating model selected which included high costs. The closure of these airlines in 2012 led to a huge impact on the employees and the aviation industry in India (Ravindrababu, 2012; Pathak, 2015).

A study of the airline's industry in India in 2008, by Krishnan, identified the following main issues which often lead to a financial distress condition in an airline:

1. "Under-capitalization,
2. Poor management,

3. Failure to build a network that could exploit economies of scale and scope
4. Poor cost economies, and
5. Overall high fare levels that suppressed demand"

The report highlights that in May 2008, the growth of passengers in India had reduced to less than 20% compared to the average of 26% in the prior 3 years. Most of the airlines could not maintain profitability. The study reported that in 2008 Kingfisher airlines and Deccan Airways together were suffering a loss of an estimated Rs. 30 million a day.

A detailed study of the government-owned Indian Airlines was made by Hashim (2003). The study showed that the productivity of the airlines was very low in the years under study (1964-99), with the unit costs increasing at almost 10 percent per annum leading to huge losses. This was aggravated by purchases of expensive aircraft (A320) when the recession was prevalent in the industry.

Focus on the introduction of low-cost airlines has been a subject of study by several authors. Bitzan and Peoples (2016), found that the reduction of costs is different for the full-service carriers (FSCs) and the low-cost carriers (LCCs). While LCCs have gained from high load factors but their technical costs are higher. For FSCs the cost benefits are mainly from mergers and acquisitions and the consequent increase in stage lengths and load factors. For these airlines, the adoption of the hub and spoke network system led to high load factors. FSC costs were often lower as they could balance the low margins for short hauls with higher earnings on long haul routes.

A study on fuel efficiency among airlines has found that the consumption of fuel has been stable in US airlines with an improvement of 2% in the fuel efficiency over a two-decade period (Zou et al., 2016).

A detailed study on the China airline market has shown that the deregulation has led to increased competition among airlines (Wang et al., 2016). A study on 49 Asian airlines was conducted on the basis of the type of model adopted: network airlines, low-cost subsidiaries from network airlines, and low-cost

carriers. The study found that the main sources of advantage were slots, brand, and product/service reputation. All the models indicated that managerial skills and experience were key resources required to build an advantage over other competitors. For low-cost carriers (LCCs), managerial competence was found to play a major role in building an efficient and profitable company (Pearson et al., 2015).

An economic and policy review of the airline industry in India shows that growth in this sector is contributed by increasing disposable incomes, the rising middle class, the nature of the untapped market, increasing tourists travel and increasing business travel. These factors will lead to a growth in passenger to an estimated rate of 12-15% per annum. To sustain these growth government policies will need to be well-coordinated efforts keeping in mind the interests of the different stakeholders. Policies which control fares will lead to airlines having reduced margins, especially when the fuel costs are rising. Government policies need to be effective and innovative. The growth of this key sector has to be methodical which will contribute to the social and economic development of the country. Policies should also keep in mind the safety and viability of the industry also (Kochher, 2015).

Review of deregulation of the airline industry has been studied in several articles. O'Connell and Williams (2006) in their case study reviewed how the new regulatory roadmap had transformed the market and supply of domestic air services. A survey among passengers showed that 30% of the passengers who fly for leisure prefer the full-service airlines and consider schedule and reliability important parameters for choosing the airline rather than the airfare. Several leisure passengers, however, chose the low-cost airlines on account of the low fare. A similar study of the impact of deregulation in the USA in the 1980s showed that the effect of deregulation was positive for the airlines in the freedom it allowed. The positive effect was however negated by the increase of fuel prices and the recession which was prevalent during this period (Gomez-Ibanez et al., 1983).

Table 2.2: Themes for Literature Review

Theme	Region	Authors	Inference
Study of Financial Distress in the Airlines Industry – Focus at Industry Level or for a particular Airlines Company	Global	Wang et al., (2016), Chow and Tsui (2017), Seufert et al (2017), Zou et al., (2016), Bitzan and Peoples (2016), , Teker et al., (2016), Trapote-Barreira et al., (2016), Lopes et al., (2016), Lee and Park (2014), Helleloid and Dakota (2015), Pearson et al., (2015), Kuzminykha and Zufana (2014), Oghojafor and Alaneme, (2014), Treanor et al., (2014), Wojahn (2012), Nataraja and Al-Aali (2011), Morrell (2011), Tolkin (2010), Liu (2009), Hofer et al., (2009), Gong (2007), Ciliberto and Schenone (2012), Huettinger (2006), O'Connell and Williams (2006), Rubin and Joy, (2005), Cobb (2013), Busse (2002), Borenstein and Rose (1995), Banker and Johnston (1993),	Reasons analyzed for the distress situation of the airline's industry in that country or for a specific airline. Impact on the shareholder and the industry evaluated. Specific issues/factors discussed for the industry or for the company and which leads to improved financial performances.

		Gomez-Ibanez et al., (1983), Gritta (1979).	
Theme	**Region**	**Authors**	**Inference**
Study of Financial Distress in the Airlines Industry – Focus at Industry Level or for a particular Airlines Company	India	Behera (2016), Saranga and Nagpal (2016), Pathak (2015), Amana (2015), Jain and Natarajan (2015), Kochher (2015), Ravindrababu (2012), Jayanti and Jayanti (2011), Hashim (2003), Krishnan (2008)	Reasons analyzed for the failure of specific airlines in India. The analysis also made for the industry at a macro level. Specific issues/factors listed for a particular company e.g Kingfisher Airlines which failed.

2.5 Theoretical Premise of the research

2.5.1 Agency Theory

Agency theory describes the relationships between two parties where one is responsible to decide on the work to be done, while the other executes the task. In this bond, one party who decides the work acts as the principal and he/she appoints an agent to carry out the task decided. (Eisenhardt, 1989).

In companies, the role of the principal is played by the shareholders of the firm who decide on the tasks which are assigned to the agent, and which is played by the management of the company. It is therefore important for the management (agent) to monitor and keep the principal (shareholders/ investors) informed on the future financial condition of the company.

The agent has to take necessary steps to ensure that the investment of the shareholder has value added to it and is not lost in the future (Shareholder Value Theory). Shareholder value theory advocates that the main responsibility of the management is to ensure that the returns for the shareholder are maximized.

Studies on Agency theory have focused on relationships between agent and stakeholder and its impact on corporate governance in the company (Langtry, 1994; Shankman, 1999; Wright, 2001; Nyberg et al., 2010). A few studies have reviewed the relevance of agency theory in a global context (Gomez-Mejia and Wiseman, 2007; Hasnas, 2013). Agency theory has also been appraised from the impact on earnings reported (Jiraporn et al., 2008; Bao and Lewellyn, 2017).

Agency theory also shows that the growth of the firm is a result of the manager being inclined to pursue growth as it will also assist the manager to achieve his/her personal goals. Growth ensures that the manager has a guarantee of employment with increased responsibility due to the growing firm (Murphy, 1985).

There is often a conflict of interest between the company managers and its shareholders where managers tend to focus on their own personal objectives. This conflict, as explained by Agency theory, is subdued when there are large debts and the lenders are the major principal in the relationship (Easterbrook, 1984; Rozeff, 1982; Grossman and Hart, 1982).

Agency theory also explains that corruption or instances of bribery are reduced where there is no division between owner and manager. However when there is an increase of equity share with a single entity becoming the largest shareholder the instances of bribery will grow when it benefits this largest shareholder (Ramdani and Witteloostuijn, 2012). The study also shows that when there are incentives awarded to executives in the form of stock options there will be a minimum conflict between senior executives (CEO, CFO, COO) and the shareholders.

2.5.2 Stakeholder Theory

The traditional definition of a stakeholder is “any group or individual who can affect or is affected by the achievement of the organization’s objectives (Freeman, 1984). The stakeholder theory is about how the relationship should be maintained with the various entities interacting with the organization.

Friedman (2006) proposed that a firm should be considered as a collection of stakeholders where the managers have to ensure that the interests of the stakeholders are protected. Management should focus on the sustainability of the company and safeguard the welfare of each category of the stakeholder.

Evan and Freeman (1988) have "advanced two fundamental principles: The Legitimacy (PI) and The Stakeholder Fiduciary Principle".

The Legitimacy (PI): "The company management should focus on the benefit of the stakeholder which are its customers, suppliers, owners, employees, and local communities while taking any major decision. These entities should be protected and should have a say in any decision taken which impacts them".

The Stakeholder Fiduciary Principle (P2): "Management has a fiduciary relationship with the different entities and must always work for the benefit of these stakeholders. Management has a responsibility to function in a way that the survival of the firm is ensured so that the long term interests of the entities are protected".

The stakeholder theory thus suggests that the Manager has a responsibility to ensure financial distress does not occur and the various stakeholders suffer. The main groups of stakeholders identified are:

- Customers
- Employees
- Local communities
- Suppliers and distributors
- Shareholders

In the event of a bankruptcy, the above stakeholders are impacted negatively.

The theory proposes that maintaining the interests of non-financial key stakeholders has a direct impact on the firm's capability to build value (Becchetti et al., 2012; Freeman, 1984, 1994, 1999; Hillman and Keim, 2001; Platt and Platt, 2012). Corporate failures (e.g., Tyco International, Enron) have

occurred in the past even though these companies efforts were focused on maximizing shareholder value. This clearly shows that a focus only on shareholders as the most important stakeholder class does not generate the results expected (as proposed by the shareholder maximization theory). Hillman and Keim (2001) have shown that developing better relationships with primary non-financial stakeholders can assist a firm in building valuable resources.

Different kinds of stakeholders can be grouped based on the relationship they have with the firm. Friedman (2006) has proposed two main groups of stakeholders:

"Group1:

• Customers
• Employees
• Local communities
• Suppliers and distributors
• Shareholders

Group 2:

• The media
• The public in general
• Business partners
• Future generations
• Past generations (founders of organizations)
• Academics
• Competitors
• NGOs or activists – considered individually, stakeholder representatives
• Stakeholder representatives such as trade unions or trade associations of suppliers or distributors
• Financiers other than stockholders (department holders, bondholders, creditors)
• Competitors
• Government, regulators, policymakers"

The role of Managers has varied according to different studies. Some regard them as stakeholders while considering them as a part of the organization's actions and responsibilities. Aoki (1984) in his study proposed managers as referees between investors and employees.

Using a stakeholder management perspective, studies have been conducted to check the impact of the characteristics of the company and the probability of filing for insolvency. Similarly, the focus has been on the parameters which influence when a firm will be solvent after spending a number of years in bankruptcy. Theoretical predictions tested for publicly traded firms from 1980–99, shows that unfavorable executory contracts with primary stakeholders positively influence a firm's likelihood of both filing and reorganizing in bankruptcy. Studies have found that filing for bankruptcy can be a means by which companies can evolve strategies to make them stronger and eliminate any reduction in value or the firm`s competitiveness in the market (James, 2016). Corporate finance theories have not explored the impact of a firm`s decision to file for bankruptcy on the influence of other stakeholder interests. Sharon has proposed that filing for bankruptcy is a potential mechanism for implementing value-enhancing changes and that strategically filing for bankruptcy can assist companies to maintain the value and ensure long-term sustainability.

2.5.3 Porters Five forces theory

Bankruptcy in the airline industry in India can also be studied from the perspective of Porter`s five forces theory (Porter, 1980). This theory states the growth and competition in an industry is dependent on five forces:

These forces are:

1. Competition in the industry;
2. Potential of new entrants into the industry;
3. Power of suppliers;
4. Power of customers;
5. The threat of substitute products.

Porter's Five Forces theory is used to explain the reasons for the varying levels of profitability in different industries. Using these forces, one gets a measure of the level of competition in the industry, pull of the sector and lucrativeness of a market.

Porter developed the five forces model so that organizations could evaluate the competitiveness of the industry and formulate strategies effectively. The theory projects that these five forces are a main influencer on the competition prevalent in the particular market. Management of an individual company can carry out analysis of the industry and the market using the five forces and decide on strategies which will leverage these forces to its advantage.

Porter`s theory provides a view on the attractiveness of the industry and the prospects of profitability conditioned by the external forces. This becomes the underpinning theory for this study where the airline industry is evaluated for its profitability.

The airline industry in India has specific characteristics which periodically lead to financial distress and this situation can be investigated from the five forces theory perspective. For this industry the forces can be defined as follows:

Power of Competition: Airlines have limited Control on the revenue due to extensive competition in the industry.

Potential of new entrants into the industry: There are new business models such as low-cost airlines which are adopted by new companies entering the market.

Power of Suppliers: Limited control on Key costs and suppliers (Fuel, airport charges, Aircraft Manufacturers, etc) with few firms dominating this business.

Power of Customers: Limited scope for differentiated strategy due to the power of customers.

The threat of Substitute Products: Advanced mode of transport such as fast and comfortable trains introduced on some routes which provide a direct threat to the airline industry.

Global studies on Porter`s theory have been conducted on the impact that the five forces have on a particular industry e.g urban transport in Spain (Gomez et al. (2014), Jordanian food industry (Jaradat et al., 2013), aviation industry in Iran (Rasouli and Malabad, 2014), pharma Industry in Saudi Arabia (Hassan and Arfaj, 2016), retail stores in India (Boora and Kiran, 2016), e-commerce (Oudan, 2016).

An review of the telecom sector in Oman, made using Porters five forces theory, focused on the competitiveness of this industry (Rajasekar and Raee,2013). The review of the sector found that the threat of entry was moderate and the power of suppliers low. The power of buyers was also moderate but the threat of substitutes was high with the new technology bringing major changes to the telecommunication business models. Competition in this industry is also high with the increasing rate of growth. The players in this market need to develop strategies focusing on new technology and ensure it is adopted by the consumers on a large scale.

A study on the relevance of the Porters theory in the IT-enabled services in India which is considered as a new age industry was conducted by Krishnamurthy (2010). The review found that the industry had low entry barriers, high competition between the players in the industry, very high bargaining power of the foreign buyers, high bargaining power of hardware suppliers and limited differentiation between the services offered by the industry players. However, this industry in India has shown strong growth and high returns which were in contrast to the conclusions derived from Porter`s theory. These studies suggest that Porter`s theory requires a greater analysis when applied to these emerging industry sectors.

Study of the Aviation industry in India has been made in a case study by Chava (2015), where analysis was made using Porter`s 5 forces theory. The study shows that the players in this sector will need to primarily focus on reducing their cost structure and adopt a cost leadership strategy. This strategy will ensure lower costs, lower fares and a competitive advantage for the airlines. This strategy is found to be specifically relevant to the airline industry where customers are highly price sensitive and costs changing dynamically. The focus areas for reduction of cost proposed by him are passenger load factor, cargo load factor, fuel consumption per kiloliter and revenue per passenger kilometer.

The strategy of full cost airlines moving to the low-cost carrier or a hybrid model requires consideration of several other factors. This study (Corbo, 2017) was made for two airlines, Air Berlin and JetBlue, and the research shows that moving between different business models requires the company to first evaluate the competitive advantage (Porter, 1980) that the airline gains from adopting a particular model. Other studies (Berman, 2015), on the advantage of low-cost airlines over full-service airline and the competitive advantage they enjoy, have been conducted using Southwest Airlines as an example. Using Porter`s theory (1980) this study defines the various strategies that other airlines can adopt when competing with low-cost airlines.

Other studies (Adler and Gellman, 2012; Demirtas, 2013; Akbar et al., 2014; Sengpoh, 2015; Akamavi et al., 2015, Pearson et al., 2015) have evaluated the strategies adopted by different airlines and offered solutions for improving the financial performance of the airlines reviewed based on Porter`s theory (1980).

The pricing strategy of airlines has been examined by Narangajavana et al. (2014) and they have found that several factors impact the strategy adopted as proposed by Porter (1980). The pricing perspectives are defined by the external environment, seasonality, competitive strategy and the demand for the particular route for the airline.

Evaluation of the diversification strategy as followed by Emirate Airlines has been reviewed in the context of Porter`s five forces theory (1980). This airlines have been found to counter new companies entering the market through the building of core competencies and collaborating with key players (such as Qantas) and the introduction of low fares for certain routes. The supplier bargaining power has been reduced through the setting up of engineering and maintenance company and an in-house catering company. The threat of substitutes has been met with a strong reward points system which motivates passenger to use the Airlines (Redpath et al., 2017).

Corporate failures are also impacted by major changes in the external environment as explained by Porter theory (1980). Industry factors such as competition changes, reduction of entry barriers, and market growth were often parameters when ignored, led to the poor organizational performance and ultimately to financial failure (Heracleous and Werres, 2016).

2.6 Factors affecting the financial condition in airlines

Factors, which influence the financial condition of airlines, have been collated from previous studies and responses from industry experts. The lists of categories and factors are shown in Table 4.1. The identified factors can be grouped into “six categories: operational, economic/government, performance related, financial, market related and external”.

Within each of these categories, there are several factors which can be considered important. For example, for the operational factors, the load factor is critical as it provides the capacity utilization for the airlines. This factor will have an impact on the pricing and profitability of the airlines (Chow and Tsui, 2017; Chang and Yeh, 2001; Behn and Riley, 1999; Zhu, 2011). Among the other important criteria is the financial one which has several factors which will impact the sustainability of the airlines. Some of them which have been considered in earlier studies are revenue or sales divided by assets, Current assets minus current liabilities or Working Capital and divided by sum of assets,

Current assets/current liabilities etc (Altman (1968); Pilarski, and Dinh (1999); Altman et al., (1977); Chow et al., (1991); Silva et al., (2005); Hsu (2017); Behera (2016); Krishnan (2008); Stepanyan (2014); Lu et al., (2015); Pineda et al. (2017)). Other criteria which can influence the financial performance of an airline are inflation, operating costs, labor costs, change in aviation fuel price, operating revenue per RPK (revenue passenger kilometer).

2.7 Modelling technique Fuzzy Analytic Hierarchy Process (FAHP) used in Evaluation

AHP is a technique by which to select the most suitable from various options or criteria (Saaty,1980). The methodology followed for ranking the alternatives is carried out using particular criteria and a numerical value is attached to each option or alternative based on how to fit the option is for the criteria specified. The decision is often based on comparisons between two options.

While carrying out a comparison between two options a scale is used to assign a number to indicate which of the two a better option (Taha, 2003) is. The scale often measures from 1 to 9 and ranges from equally important to the highest importance. In matrix which is developed after the pairwise comparison matrix, the value 9 specifies that this factor, when compared to another, is of maximum importance as compared to the other. The reverse is indicated by 1/9 which shows that the factor is of least importance when compared with another (Talluri and Narasimhan, 2003).

Saaty (1980) developed the process of AHP to assist in finding optimum solutions for ranking of different factors based on the criteria. The process has been used extensively as a tool and used to provide a solution to various prioritization problems in management and economics (Bard and Sousk, 1990; Evangelos, 2000; Wabalickis, 1987). AHP has been deployed in a number of decisions making exercise such as supplier selection, evaluation of various projects and even arriving at a decision on the person to be employed.

AHP thus helps the manager or decision maker to find a resolution to a complicated problem through a process based solution of deciding which factors are most relevant to the solution especially where the factors are in conflict with each other.

Studies have found that AHP is a very useful and flexible tool which can be utilized for breaking up complex tasks or issues specifically where there are qualitative and quantitative facets to be measured. AHP is an analytical tool which provides a solution by building a hierarchy list of the key issues of the problem (Bertolini et al., 2004). AHP has been used effectively in various areas especially in supply chain management and similar applications (Ali and Kumar, 2011; Kumar et al., 2007; Kumar and Ali, 2010; Srinivas and Kumar, 2009; Mani et al.,2016; Mani et al.,2016; Mani et al., 2018; Mani and Gunasekaran, 2018; Li et al., 2018)..

Factors at each level are compared pairwise and the preference of each of them is specified through an eigen value. The process is continued for sub-criteria (factors are broken up into sub-criteria) until each sub-criteria is assigned a weight which gives it a rank against the objective being studied or resolved (Pohekar and Ramachandran, 2004). Prior studies have shown that the comparison ratios in AHP are a result of uncertain or imprecise decisions (Leung and Cao, 2000). It has been found that humans are unable to make precise quantitative comparisons but are more comfortable in qualitative forecasting (Kulak and Kahraman, 2005; Zhang et al., 2017; Sahu et al.,2018; Zhang et al.,2018). This imprecise and subjective judgment leads to inaccurate prioritization in the AHP process and hence wrong results (Leung and Cao, 2000).

To counter this weakness in the AHP technique, Fuzzy AHP was proposed by Chang (1992). The fuzzy AHP technique is considered to be an advanced analytic hierarchy process developed from the traditional AHP. Several studies (Boender et al., 1989; Buckley, 1985; Chang, 1996; Laarhoven and Pedrycz, 1983; Lootsma, 1997; Ribeiro, 1996) have found that fuzzy AHP which is based

on Saaty`s theory provides better results than the conventional AHP. "Fuzzy theory-based methodology mitigates the uncertainty arising in the decision-making process which is absent in conventional AHP (Luthra et al., 2016; Sengar et al., 2018)".

Fuzzy AHP has been deployed in different ranking or prioritization problems in management applications.

When the system is complex, the inputs from humans lead to ambiguous inputs. These inputs can provide more accurate results using the Fuzzy AHP.

Simple AHP technique does not take care of the uncertainty derived from the human inputs into the ranking results (Cheng et al., 1999). Extent analysis on fuzzy AHP as proposed by Chang utilizes triangular fuzzy values preparing the matrix of pairwise comparisons between factors.

"Many authors have used this framework in diverse areas and have found the framework to be robust in such situations (for example, the studies of Prakash & Barua, 2016; Vishwakarma et al., 2016; Prakash et al., 2014, 2015;)".

Details of decisions in management issues where this approach has been used are given in Table 2.3.

Table 2.3: "Application of Fuzzy AHP approach

Serial No.	Study	Approach	Stream
1.	Junior et al., (2014)	Fuzzy AHP	Supplier selection and evaluation model
2.	Taylan et al., (2014)	Fuzzy AHP	Assessment and evaluation of construction projects
3.	Patil & Kant, (2014)	Fuzzy AHP	Overcome the barriers to knowledge management adoption
4.	Jakhar, S. K., & Barua, M. K. (2014).	Fuzzy AHP	An integrated model of supply chain performance evaluation and decision-making using

			structural equation modeling and fuzzy AHP
5.	Chen et al., (2015)	Fuzzy AHP	Assessment and evaluation of teaching performance
Serial No.	**Study**	**Approach**	**Stream**
6.	Govindan et al., (2015)	Fuzzy AHP	Evaluation of the drivers of GSCM
7.	Prakash et al., (2015b)	Fuzzy AHP	Overcome the RL barriers to prioritize the solutions
8.	Prakash C, Barua M.K. (2015)	Fuzzy Environment	This looks at the combination of AHP-TOPSIS method for ranking of solutions reverse logistics process.
9.	Prakash C, Barua M.K. (2016)	Fuzzy Environment	Model for reverse logistics in third-party selection of partners.
10.	Cengiz et al., (2016)	Fuzzy AHP	Prioritize the action plan for strategic decision making
11.	Zyoud et al., (2016)	Fuzzy AHP	Assessment of water loss management framework
12.	Lee and Seo, (2016)	Fuzzy AHP	Evaluation of cloud service selection framework
13.	Kumar et al., (2017)	Fuzzy AHP	Allocation model for sustainable supply chain
14.	Li et al., (2017)	Fuzzy AHP	Assessment of in-flight service quality of airline
15.	Awasthi et al., (2017)	Fuzzy AHP	Evaluation model of globally sustainable supplier selection

Serial No.	Study	Approach	Stream
16.	Kumari et al., (2017)	Fuzzy AHP	Study of key factors for the role of entrepreneurs by women in India.
17.	Prakash C., Barua M.K. (2017)	Fuzzy AHP	Use of Fuzzy AHP and IRP Framework for building a model applied to logistics industry".

The above list of studies shows that the Fuzzy AHP logic technique has wide application in various evaluations of various items such as critical suppliers, service levels, performance levels, and projects.

2.8 Literature on Bankruptcy models – generic and specific to Aviation Industry – Global, India

2.8.1 Generic Prediction Models - Global

Over the past fifty years, a large number of studies have developed a variety of bankruptcy prediction models which can alert in advance the prospective failure of individual firms.

Use of accounting ratios has been widely adopted in these models. Attempts have been made to come up with a combination of ratios which could lead to the prediction of bankruptcy and thereby foresee the financial stability of the company.

Beaver`s (1966) proposed the use of cash balances and divided it by liabilities to predict bankruptcies. He studied with a data of 60 companies and obtained

thirty financial variables/ratios for failed and non-failed companies. He concluded that the ratio with cash and liabilities provided higher accuracy of the occurrence of bankruptcy.

Altman (1968) was a pioneer in the use of multiple discriminant analysis (MDA) in the development of a bankruptcy forecast model. Altman used five ratios from the financial statements and developed a score which he called as the Z score. This score would provide an indication of the occurrence of financial failure in the future.

Altman et al., (1977) revamped the existing model and called the new model, ZETA, which was effective in predicting failures leading to bankruptcy even up to 5 years in advance for a sample of corporations from the manufacturing and retail industry. The variables used and the weights for these variables would differ across countries, industry sectors and regions. This limitation of the Altman`s earlier model led to the development of a specific model for Mexico based on data from Mexican companies (Altman`s Emerging Market model of 1995).

Springate (1978) developed a model selecting four ratios which were used to distinguish between sound business and those that actually failed. "The four ratios were working capital/total assets, net profit before interest and taxes/total assets, net profit before taxes/current liabilities and sales /total assets".

In Springate`s model, the company is predicted to become bankrupt when Z is equal to or less than 0.862. The model was tested on 40 companies and was able to predict bankruptcy one year in advance and with an accuracy of 92%.

Fulmer et al. (1984) developed a model using MDA with forty accounting and financial ratios which were taken from a sample of sixty companies which had an equal distribution of healthy and failed companies. The accuracy of this model was 98% one year in advance and 81% two years earlier.

Researchers in different countries have tested the accuracy of these models in diverse industries with mixed results.

Using data of American companies from 1980 to 2006 “five bankruptcy prediction models: Altman (1968), Ohlson (1980), Zmijewski (1984), Shumway (1999), Hillegeist et al., (2004)” were tested for accuracy levels (Wu et al., 2010). The study indicated that the MDA model developed by Altman is less accurate when compared to the other four models. Ohlson and Zmijewski proposed models based on accounting ratios showed high accuracy levels of prediction for prior years but lower for the current periods. Shumway hazard model, which used market and company financial data, gave better results than the other models using only accounting ratios. Hillegeist model (2004). was an option implied probability model, and had lower accuracy than the Shumway model.

Shumway (1999) model was found to give better results and could be used by auditors to test the going concern status of the company being audited (Sun, 2007).

Springate and Altman models were tested in Turkey using 3-year data of Istanbul listed companies. A comparison was made for the results emerging from the application of the two models. The results for both these models showed that they led to similar conclusions for the different sectors tested (Turk and Kurklu,2017). The different models proposed by Altman (Z score, Zeta model and Z3 Modified Model) have been tested for the prediction of the bankruptcy of industrial companies listed on the Iraq Stock Exchange. The output was different for three models, but they all predicted that the identified distress companies would go bankrupt (Ali and Abbas, 2015).

Taffler (1984) model was tested with the data of companies operating in Jordan and results indicated that the inclusion of non-financial indicators led to higher accuracy percentages (Al-Kassar and Soileau, 2014).

The Altman model has been tested with data from different countries and companies. These results have found the model to be robust and can predict insolvency one to two years ahead. However, the accuracy reduces when tested for three years prior to bankruptcy, especially for the service industries. A comprehensive study found that the original Z''-Score Model gave good results when used in other European countries. However, the accuracy improved with country-specific variables and factors (Altman et al., 2014). Companies in Iran were also tested using the Altman model for insolvency prediction and it was found suitable for subsidiaries of a group of companies (Aghaei and Kazemi, 2013). In another study for companies in Romania, Altman scores were built through statistical methods and then tested on the data (Balan, 2012). The results were consistent with other studies using the Altman model.

The current trend has been to design models using non-parametric techniques such as Neural Network (NN), Rough Set DEA, Case-based Reasoning and Support Vector Machine and non-parametric CART (Classification and Regression Trees) decision trees (Odom and Sharda, 1990; Tam and Kiang, 1992; Altman et al., 1994; Yang et al., 1999; Atiya, 2001; Shen and Tay, 2002; Cielen et al., 2004; Shetty et al., 2012; Virág and Kristof, 2005; Bose, 2006; Hui and Sun, 2006; Hua et al.; 2007; Ahn and Kim (2009); Chen et al., 2011; Premachandra et al.,2011; Brédart, 2014; Gepp and Kumar, 2015).

Data from 60 Latin American firms and 185 Polish companies were used to develop models using Discriminant analysis, CART and ANN (artificial neural network) techniques. The results show that the model built using the CART technique was much more suitable for the dynamic and unstable markets of Latin American countries than the discriminant analysis or ANN-based models (Korol, 2013).

Different techniques used for developing these assessment models have shown varying results. For a particular data, decision tress performed better than logistic regression. However logistic regression technique was found to be more

accurate than the radial basis functions. Similarly, support vector machines showed poorer results as compared to other techniques. Decision tree models were found to give better results but neural network model parameters could fit into any set of data. The particular technique chosen depends highly on the preferences adopted by the user (Olson et al., 2012).

Case-Based Reasoning (CBR) has been used to develop distress assessment models in some studies (Martin et al., 2012; Ahn and Kim, 2009). This method is found to have certain advantages over other methods as it uses business intelligence (BI) methods and thereby hence provides higher accuracy of assessment.

Global models have been developed using data from bankrupt companies from across the continents of Asia, Europe, and America. These models used the logistic regression technique and the results have found acceptance by many multinational companies to evaluate companies in the region they operate (Alaminos et al., 2016).

A different method for computing the Z-score was developed using a Pearson type of distribution to the modofied financial ratios (Naresh Kumar and Hari Rao, 2015). This technique was found to be superior to the MDA (multiple discriminant analysis) methods proposed by Altman (1968). Similarly, a model developed using logistic regression with accounting ratios from Hungarian companies was found to give a higher accuracy than a discriminant analysis model (Hajdu and Virag, 2001).

A study was conducted in 2009 in Romania to compare the results from Altman and Taffler model with a new model developed using logistic regression. The authors found that the model developed, using logistic regression, was the most ideal for the data (Smarandaa, 2014). Logistic regression bankruptcy models using Bianco and Yohai (BY) estimator method were found to give higher accuracy in the classification and prediction of bankrupt firms (Hauser and Booth, 2011).

The “Partial Least Squares Logistic Regression (PLS-LR)” technique allows the integration of a large number of ratios in the model and further reduces any correlation issues. This method was used to develop a model with thirty-three financial ratios. The ratios were chosen from earlier studies of Altman, Deakin, Ohlson, etc and further based on their impact on the financial situation of businesses. The authors applied this technique to 800 French companies and found this technique gave accurate results, similar to a logistic regression model (Ben, 2017).

Value Erosion Model (VEM) has also been used in the prediction of bankruptcy in companies in some studies. The model developed shows that the value of the company diminishes as the company faces insolvency (Jayasekera, 2018).

Using trend variables with discriminant analysis and decision tree methods has been found to have a better predictive ability than the Altman model (Gavurová et al., 2017).

Type of ratios used for developing a distress assessment or prediction model also depends on the country where the company operates. A model was developed to predict bankruptcy in European and Japanese companies using three predictor variables: Retained Earning/Total Asset, Total Debt/Total Asset and Current Liability/Sales using the LASSO (least absolute shrinkage and selection operator) method. The model was developed using a discrete hazard model and tested over different prediction horizons. The model found the ratio of equity to total liabilities was not suitable for Japanese companies, as these firms have other alternatives of obtaining financial support from a (Keiretsu) group company (Tian and Yu, 2017, Sensini, 2016). Hazard models are found to be better in accuracy when used with market and accounting information as tested with data from UK companies (Bauer and Agarwal, 2014).

Cash flow ratios as a predictor of insolvency were also explored in 1995 (Rujoub et al., 1995) and were found to have higher accuracy when compared to the accrual accounting data.

Comparison of different financial variables used in the existing bankruptcy or distress prediction models in seven post-Communist countries shows that irrelevant variables can be reduced without impacting the accuracy of the model (Zvarikova et al., 2017, Kubickova and Nulicek, 2016).

Bankruptcy Index method consists of combining linear discriminant analysis and Box-Cox transformation of variables. The variables used in this technique are the total assets turnover ratio (ratio of sales to total assets), the ratio of quick assets (current assets minus inventories) to sales, and the value of total assets in euros. This model was tested with data from the Czech Republic for the period 2008–2010. The results show that the model gives a higher prediction accuracy than the Altman model specifically for non-manufacturing companies and smaller size companies (Karas and Reznakova, 2014).

A model based on the accounting, market and macroeconomic variables for companies in the Cyprus stock exchange found that the prediction power of the bankruptcy model designed based on market and accounting variables and using logistic regression, had the highest accuracy compared to those built only with accounting data alone or with market data only (Nouri and Soltani, 2016).

Employee-related ratios along with financial ratios were tested in a prediction model for Austrian companies. The study found that the inclusion of employee-related ratios had a limited impact on the predictive accuracy of the model (Situm, 2015). Similar tests for a model based on financial, macroeconomic and market variables were conducted with data for companies from the USA for the period 1980 to 2011. The results showed that combining accounting, market data in financial distress prediction models for listed companies gave better results than accounting only models (Altman model). However macro-economic data did not add any value to the accuracy of the model (Tinoco and Wilson, 2013).

A study using only debt ratios was conducted for the Romanian companies in 2016 for the period 2001 to 2011. The research recommended the use of debt

ratios in several categories based on the risk of bankruptcy, for a decision on granting loans to companies. High-risk companies which have a greater probability of insolvency will not be eligible for getting further debt from financing institutions. A similar study was conducted for the same sample by the author using the ratio: Total assets/ total liabilities. This ratio provided an indication to the creditor on the potential of a bankruptcy (Brîndescu-Olariu, 2016). A similar study of Italian companies used the logit model with debt coverage ratios, capital structure ratios, and composition of assets ratios. The results were comparable to the Altman model (Muscettola, 2015).

Globally studies are now focusing on designing models which use specific factors from the relevant industry for which the model is being developed. This approach has been found to give a prediction accuracy which is much higher than industry generic models (Avenhuis, 2013; Tinoco and Wilson, 2013; Nanayakkara and Azeez, 2015; Altman et al., 2014; Sayari and Mugan, 2017, Bandyopadhya, 2006). The factors which are incorporated into these models are taken from the internal operating conditions and from the external environment in which the company operates.

Models specific to industry for use by the banks, have been prepared using data from Hungarian companies. These models were prepared with logistic regression which was found to have better accuracy as compared to the MDA method (Hajdu and Virag, 2001).

A model developed using qualitative ratios based on human capital when combined with financial ratios gave higher accuracy of prediction of insolvency. This is more relevant when applied to new firm defaults in knowledge-intensive and high technology industries (Wetter and Wennberg, 2009).

A study on the US and Canadian companies which became insolvent was conducted in 2013. Four techniques were utilized to develop the models: “Bayesian, Hazard, Mixed Logit and Rough Bayesian techniques” as per

research conducted by Chaudhuri, 2013 . Those companies which were financed with a significant amount of debt and later went bankrupt led to the Type 1 error where the company was heading for insolvency but was not identified as a high-risk firm. This erroneous prediction led to a high level impact of Type I error. However, those companies which were predicted wrongly with a high risk of bankruptcy were not advanced credit and led to the Type 2 error. The cost was lower than the cost incurred for the Type 1 error. The results indicate that the "Hazard, Mixed Logit and Rough Bayesian models are superior to the Bayesian model based on randomly selected samples when the ratio of Type 1 to cost of Type 2 errors is low. When the ratio of Type 1 to Type 2 is high, the Bayesian model is preferred in insolvency predictions" as per the research of Chaudhuri, 2013.

Models designed using variables from the local macroeconomic conditions and markets have shown higher accuracy in their prediction when matched to a model using only financial or accounting variables (Madrid-Guijarro et al., 2011, Xie et al., 2011). Results from these studies have shown that these prediction solutions, exhibit accurate results when it is developed for a particular sector or a country. Generic models do not always fit well with the local country and industry conditions.

A study to identify if the bankruptcy of young firms is more difficult to predict than the bankruptcy of established firms. This was confirmed when data from Belgium were tested (Pompe and Bilderbeek, 2005).

Impact of the distress condition on the investment decision of a company has found that the investment behavior does not follow the same pattern for companies facing financial distress, and the inclination to under-invest is subject to the opportunities to invest made available to the company (López-Gutiérrez et al., 2015). This study is important as it highlights why companies which are undergoing reorganization when in distress, often miss out profitable opportunities in their inclination to under-invest.

The insolvency of companies measured using the Black–Scholes–Merton (BSM) has also been compared with that of the Bharat Shumway model in some studies. The review found that measuring volatility directly calculated from the monthly value returns gave superior results than the method of measuring random volatility as suggested in the Bharat Shumway method (Charitou et al., 2013). A study based on data from British companies shows that a comparison of market and accounting based models gave similar results (Agarwal and Taffler, 2008).

Bankruptcy prediction models have also been developed by removing the impact "of earnings management resulting in a higher accuracy of prediction of financial distress" as denoted in the studies of Lin et al., 2016 and others (Cho et al., 2012; Lin et al., 2016; Veganzones and Séverin, 2017).

The focus of several studies has been an assessment of the risk of financial distress rather than complete insolvency. Models which provide an alert mechanism on the occurrence of financial distress have been developed globally (Gudmundsson, 2002, 2004; Colff and Vermaak, 2014; Manzaneque et al., 2015).

Financial distress is the precursor to the company going bankrupt and it is extremely useful to investors, lenders, and shareholders as they are forewarned about the occurrence of complete insolvency. These models define the state of financial distress and attempt to predict the occurrence of such a state.

Several definitions of financial distress have been adopted in prior literature. A state of financial distress condition exists when it appears that the company will not be able to meet the payments against its short and long-term liabilities in the next six months. Further, if the financial status is so critical that there will be insolvency in the following 6 months then it is considered to be in distress (Colff and Vermaak, 2014). Some authors (Gudmundsson, 2002), have defined financial distress as a state occurring when it incurred operating losses continuously for two years or in three or more of the five years under review.

Other studies have defined financial distress as a) When earnings before interest, taxes, depreciation, and amortization are below its financial expenses for two consecutive years and /or

b) when the market value of the company falls for two consecutive periods (Manzaneque et al., 2015).

2.8.2 Generic Prediction Models - India

A number of studies in India have also used these models and applied them to companies from the textile, cement and pharmaceutical industries.

Barki and Halageri (2014) studied the financial health of five textile companies in India from the period 2002 – 20012 and applied the Altman Z Score model to these companies. The objective was to predict, analyze and compared their financial health using the model.

Study of top 25 Indian pharmaceutical companies based on their debt was made by Vimala and Saranya (2014), using the Altman`s Z score and Zeta score. The study was based on the consolidated financial statements reported by these twenty-five companies. Out of the twenty-five companies, it was found that twenty percent of the companies were in danger of becoming bankrupt in the next two years based on their Z scores.

There are also a number of papers which have studied the performance of logit regression and neural networks models and compared them to those based on multiple discriminant analysis.

Bapat and Nagale (2014), compared the performance of bankruptcy prediction models using multiple discriminant analysis, logistic regression and neural network for listed companies in India for the period 1991 to 2013 using data of 72 bankrupt and 72 non-bankrupt companies. The bankrupt companies in this study were those companies which were delisted from Bombay Stock Exchange or National Stock Exchange and whose latest net worth and the net worth prior to the year of delisting was negative. In this study, thirty-five financial ratios

were used for analysis. The results indicated that neural network achieved the highest overall classification accuracy for all the three years prior to bankruptcy as against the results found using the multiple discriminant analysis and logistic regression. The paper recommended that non-financial variables should be studied further for their use in bankruptcy predictions.

Research on these topics in India, has been focused on using models developed in other countries and applying them to different industries in India, such as cement, pharmaceutical, banks etc. (Bapat and Nagale (2014); Karthik and Nair, 2015; Narendar et al., 2013; Pradhan et al., 2011, 2013; Barki and Halageri, 2014; Yadav and Vijay, 2015).

A detailed study (Singh and Mishra, 2016) of 208 manufacturing companies in India was conducted in 2016 with 130 of the companies being insolvent. Bankruptcy models developed by Altman (1968), Ohlson (1980) and Zmijewski (1984) were re-estimated using data from Indian companies. Altman and Zmijewski model were re-estimated using local data and with Multiple Discriminant Analysis (MDA) and Probit techniques respectively, while logit regression was used for the Ohlson model. The results showed that the accuracy level of the re-estimated models for Indian companies was higher than the original models. The study also showed that time periods have a significant impact on the coefficients used in the model. This study was however limited to manufacturing and excluded the banking and service sector.

Evaluation of the steel industry in India was carried out using cluster analysis and stepwise logistic regression analysis. The results showed that the rate of growth of profit after tax is a key ratio which impacts the long term sustainability of a company in this sector (Mondal and Roy, 2013).

A combination of Altman Z score and Adaptive neuro-fuzzy inference system (ANFIS) has been used for prediction of companies in India. The data from the solvent and insolvent companies is first converted into a Z score as per the Altman model. This score is then fed into a Time series model which gives a

better prediction of the insolvency of a firm than the Z score alone (Arora and Saini, 2013).

A bankruptcy prediction model was developed by selecting the most suitable static ratios incorporating the Fuzzy C-means clustering and MARS (Multivariate Adaptive Regression Splines). This was further enhanced using Genetic Algorithm to arrive at the most suitable factors which can be built into an insolvency prediction model (Martin et al., 2011).

Table 2.4: Summary of Financial Distress/ Bankruptcy Models- Global/India

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
1	Beaver	1966	Finance/Accounting	Univariate	Generic	USA
2	Altman	1968	Finance/Accounting	Multivariate Discriminant Analysis (MDA)	Manufacturing firms	USA
3	Altman et al.	1977	Finance/Accounting	Multivariate Discriminant Analysis	Generic	USA
4	Springate	1978	Finance/Accounting	Multivariate Discriminant Analysis	Generic	USA
5	Ohlson	1980	Finance/Accounting	Conditional Logit Analysis	Generic	USA
6	Taffler	1984	Finance/Accounting	Multivariate Discriminant Analysis	Distribution Companies	UK
7	Fulmer	1984	Finance/Accounting	Multivariate Discriminant Analysis	Generic	USA
8	Zmijewski	1984	Finance/Accounting	Probit	Generic	USA

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
9	Odom and Sharda	1990	Finance/Accounting	Neural Network (NN)	Generic	USA
10	Tam and Kiang	1992	Finance/Accounting	MDA, Logit, K nearest neighbor, Inductive Dichotomizer, Neural Network	Banks	USA
11	Altman et al.	1994	Finance/Accounting	Multivariate Discriminant Analysis	Generic	32 European and 3 non-European
12	Yang et al.	1999	Finance/Accounting	NN, Probabilistic NN, MDA	Oil and Gas	USA
13	Gudmundsson	1999; 2002	Finance/Accounting/Macroeconomic	Logistic Regresssion	Aviation	USA
14	Shumway	1999	Market/Firm	Hazard	Generic	USA
15	Atiya	2001	Finance/Accounting	Neural Network, KMV	Generic	USA

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
16	Hajdu and Virag	2001	Finance/Accounting	Logistic Regression	Generic	Hungary
17	Hillegeist et al.	2004	Market/Firm	Black Scholes Merton	Generic	USA
18	Cielen et al.	2004	Finance/Accounting	DEA Analysis	Generic	Belgium
19	Virág and Kristof	2005	Finance/Accounting	MDA and Logistic Regression	Banks	Hungary
20	Pompe and Bilderbeek	2005	Finance/Accounting	MDA	Manufacturing firms-small and Medium Size	Belgium
21	Bandyopadhyay	2006	Finance/Accounting	Factor Analysis	Cement	India
22	Bose	2006	Finance/Accounting	Rough Set theory	Dot Com Companies	USA

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
23	Hui and Sun	2006	Finance/Accounting	Support Vector Machine (SVM)	Generic	China
24	Hua et al.	2007	Finance/Accounting	Support Vector Machine (SVM)	Generic	China
25	Agarwal and Taffler	2008	Finance/Accounting	Altman Model and Structural Model	Generic	UK
26	Madrid-Guijarro et al.	2011	Internal and External Variables	Nil	SMEs	Spain
27	Ahn and Kim	2009	Finance/Accounting	Case-Based Reasoning	Generic	Korea
28	Wetter and Wennberg	2009	Finance/Accounting/Human Capital ratios	MDA	Technology	Sweden

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
29	Xie et al.	2011	Finance/Accounting/Internal Governance/Mkt Variables/Macroeconomic	MDA and SVM (Support Vector Machine)	Manufacturing Cos	China
30	Chen	2011	Finance/Accounting/Macroeconomic	linear discriminant analysis (LDA), logistic regression (LR), C5.0, CART, SOM, LVQ, SOM, GA, and PSO techniques	Generic	Taiwan
31	Premachandra et al.	2011	Finance/Accounting	DEA Analysis	Generic	USA
32	Martin et al.	2011	Finance/Accounting	Genetic Algorithm etc	No Data	Generic
33	Pradhan et al.	2011;2013	Finance/Accounting	Altman Model/Neural Network		

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
34	Shetty et al.	2012	Finance/Accounting	DEA Analysis	IT/ITES	India
35	Olson, et al.	2012	Finance/Accounting	Logistic regression, decision trees, support vector machines, neural network models.	Generic	USA
36	Martin et al.	2012	Finance/Accounting	Case-Based Reasoning	Generic	India
37	Cho et al.	2012	Finance/Accounting	Logistic Regression	Generic	USA
38	Arora and Saini	2013	Finance/Accounting	Adaptive neuro-fuzzy inference system (ANFIS)	Generic	India
39	Mondal and Roy	2013	Finance/Accounting	Logistic Regression	Steel Industry	India

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
40	Chaudhuri	2013	Finance/Accounting	Hazard, Mixed Logit and Rough Bayesian modes, Bayesian Model	Generic	USA
41	Aghaei and Kazemi	2013	Finance/Accounting	Altman Model	Generic	Iran
43	Tinoco and Wilson	2013	Finance/Accounting/Market/Macro	Panel Logit Model	Generic	USA
44	Korol	2013	Finance/Accounting	CART model	Generic	Latin America
45	Charitou et al	2013	Finance/Accounting/Market	Black-Sholes Merton Model and Bharat Schumway models	Generic	USA
46	Nair	2013	Finance/Accounting	Altman	Textile	India

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
47	Narendar et al.	2013	Finance/Accounting/Market	Altman`s score and KMV Merton	Generic	India
49	Colff and Vermaak	2014	Finance/Accounting/Industry	De la Rey K-Score	Generic excluding mining, financial	South Africa
50	Bapat and Nagale	2014	Finance/Accounting	MDA. Logistic Regression, Neural Network	Generic	India
51	Barki and Halageri	2014	Finance/Accounting	Altman Model	Textile	India
52	Altman et al	2014	country-specific variables and factors	Multivariate Discriminant Analysis	Generic	Poland, Finland, China
53	Brédart	2014	Finance/Accounting	Neural Network	Generic	Belgium

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
54	Vimala and Saranya	2014	Finance/Accounting	Altman	Pharma	India
55	O'Leary	2015	Finance/Accounting	Neural Network	Generic	USA
56	Gepp and Kumar	2015	Finance/Accounting	Decision Tree	Generic	USA
57	López-Gutiérrez	2015	Finance/Accounting	Altman`s model, Ohlson`s model	Non-Financial Companies	Germany, Canada, Spain, France, Italy, United Kingdom, United States.
58	Nanayakkara and Azeez	2015	Finance/Accounting/Market	MDA	Generic	Sri Lanka

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
59	Situm	2015	Financial and Employee Ratios	MDA	Generic	Austria
60	Muscettola	2015	Finance/Accounting	Logistic Regression	Generic	Italy
61	Yadav and Vijay	2015	Finance/Accounting	Altman and Springate model	Generic	India
62	Singh and Mishra	2016	Finance/Accounting	MDA and Probit	Manufacturing firms	India
63	Brîndescu-Olariu	2016	Finance/Accounting	Nil	Generic	Romania
65	Alaminos et al.	2016	Finance/Accounting	Logistic Regression	Generic	Asia, Europe and America
66	Lin et al.	2016	Finance/Accounting	Logistic Regression	Generic	China

Serial No.	Author/ Year	Year	Data Source	Method/Model	Industry	Country
67	Manzaneque et al.	2015	Finance/Accounting/Board Size and composition	Conditional Logit Analysis	Generic excluding financial	Spain
68	Turk and Kurklu	2017	Finance/Accounting	Multivariate Discriminant Analysis	Generic	Turkey
69	Sayari and Mugan	2017	Finance/Accounting	Factor Analysis, Entropy method, Logistic Analysis	Generic	USA
70	Veganzones and Séverin	2017	Finance/Accounting	MDA and Logistic Regression	Retail, Construction, Services	France

2.8.3 Bankruptcy models for the Aviation Industry – Global

Altman Z score model has been tested for financial distress in airlines around the world. Data from American Airlines and Southwest Airlines was used to apply the Z score model and assess the risk of insolvency in these two companies as a case study (Hsu, 2017).

Using the data from the top 12 airlines, a model was developed for the airline industry with variables from the financial and operational conditions. Selection of factors was made using DEMATEL analysis, which was then included in the model (Pineda et al., 2017). Using Bayesian quantile regression, and logit models with US airline data for the period 1990 to 2011 it was found Bayesian binary quantile regression showed higher accuracy (Lu et al., 2015). Another case study of US airlines was conducted using the Altman score for the period 2007 to 2012 to access the risk of bankruptcy in these companies. The results showed that all the airlines were likely to become insolvent in the next two to three years (Stepanyan, 2014).

For the aviation industry, authors have developed bankruptcy prediction models using financial and non-financial factors (Gudmundsson, 2002). Other studies have combined different variables which are specific to the aviation industry and developed models for the prediction of financial distress.

A detailed analysis of airline companies in the USA has been done by Gritta et al. (2006). In this study, eight bankruptcy models have been reviewed and analyzed for their accuracy in the prediction of the bankruptcy of airline companies. Gritta et al. (2006) analyzed two generic and six aviation specific bankruptcy models and concluded that models built with industry-related variables had higher accuracy of predicting financial distress in airlines. These results have been confirmed by other authors as well, for the aviation industry (Chow et al., 1991, Pilarski, and Dinh, 1999, Gudmundsson, 2002, Silva et al., 2005).

A study on the impact on airfares charged by companies facing financial distress and bankruptcy shows that companies in this financial state charge lower fares. This behavior is due to lower demand on account of the risk of failure of the company. Further such companies reduce their costs after going through a restructuring under Chapter 11 and hence could afford to charge lower fares (Hofer et al., 2009).

2.8.4 Bankruptcy models for the Aviation Industry – India

In India, the solvency of the airline companies has been analyzed using the Z-score model (Altman, 1968) using financial factors (Vasantha, et al., 2013). The research paper on the use of Altman`s model for prediction of bankruptcy in the airline industry has shown that the method could be accurately used, 2-3 years in advance to predict the bankruptcy in the three companies Jet Airways, Kingfisher Airlines, and Spicejet.

Results from these studies have shown that these prediction solutions, are specific for a nation or a sector and do not always fit well with the local country and industry conditions.

Using data for Kingfisher Airlines of India, the Altman Z original and revised Z-score was applied to assess the financial distress condition of these particular airlines. The Z score showed that the airlines were in poor condition from 2005 to 2012 (Kumar and Anand, 2013). A similar study was conducted for five airlines in India in 2012 using the Altman Z score model (Kumari and Chaudhry, 2012). This study showed that only one airline (Spicejet Airlines) was in a healthy financial condition with a Z score greater than 2.60 in the period reviewed.

Table 2.5: Summary of Financial Distress/ Bankruptcy Models and studies for the Aviation Industry

S.No.	Author/Year	Year	Data Source	Method/Model	Country
1	Gritta	1979	Finance/Accounting	Altman Model	USA
2	Gritta	1982	Finance/Accounting	Altman Model	USA
3	Chow et al	1991	Finance/Accounting/market	Multivariate Discriminant Analysis	USA
4	Gritta et al	1995	Finance/Accounting	Financial Analysis	USA
5	Pilarski, and Dinh,	1999	Finance/Accounting/market	Logistic Regression	USA
6	Gritta et al.	2000	Finance/Accounting	Neural Network	USA
7	Gudmundsson	2002	Finance/Accounting/Operational/ Macroeconomic	Logistic Regression	USA
8	Silva et al.	2005	Finance/Accounting	HFSAT	USA/ Brazil
9	Davalos et al.	2005	Finance/Accounting	Genetic Algorithm	USA
10	Gritta et al.	2006	Finance/Accounting	Eight Models evaluated	USA
11	Kumari and Chaudhry	2012	Finance/Accounting	Altman Model	India

S.No.	Author/Year	Year	Data Source	Method/Model	Country
12	Vasantha et al.	2013	Finance/Accounting	Altman Model	India
13	Kumar and Anand	2013	Finance/Accounting	Altman Model	India
14	Stepanyan	2014	Finance/Accounting	Altman Model	USA
15	Lu et al.	2015	Finance/Accounting	Bayesian	USA
16	Hsu	2017	Finance/Accounting	Altman Model	USA
17	Pineda et al.	2017	Finance/Accounting/Operational	DEMATEL	USA

2.9 Chapter summary

This chapter initially reviews the literature on the financial issues faced by the airline industry across countries and specifically in India.

The section next reviews the studies conducted on the Agency Theory, Stakeholder Theory and Porters Theory and how they explain the requirement of reporting the financial distress condition in airlines. The review then focuses on the MCDM techniques in identifying factors and variables which have an impact on the financial condition of airlines.

The topics reviewed also cover the financial distress assessment/prediction models which have been designed as generic or specific to an industry. The review evaluates the country for which they have been designed and tested and discusses the results of each of them.

The next chapter focuses on the research methodology adopted in this study.

Chapter 3
Research Methodology

Overview

This chapter discusses the methodology adopted for achieving the research objectives listed earlier. The method used to rank the factors which impact the financial distress condition of an airline is explained in detail. The techniques and procedures used to incorporate the identified factors into a model are next discussed. The data collection methods and the sources of data are described in this chapter.

3.1 Research design

Research design is the first stage of the research methodology which draws a roadmap for the entire study. Yin (2009) described a research design as the logical chain that connects the empirical data to the study's initial research questions and ultimately to its conclusion.

There are two categories of research design i.e. exploratory and conclusive. Exploratory research includes a comprehensive study of literature on the subject under study e.g. airline financial distress condition as carried out in this research. This approach provides a detailed insight into the issue under review and has often been used to arrive at the objectives of a study.

Conclusive research can be further classified as descriptive and causal. Descriptive research explores and describes a particular sector or group. The objective of this type of research is to identify the various components and features of the group under review.

Causal research is conducted to analyze the bond between the occurrence of various results based on the input parameters. Causal research, therefore, assists in identifying the relationship between different variables.

In this study conclusive research design is used in the assessment of the financial distress of the airlines and has utilized independent and dependent variables to build a relationship, leading to a particular output.

A mixed approach using all the above methods of research designs have been utilized in the study. Combination of these designs provides a holistic and structured view of the research problem. These research designs further complement and support each other for this study. The step-wise detail of research flow is as follows:

Step 1:

A review of the conditions which impact the financial condition of airlines is conducted based on prior studies.

The conditions evaluated are:

Operational
Economic
Performance
Financial
Market
External

Step 2:

Multi-criteria decision-making technique is deployed to identify those factors or variables which are major contributors to the financial condition of a company through inputs from domain specialist or stakeholders.

The importance and ranking of the factors, based on their impact on the financial condition of the airlines, is obtained from experts from the aviation industry. The ranking is based on a pairwise comparison method. Fuzzy AHP technique is applied to the initial expert ranking to arrive at a final priority list of factors which were major influencers of the financial status of airlines in India.

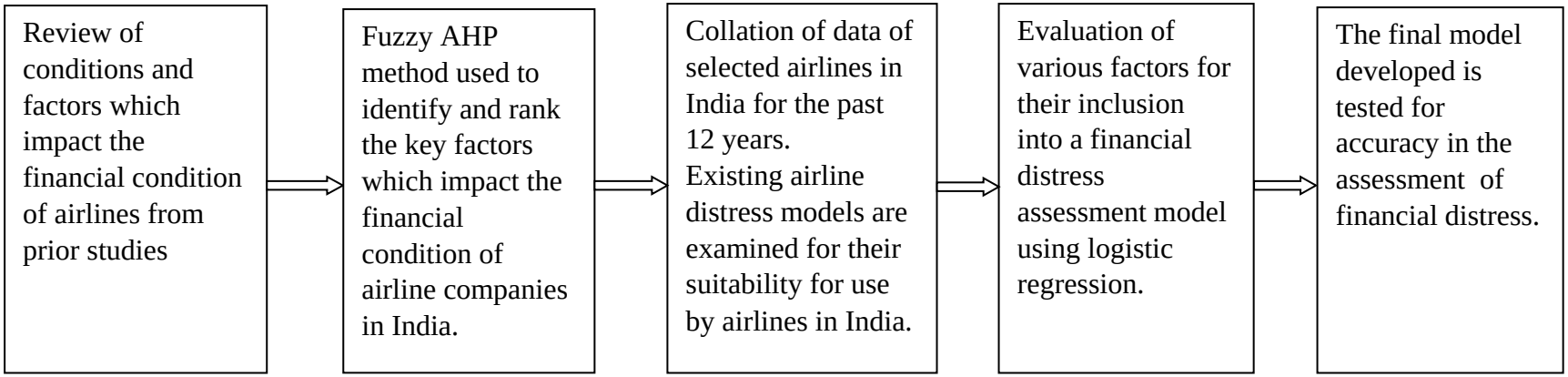

Figure 3.1: Schematic Flow diagram

Step 3:

The study collated key data of selected airline companies in India for the past 12 years from various sources. The secondary data was sourced from published reports/journals/articles/papers and databases provided by the Directorate General of Civil Aviation (DGCA), Airport Authority of India (AAI), Centre for Aviation (CAPA), IATA (International Air Transport Association) and CMIE (Centre for Monitoring Indian Economy)-Prowess.

Global models for assessment of financial distress were tested using data of six privately owned airlines operating in India.

Step 4:

The next step was to shortlist factors in the development of a financial distress assessment model. Multicollinearity tests were conducted among the factors and only those factors which exhibited low correlation with others were included in the final model. Combination of different factors was tested before their inclusion into a financial distress assessment model using logistic regression.

Step 5

The final model developed was tested for accuracy in its assessment of the financial distress of the sample used. Those factors which led to a model with the highest accuracy was finally accepted.

3.2 Questionnaire design

The questionnaire is designed on the basis of literature review and experts opinions for the objectives mentioned in Chapter 1. In the beginning, 45 financial distress factors were identified from the existing literature. In the next step, industry experts were invited to assess these set of factors. Experts have discussed and suggested to retain only significant factors. Hence, experts have finalized 38 financial distress factors which are categorized under 6 groups.

Finally, a questionnaire is developed to provide a pairwise comparison to estimate the critical financial distress factors (Refer to Appendix A).

3.3 Sample design

The selection of a suitable and feasible sample is necessary to fulfill the objective of the research. Sampling techniques are generally categorized into two types: probability sampling and non-probability sampling. There could be several stages in the designing of samples such as, identifying the target population, defining the sampling structure, choosing the sampling method, estimating the sample size, etc.

The main concern during the sample selection is whether the sample is industry specific or not. Literature and expert judgments provide information on the specific challenges which are faced by each industry. Hence, the sample should be industry-specific, which gives more applicability to the research findings for the sector under review (Senthil et al., 2014). Another concern regarding the selection of the sample is linked to the kind of respondents needed for the research and the accomplishment of research depends on the selection of suitable respondents. In this work, respondents have been selected from middle level and senior level managers' personnel of the airline industry related companies.

The target population is described for its elements and sampling units. Time and the coverage are also identified for the target population.

The details of the target population for the present work are:

Elements – Management personnel (middle or upper-level managers)

Sampling units – Management personnel of the airline companies, a representative from ministry, regulators, airport personnel, consultants, industry associates, etc.

Time – October 2017 to February 2018.

Extent – All India

The elements of the study are management personnel of the airline-related companies. In the process of data collection, an expert panel of 18 professionals was created. The selection of professionals was decided on the basis of certain criteria such as their individual experiences, expertise in the area, their level in the organization, etc. Identified professionals are highly skilled personnel in their field and with good knowledge of the aviation industry.

The industrial and consultancy experience of the respondents is important to apply their knowledge of airline company operations. Data collected on work experience of respondents (in years) is given in Table 3.1.

Table 3.1. Industrial and consultancy experience of the respondents

Respondents industrial experience (In Years)	**Frequency**	**Percent**
5-10 years	01	6
11-15 years	07	39
16-20 years	06	33
More than 20 years	04	22
Total	**18**	**100**

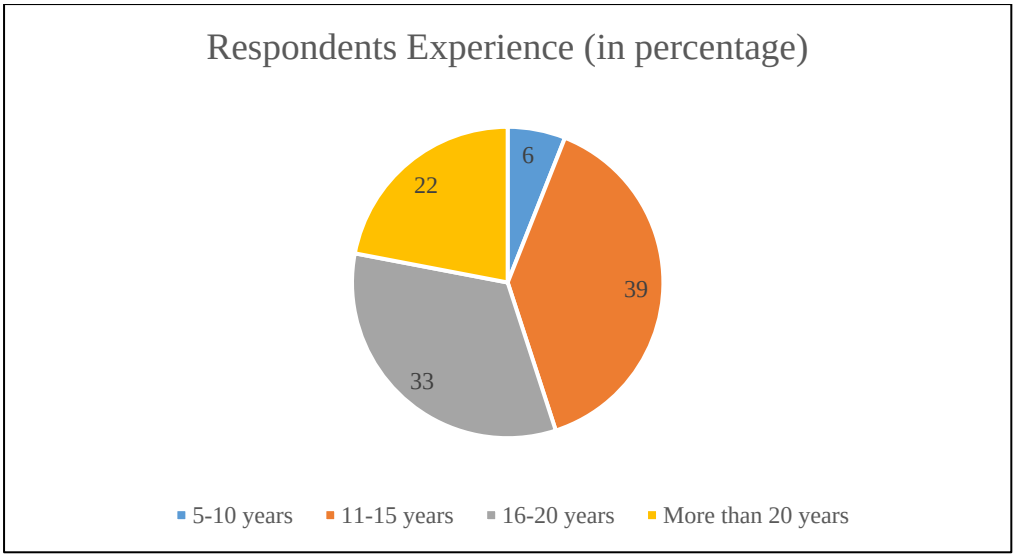

Figure 3.2: Experience of Respondents in the Airlines Industry

The profile of the respondents is important to have an accurate view of the factors being evaluated. Data collected on the profile of the respondents are presented in Table 3.2.

Table 3.2: Profile of the respondents

Profile of the respondents (In Numbers)	**Frequency**	**Percent**
Head-Operations - Airlines	04	22
Head- Finance - Airlines	05	28
Representative, Ministry of Civil Aviation	02	11
Consultants	04	22
Airport Manager	02	11
Industry Associates	01	6
Total	**18**	**100**

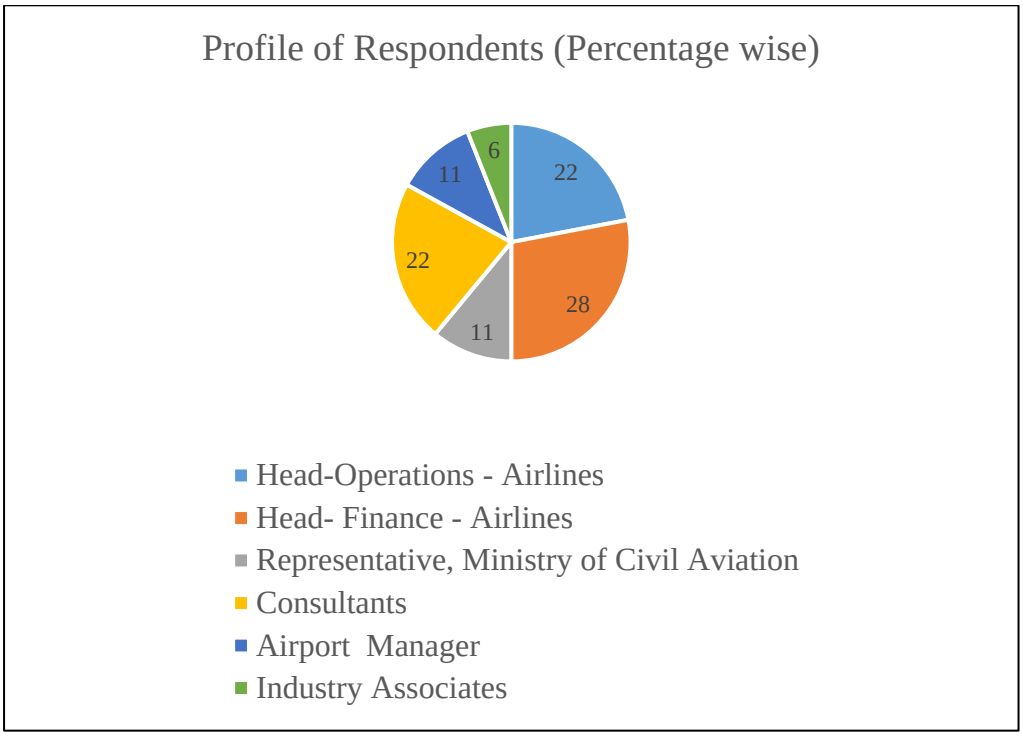

Figure 3.3: Profile of the respondents

3.4 Data collection procedures

Data collection was carried out for objectives 1 and 2:

Objective 1: To identify, analyze and prioritize the relevant factors from internal and external sources which impact the financial condition of airline companies in India (See Chapter 4 for more details).

Objective 2: To develop a model for the assessment of financial distress in airline companies in India with the identified factors (See Chapter 6 for more details).

The main sources of operational and financial data are the secondary sources which are published by various authorities. The operational data is obtained from the Directorate General of Civil Aviation (DGCA) which publishes the operational and key performance data for the various airlines in India on a monthly basis. The financial data was compiled from the financial reports published by the airline companies. This data is collated in the financial

database PROWESS developed by CMIE (Centre for Monitoring Indian Economy).

The inputs for the ranking of the factors using Fuzzy AHP has been collected from experts from the airline industry as described in the earlier sections.

3.5 Data analysis

Analysis of data for the desired objectives was carried out on the data collected. The data were reviewed and analyzed using different methods to achieve the objectives and provide answers to the research questions.

The methods used to analyze the data collated along with the findings are given in the subsequent chapters of the thesis.

3.6 Proposed research methods and techniques

This study uses MCDM or Multi-criteria decision-making methods to rank the factors which impact the financial distress situation of an airline. Prior studies have concluded that case-based research and studies provide better solutions to real-life management problems (Yin, 2009).

Fuzzy AHP is the tool for ranking as this method helps in converting vague expert inputs into specific ranks for a list of factors. This technique is used to build the priority list and is aimed at achieving the first research objective. The technique adopted is explained in detail in the next section.

Logistic regression technique is used to build the model from the data collated for the key factors. This method is used when the dependent variable has a dichotomous (binary) value. This type of regression provides a prediction type of analysis and is deployed to provide information on the behavior of one dependent binary variable and an independent variable. The independent variable can take a nominal, ordinal, interval or ratio value. The method is further explained in the next section.

3.6.1 Fuzzy AHP Technique

Saaty (1980) developed AHP (Analytic Hierarchy Process) which is a numeric form of MCDM ("multi-criteria decision making"). The application of Saaty's AHP is limited to crisp environments or where there is an absence of uncertainty. In this research a fuzzy method has been adopted to solve prioritization decisions since there is uncertainty in the selection of the factors.

Fuzzy AHP method developed by Chang (1992) has been adopted in this research. This method transforms the inexact opinion of experts to priority ranks using predefined linguistic variables. Pairwise comparison of the factors is provided by experts based on the linguistic variables given (Table 3.3).

Table 3.3: "Triangular Fuzzy Numbers

Linguistic variables	**Assigned Triangular Fuzzy Numbers (TFN)**
Equal	(1, 1, 1)
Very Poor	(1, 2, 3)
Poor	(2, 3, 4)
Average	(3, 4, 5)
Good	(4, 5, 6)
Very Good	(5, 6, 7)
Outstanding	(6, 7, 8)"

Chang (1992) method:

"Definition 1 If $\breve{\mathrm{N}}_1 = (p_1, q_1, r_1)$ and $\breve{\mathrm{N}}_2 = (p_2, q_2, r_2)$ are representing two TFNs then algebraic operations can be stated as follows-

$\breve{\mathrm{N}}_1 \oplus \breve{\mathrm{N}}_2 = (p_1, q_1, r_1) \oplus (p_2, q_2, r_2) = (p_1 + p_2,\ q_1 + q_2, r_1 + r_2)$ ..Eq. (3.1)

$\breve{N}_1 \ominus \breve{N}_2 = (p_1, q_1, r_1) \ominus (p_2, q_2, r_2) = (p_1 - p_2,\ q_1 - q_2, r_1 - r_2)$ ...Eq. (3.2)

$\breve{N}_1 \otimes \breve{N}_2 = (p_1, q_1, r_1) \otimes (p_2, q_2, r_2) = (p_1 p_2,\ q_1 q_2, r_1 r_2)$ ... Eq. (3.3)

$\breve{N}_1 \oslash \breve{N}_2 = (p_1, q_1, r_1) \oslash (p_2, q_2, r_2) = (p_1/p_2,\ q_1/q_2, r_1/r_2)$ ...Eq. (3.4)

$\alpha \otimes \breve{N}_1 = (\alpha p_1, \alpha q_1, \alpha r_1)$ where $\alpha > 0$ …Eq. (3.5)

$\breve{N}_1^{-1} = (p_1, q_1, r_1)^{-1} = \left(\frac{1}{r_1}, \frac{1}{q_1}, \frac{1}{p_1}\right)$ ..Eq. (3.6)"

"To apply the fuzzy analytical hierarchical process using Chang`s (1992) steps for extent analysis the following steps are computed:

$M_{g_i}^1, M_{g_i}^2, M_{g_i}^3 \ldots\ldots, M_{g_i}^m$ Where g_i is the goal set (i = 1, 2, 3, 4, 5 …....n) and all the $M_{g_i}^j$(j = 1, 2, 3, 4, 5 ....., m) are TFNs given in Table 3.3".

Step 1: Determine S_i (this denotes the synthetic extent fuzzy value) in comparison to the other i^{th} criterion:

$$S_i = \sum_{j=1}^{m} M_{g_i}^j \times \left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{g_i}^j\right]^{-1} \quad \text{.....……Eq. (3.7)}$$

$$\sum_{j=1}^{m} M_{g_i}^j = \left(\sum_{j=1}^{m} p_{ij}, \sum_{j=1}^{m} q_{ij}, \sum_{j=1}^{m} r_{ij}\right)$$

$$\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{g_i}^j\right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} r_{ij}}, \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} q_{ij}}, \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} p_{ij}}\right)$$

Where p shall have a lower limit value, while q will be the best likely while r has the highest possibility.

Step 2: In the second step the degree of possibility is explained as follows:

$S_2 = (p_2, q_2, r_2) \geq S_1 = (p_1, q_1, r_1)$ is explained by the equation:

$V(S_2 \geq S_1) = \sup_{y \geq x}[\min(\mu_{S_1}(x), \mu_{S_2}(y)]$

Here x and y variables denote the membership numbers which can be specified as per the equation 3.8 given below:

$$V(S_2 \geq S_1) = \begin{cases} 1 & \text{if } b_2 \geq b_1 \\ 0 & \text{if } a_1 \geq c_2 \\ \frac{p_1 - r_2}{(q_2 - r_2) - (q_1 - p_1)} = \mu d, & \text{otherwise} \end{cases} \quad \text{…….. (3.8)}$$

"Here μd signifies the maximum membership specified by μ_{S_1} and μ_{S_2} (refer figure 3.4)

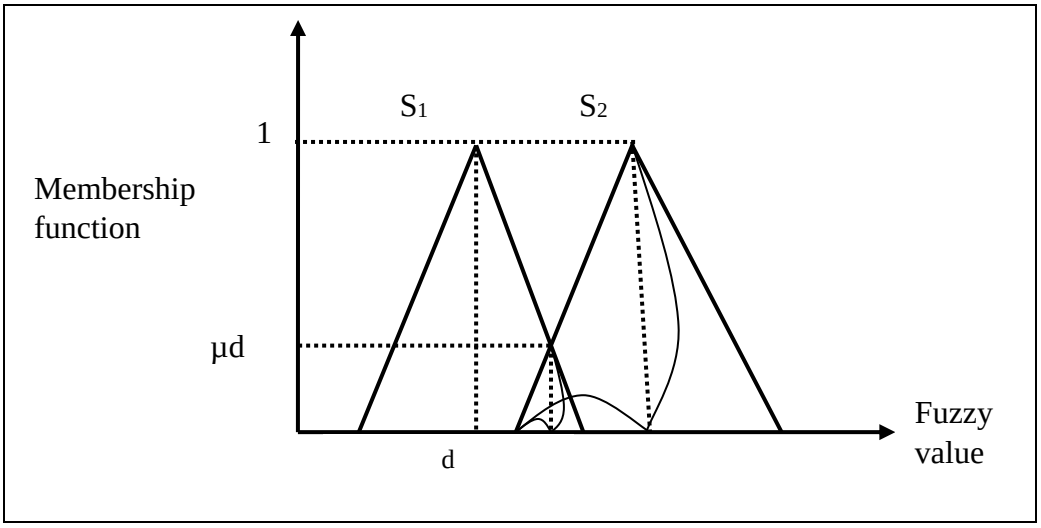

Figure 3.4: The intersection of fuzzy numbers

S_1 and S_2 are compared with values of V(where $S_1 \geq S_2$) and V(where $S_2 \geq S_1$)".

Step 3: In this step extent of the probability that a convex fuzzy number defined as S will be larger than k convex fuzzy numbers Si (i= 1,2,.....,k) and is formulated as

$V (S \geq S_1, S_2, ..., S_k)$

$= V [(S \geq S_1)$ and $(S \geq S_2)$ and .....and $(S \geq S_k)]$

$= \min V (S \geq Si),$ i= 1,2,.....,k

Assume that $d'(Ai) = \min V(Si \geq Sk)$ ……Eq. (3.9)

The value of k = 1, 2, …, n, k ≠ i, shall have a value of the weight vectors as per Equation 3.10 :

$W' = (d'(A_1), d'(A_2), ..., d'(A_m))^T$ ……Eq. (3.10)

Step 4: In step 4 Equation 3.11 provides the normalized weight vectors as shown:

$W = (d (A_1), d (A_2), ..., d (A_m))^T$ ……Eq. (3.11)

3.7 Development of the model

3.7.1 Data Collection and analysis:

Secondary data for the past 12 years (2006 to 2017) was collected for all the privately owned airline companies operating in India. The financial data is taken from the annual reports published by the companies and from CMIE- Prowess database. Operating data is obtained from the industry and airline reports published by the Directorate General of Civil Aviation (DGCA).

The data collected from the specified sources were reviewed for missing information. Those airlines which do not have complete data published were not considered and a final list of seven privately owned airlines was finalized for the study over twelve years (2006 to 2017). The airlines selected for their financial and operating performance are Kingfisher Airlines, Jet Airways, Jetlite, Spicejet, Go Air, Paramount Airlines and Indigo airlines.

The financial data as obtained from the Prowess database was also checked from published financial reports. The variables collated for each of the seven airlines for the twelve years consisted of the following variables:

Data extracted from (CMIE)-Prowess database:

1. Current Assets
2. Retained Earnings
3. Book Value
4. Total Assets
5. Total Liabilities
6. Interest Expenses
7. Sales
8. Operating Profit

From Directorate General of Civil Aviation (DGCA):

1. RPK (Revenue passenger kilometer)
2. Operating expenses per RPK
3. Labor cost per air KM
4. Passenger Load factor (%)
5. Number of different brands operated by the airlines

From other sources:

1. GDP growth rate for each year from 2006 to 2017 in percentage (https://data.worldbank.org/indicator/ny.gdp.mktp.kd.zg).

2. Aviation fuel price for each year from 2006 to 2017 in Rupees per gallon (https://www.indexmundi.com/commodities)

In the second part of the research, various financial distress assessment models which have been used in earlier global studies were tested, using the data collated for the six privately owned airline companies in India. The results were assessed for accuracy and consistency in the assessment of the financial condition of the individual company.

The study applied the following bankruptcy models to six privately owned airlines in India. (Paramount Airlines was not tested as it did not have the specific operational data required for testing in the models).

The models used for testing were:

1. Altman Z" score model
2. "The Airscore model"
3. "The Pilarski or P score model"
4. The Gudmundsson model
5. HFSAT model
6. Kroeze model"

In the next part of the study, key factors were reviewed for the impact on the financial status of the company in a particular year. Factors were selected for this study based on their ranks of the previous analysis and from prior studies

as well as on the availability of data. A total of thirteen factors were shortlisted for inclusion in the model based on their ranking and prior studies.

A company was classified as financially distressed in a particular year if there existed operational losses for three years continuously or the company had been declared insolvent during the period (2006 to 2017) under review.

To further evaluate the suitability of these thirteen factors, a t-test was conducted to confirm that the mean of these factors was statistically different between distressed and non-distressed companies.

To identify the factors for inclusion into the model, multicollinearity test was conducted for the thirteen selected factors. Those factors or variables found to be highly correlated with each other were rejected for further use in the analysis.

Logistic regression was adopted as the technique to design the models for assessment of financial distress.

3.7.2 Logistic Regression

Logistic regression is an analysis, where the value of the dependent variable takes a binary value. In this type of regression the probable value, or odds of the response taking a particular value, is assumed based on the blend of values taken by those variables which act as predictors (Laurence & Hughes, 2012). Logistic regression is thus applicable, to perform descriptive discriminate analyses and classify companies into two categories of financial distress or bankruptcy risk, based on the explanatory variables consisting of various data. Logistic regression technique provides an estimate of the possibility of financial weaknesses and insolvency potential issues. The major advantage of logistic regression, unlike the Multiple Discriminant Analysis scoring method, is that it makes no assumptions about the distributions of the predictor variables.

This technique has been used in extant literature and was found to be the most accurate in its results, as compared to the other techniques or methods. Global models have been developed using data of bankrupt companies from Asia,

Europe, and America and employing the logistic regression method. These models have been were adopted by many multinational companies to evaluate the distress condition of the firms in the region they operate in (Alaminos et al., 2016). Similarly, a model developed using logistic regression, with accounting ratios from Hungarian companies, was found to give higher accuracy in distress prediction than a model developed using the MDA (multiple discriminant analysis) method (Hajdu and Virag, 2001).

Tests were also conducted using the SME data of Romanian companies (Smaranda, 2014) to compare the results obtained from three models designed for the prediction of financial distress. The three models compared were those of Altman (1968), Taffler (1984) (where MDA -multiple discriminant analysis techniques were adopted) and the third which was designed using logistic regression. The results showed that the model developed with logistic regression was a better fit for the data studied. Logistic regression bankruptcy models have given better results for the classification and prediction of bankrupt firms in several other studies (Hauser and Booth, 2011).

3.7.3 The probability of financial distress using financial factors and logistic regression

The Z-score model proposed by Altman (1968) to predict financial distress uses five accounting variables in the model:

Z= 1.2 WC/TA + 1.4 RE/TA + 3.30 EBIT/TA + 0.60 LEV + 0.99 SA/TA……Eq. 3.12

The variables in the equation are working capital (WC), retained earnings (RE), earnings before interest and taxes (EBIT), Leverage as measured by the dividing the equity by the recorded value of debt (LEV) and the value of revenue earned (SA). The ratios excluding leverage are all divided by total assets in the model.

This paper uses these five-factor accounting variables and constructs the below model (Lin et al., 2016) for assessing financial distress in the following year.

"$FD_{it} = \beta 0 + \beta 1\ (WC_{it-1} / TA_{it-1}) + \beta 2\ \ (RE_{it-1} / TA_{it-1}) + \beta 3\ (EBIT_{it-1} / TA_{it-1}) + \beta 4\ (BVE_{it-1} / TL_{it-1}) + \beta 5\ (SA_{it-1} / TA_{it-1}) + \varepsilon_{it}$ …….Eq. 3.13"

Where

"FD_{it} is a dummy variable that equals 1 when the company i suffers financial distress in year t". The company is categorized as financially distressed if the company has negative earnings in the previous three years or has been declared as insolvent during the year under review.

WC_{it-1} is the Working capital of the i^{th} company in year t-1

RE_{it-1} is the retained earnings of i^{th} company in year t-1

$EBIT_{it-1}$ is the earnings before interest and taxes in the year t-1

BVE_{it-1} is for company i and measures the leverage calculated by dividing the book value of equity to the value of book debt. Since most of the airline companies in India are privately owned the book value of equity has been taken in this calculation.

SA_{it-1} refers to the sales value for the i^{th} company in year t-1

TA_{it-1} refers to the value of the total assets for the i^{th} company in year t-1

$\beta 0$ is the Intercept and ε_{it} is the error term and are > 0.

The model uses a logistic regression method and derives the values of the coefficients ($\beta 0$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, and $\beta 5$), for each of the accounting variables.

This model using financial factors is analyzed for its accuracy and goodness of fit through various statistical tests.

The second model is tested for accuracy by incorporating into the first model additional variables from financial, operational and performance conditions specific to the airline industry. After several regression runs, only those factors are included in the revised model, which provide the highest accuracy and fit.

Content validity tests have been performed on the results using the following techniques:

a. Sensitivity Analysis for the output of Fuzzy AHP
b. The goodness of fit tests for the models designed
c. Classification table for the models designed
d. ROC curves for the models developed
e. "Tests for Vector Inflation Factor (VIF) and Tolerance values to test the level of collinearity between the variables used in the model".

3.8 Chapter Summary

This chapter discusses in depth the methodology used for achieving the research objectives. The data collection methods used and the evaluation of this data using different procedures and techniques is explained. The technique used to prioritize the factors using the Fuzzy AHP method is described in detail in this chapter. Logistic regression method used for development of the distress assessment model is also explained. The formulation of the model and the rationale behind the assumptions are also detailed out.

The next chapter describes the Fuzzy AHP process and the results obtained from using this technique.

Chapter 4

Evaluation of Factors affecting financial distress of airlines

Overview

This chapter provides detailed steps for the identification, finalization, and prioritization of the factors impacting the financial distress in an airline. Fuzzy AHP process is adopted and the steps explained to show how it leads to the final ranking of the critical factors.

4.1 Introduction

The aviation industry in India is on a growth path, with annual passenger traffic growing at over fifteen percent every year. Government is also aggressively developing airport infrastructure in many cities to assist this growth. However airline companies, periodically face financial distress as the internal and external environmental factors change dynamically. Management needs to be aware of those key factors which have a major impact on the financial condition of the company so as to ensure they do not become critical. To assess all the factors influencing the financial status of the company it is important to study both the internal and external conditions that the company operates in. Once the key factors from these conditions are identified, management can focus on developing strategies, which will mitigate financial issues arising out of these parameters. This chapter aims to describe the method adopted to achieve the first objective (chapter 1), mentioned as below:

"Part of this chapter has been published in

- Transportation Research Part A: Policy and Practice 117 (2018), 87-102"

Objective 1: To identify, analyze and prioritize the relevant factors from internal and external sources which impact the financial condition of airline companies in India.

To fulfill the desired objective a framework for identification and prioritization of major factors impacting the financial performance of an airline company is developed. The analysis of factors is carried out by ranking the factors and thus get a more accurate result which will show their criticality. To identify the most prominent factors, major Indian airlines have been selected for the study.

Ranking of the factors is determined using the AHP or Analytic Hierarchy Process methodology. This technique is a multi-criteria decision making (MCDM) method, which provides a process in determining the relative position or rank of the major factor and its subfactor. This is achieved through pairwise comparison considering both qualitative and quantitative attributes. Prior studies have shown that standalone AHP is unable to provide an interpretation of linguistic variables which are rated using a Likert scale (Prakash and Barua, 2015; 2016). Fuzzy AHP method is therefore preferred, as it allows uncertainty and fuzziness in decision making and is more suitable in many real-world applications.

4.2 Proposed Framework

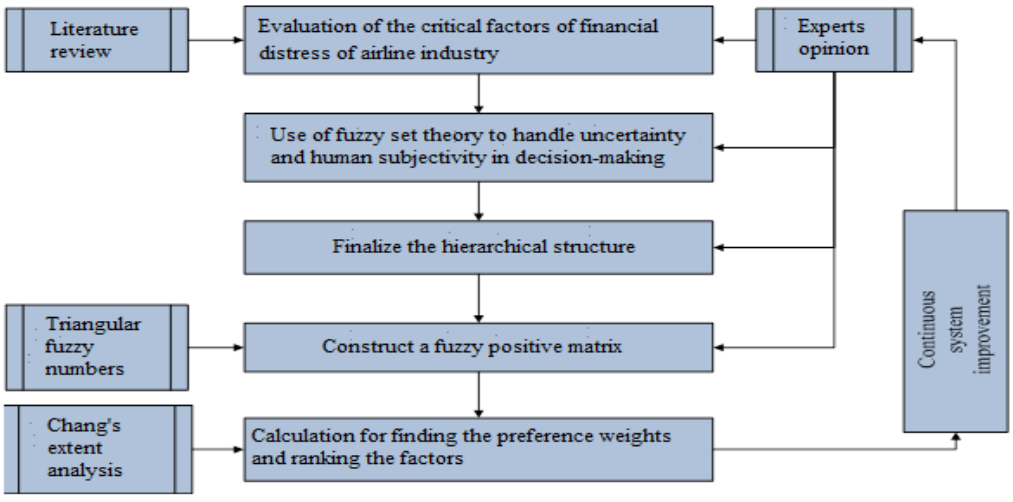

Figure 4.1 Flowchart for Fuzzy AHP analysis

In this review, AHP combined with Fuzzy is applied for prioritizing and assessing the specific causes of financial distress of the airline business as shown in figure 4.1

4.2.1 Identification of factors affecting the financial condition of airlines

Factors, which influence the financial condition of airlines, have been collated from previous studies and responses from industry experts. The list of categories and factors are shown in Table 4.1. The identified factors have been grouped into six categories: operational, economic/government, performance related, financial, market related and external . Each of these categories has within it a list of factors which are explained below in detail:

4.2.1.1 Operational factors

These are factors which represent the operational conditions of the airline. One of the most important parameters in this category is the load factor, which measures the performance of the airlines based on the capacity utilized." It is calculated as the percentage of seats sold against the available seats ("calculated in percentage by dividing the passenger kilometers performed by the total seat kilometers available)". Maximizing the "load factor is an important objective" for an airline, as this ensures that the "fixed costs, incurred for each flight", are spread over a larger number of seats. With higher load factors, the gross margin increases and leads to higher profitability (Chow and Tsui, 2017; Chang and Yeh, 2001). Airlines will strive to increase its load factor through processes which estimate demand and set the various fares (Behn and Riley, 1999, Zhu, 2011). When the demand is low, airlines aim to reduce the number of flights and thereby lowering the capacity available to match the demand. Another factor often measured is the average number of passengers carried per departure. This is also an indicator of capacity utilization by the airlines and the volume of seats sold.

Gudmundsson (2002) in his study has also identified several other operational factors which are key to the sustainability of the airlines.

The number of hours flown per pilot is an indication of the utilization of this expensive resource. Further, the number of departures per aircraft is a measure of the configuration of the routes flown by the airlines. These can be categorized as long haul and short-haul routes. Longer routes require a lower number of departures in a period which leads to lower costs for that period. The number of pilots employed provides an indication of the labor cost of the airlines as these resources are the most expensive.

"The average age of the aircraft fleet provides information on the maintenance cost and the fuel costs incurred by the company". When the aircraft is older, it incurs a higher maintenance cost with increased fuel consumption.

If an airline uses a large number of brands of aircraft, spares, and maintenance labor costs increase as these have to be procured to cater to a large number of brands to be serviced. Airlines operating with an excessive number of brands are found to have a high maintenance cost structure. Another factor to be considered is the number of international routes flown by the airlines. These routes tend to have a higher gross margin due to lower operational costs (Gudmundsson, 2002).

4.2.1.2 Economic or Government policy related Factors

Airlines have limited control over factors which are related to government policies or the economic conditions of the country. The key factor in this category is annual inflation, which signifies the increase in input costs in a country. High rates of inflation in a country, lead to higher costs and lower demand with a negative impact on the airlines' operating results (Gudmundsson, 2002, Tinoco and Wilson, 2013, Xie et al., 2011) .

GDP growth rate of a country reflects the economic conditions prevailing and is an important factor for continuous sustenance of the industry (Xie et al., 2011). Aviation fuel price per liter is another key factor to be measured. An increase in this input has a major impact on the costs incurred by the company. A study of the operating expenses for an airline in India has shown that fuel

costs are around 30% of the overall cost structure ("Hand Book On Civil Aviation Statistics, 2016-17; DGCA, report"). A rise in this cost forces airlines to reduce the input costs of other components so that there is minimal impact on the profit margin (assuming that airlines do not increase the fares when fuel rates increase). In India, government taxes also play a major role in the increase in the price of aviation fuel.

Another factor identified is the average growth in the total number of passengers using air travel in the country. This variable is important and indicates the economic conditions prevailing in the country.

4.2.1.3 Performance-related factors

These factors are a measure of the operations efficiency of the individual airline company. Directorate General of Civil Aviation (DGCA), which is the aviation industry regulator in India, publishes this data for companies operating in the aviation sector.

Available seat kilometer (ASK) is calculated as the sum of the product of the number of seats available per flight and the flight distance completed. This is a measure of the total capacity offered by the airlines. Available seat kilometer per employee is an indicator of the operational efficiency of the airlines.

Revenue passenger kilometer (RPK) is a measure of the total revenue generated per passenger and is computed as the number of revenue passengers carried on each flight multiplied by the flight stage distance which is then divided by the total flight stage distance for the airline .

Average stage length flown (in kilometers) is calculated by dividing the total kilometers flown by the total number of aircraft departures and points to the utilization of the aircraft. This variable will provide information on the type of routes that the airline has operated (long haul or short haul) in the period.

Fuel efficiency measured as liters per air kilometer gives the efficiency of the operations and of the particular type of aircraft used by the airlines. Breakeven

load factor is that value at which the gross margin earned by the airlines in a period is equivalent to the fixed expenses for that period.

Labor cost per air km indicates the labor expenses incurred by the company over the distance flown.

4.2.1.4 Financial Factors

Financial conditions of a company are indicated by different financial or accounting ratios. These are important indicators of the financial status of the company and are often monitored by shareholders, government, analysts and regulatory bodies (Sharma et al., 2012; Kumar et al., 2017). Some of the key financial ratios applicable to airlines are explained in this section.

Operating Revenue divided by sum of all the assets is an indicator of the utilization of resources of the company to generate revenue. This ratio is used extensively in financial statement analysis and was included in the original Altman (1968) model and in later models for airline companies (Pilarski, and Dinh, 1999). In other industries, this is also measured as sales to total assets and is an important variable in measuring the efficiency with which the company is utilizing its assets to generate revenue.

Another ratio used in earlier studies is operating profit to total assets (Altman, 1968). This is a measure of the profitability earned from operations using the total assets.

Airlines should also monitor retained Earnings to total assets which indicate the profitability of the company. A lower value of this ratio will lead to a higher risk of financial distress (Altman, 1968; Pilarski and Dinh, 1999).

The market value of equity (or book value when the company is not publicly listed) to total debt obligations or total liabilities is a leverage ratio and measures the extent of borrowings in comparison to the market value of equity (Kumar and Rao, 2016). A lower ratio shows high debt when compared with the value of equity and is found to be prevalent in companies in financial distress (Altman, 1968; Altman et al., 1977, Pilarski and Dinh, 1999, Chow et al., 1991).

Current ratio measured by dividing current assets by current liabilities is a liquidity ratio and measures the ability of the company to use its current assets for paying off its short-term debts (Sharma and Kumar, 2011; Joshi and Yadav, 2018). The ratio was also used in generic models of Altman (1968) and in the ZETA scores (Altman et al., 1977). It is also included in the Pilarski Score model (Pilarski and Dinh, 1999) developed for the airline industry.

Earnings before interest and taxes divided by operating revenue measures the profit margin achieved by the company. Higher margins indicate higher efficiency in the airline's operations and a lower risk of distress occurring (Pilarski and Dinh, 1999).

The ratio of interest by total liabilities (also called the debt service ratio) gives the indication of the average interest rate paid on the total loans of the company. This ratio indicates the efficiency in the manner the company has managed its liabilities. A high cost of debt will negatively affect the profitability of the company. The ratio is a part of the AIRSCORE model developed for the airline industry in America (Chow et al., 1991) and in the generic ZETA score model (Altman et al., 1977).

Operating revenues per air kilometer is an indicator of the revenue generated by airlines per distance flown.

Earnings stability, measured as the deviation around a 10-year trend line of the return on assets, represents the fluctuation of profitability over a ten-year period. This is a measure of the financial stability of the company.

Firm size computed as the log of the firm’s total assets provides information on the stature of the company (large, medium or small) and is used in the generic ZETA score.

4.2.1.5 Market-related factors

These are factors, which are specific to the aviation industry and influence all the companies operating in this market. The number of airlines operating in a country indicates the firms operating in different segments: low cost or high

cost and gives information on the competitive landscape of the aviation industry. Passenger growth (in percentage) for the company as measured against the industry growth is a measure of how the company has performed against the total demand in this industry. Market share can be measured as the ratio of passengers using the airlines against the total demand. The ratio provides the position of the company in the market as compared to that of its competitors. Government policies regarding allotting routes to airlines shows the market factors controlled by the government. Airport preference of airlines indicates the cost-benefit, which certain airports provide and these impact the profitability of the airlines.

4.2.1.6 External Factors

Environment or weather conditions in a country are important factors which often influence the operations of an airline. If these conditions regularly deteriorate in the region where the company operates, airlines will find it difficult to meet its schedule and maintain the load factor. Geographical location of the airlines is an indication of the routes that the company can efficiently operate in the country. Another important factor, which affects airlines, is the threat to national security. A high-security environment requires additional security controls which will lead to flight delays, reduced turnaround time and enhanced operational costs.

Political influence is a measure of the proportion of ownership controlled by the government in the airlines operating in a country. Higher political controls lead to poorer financial performance, and studies have shown that there is limited incentive for the management to strive for efficiencies and financial prudence in its operations (Gudmundsson, 2002).

The final list which was evaluated contained thirty-eight factors, spread across the six categories described above.

The list of the factors with the category code and the prior literature where they were referred to is given in Table 4.1.

Table 4.1: "List of the factors affecting the financial condition of airlines**"**

S.No.	Factor Category	Category Code	Factors	References
1	Operational Factors (OP)	"OP1	Load factor	Chow and Tsui (2017), Chang and Yeh, (2001), Behn and Riley (1999); Zhu (2011), DGCA (2006-2017), Pathak (2015),
		OP2	Average number of passengers carried per departure	
		OP3	Average Number of hours flown per pilot	
		OP4	Number of departures per aircraft	
		OP5	Number of pilots per aircraft	
		OP6	The average age of the aircraft fleet	
		OP7	Number of different brands of aircraft operated	
		OP8	International operations"	
2	Economic/Government Factors (EG)	EG1	Annual inflation	Gudmundsson, (2002), Tinoco and Wilson (2013), Xie et al. (2011), Krishnan (2008), Behera (2016), DGCA (2006-2017)
		EG2	GDP Growth Rate	
		EG3	Aviation Fuel price (INR per liter)	
		EG4	"Average Growth in the number of Passengers carried in the country"	

S.No.	Factor Category	Category Code	Factors	References
3	Performance Related Factors (PRF)	PRF1	"Available Seat Kilometer (ASK)	DGCA (2006-2017), Behera (2016), Krishnan (2008), Gudmundsson, (2002), Merkert and Gudmundsson (2013), Pearson et al. (2014).
		PRF2	Revenue passenger kilometer (RPK)"	
		PRF3	Available Seat KM per employee	
		PRF4	Average Stage Length Flown in Kilometer	
		PRF5	Fuel Efficiency (liters per KM flown)	
		PRF6	Break Even Load Factor	
		PRF7	Labor cost per KM flown	
4	Financial Factors (FF)	FF1	"Operating revenues/total assets	Altman (1968), Pilarski, and Dinh (1999), Altman et al. (1977), Chow et al. (1991), Silva et al. (2005), Hsu (2017), Pathak (2015), Behera (2016), Krishnan (2008), Stepanyan (2014), Lu et al. (2015), Pineda et al. (2017).
		FF2	Operating Profit/ Total Assets	
		FF3	Retained earnings divided by sum of all assets	
		FF4	Equity Value based on market estimates (Or Recorded Value where not listed) of Equity/Total Book value of debt	
		FF5	Current assets/current liabilities"	

S.No.	Factor Category	Category Code	Factors	References
		FF6	"Earnings before interest and taxes/operating revenues	
		FF7	Interest/total liabilities or Debt Service	
		FF8	Operating revenues per air kilometer	
		FF9	Earnings stability (the deviation around a 10-year trend line of return on assets)	
		FF10	Firm size (measured by the log of the firm's total assets)"	
5	Market-Related Factors (MRF)	MRF1	Number of airlines operating	DGCA (2006-2017), Behera (2016), Krishnan (2008), Merkert and Cowie (2012).
		MRF2	Individual Airline Passenger growth (%) / Industry passenger growth (%)	
		MRF3	Market share	
		MRF4	Govt. policies regarding slot allocation	
		MRF5	Airport preference of airlines	

S.No.	Factor Category	Category Code	Factors	References
6	External Factors (EX)	EX1	"Environment or weather conditions	DGCA (2006-2017), Behera (2016), Krishnan (2008)
		EX2	Geographical location	
		EX3	Threats to National security	
		EX4	Political influence"	

4.3 Phase II Fuzzy Analytical Hierarchy Process

The Fuzzy AHP approach used in this research work is discussed in chapter 3.

4.4 “Determination of weights of specific factors

The expert’s team has done a pair-wise comparison of 6 categories and 38 factors based on the assigned TFNs (table 4.2). This pairwise data is presented in table 4.3. The Chang method has been applied to determine the weights of the specific category as shown below”.

Table 4.2: “Assessment scale

Semantic attributes	Assigned TFN
Equal	(1, 1, 1)
Very Poor	(1, 2, 3)
Poor	(2, 3, 4)
Average	(3, 4, 5)
Good	(4, 5, 6)
Very Good	(5, 6, 7)
Outstanding	(7, 8, 9)”

Table 4.3: Comparison matrix of the specific factors

	OP	**EG**	**PRF**	**FF**	**MRF**	**EX**
OP	(1, 1, 1)	(0.33,0.5, 1)	(1, 2, 3)	(3, 4, 5)	(3, 4, 5)	(0.25, 0.33, 0.5)
EG	(1, 2, 3)	(1, 1, 1)	(0.33, 0.5, 1)	(0.2, 0.25,0.33)	(2, 3, 4)	(3, 4, 5)
PRF	(0.33, 0.5, 1)	(1, 2, 3)	(1, 1, 1)	(0.25, 0.33, 0.5)	(1, 2, 3)	(2, 3, 4)
FF	(0.2, 0.25,0.33)	(3, 4, 5)	(2, 3, 4)	(1, 1, 1)	(2, 3, 4)	(2, 3, 4)
MRF	(0.2, 0.25, 0.33)	(0.25, 0.33, 05)	(0.33, 0.5, 1)	(0.25, 0.33, 05)	(1, 1, 1)	(3, 4, 5)
EX	(2, 3, 4)	(0.2, 0.25,0.33)	(0.25, 0.33, 0.5)	(0.25, 0.33, 0.5)	(0.2, 0.25,0.33)	(1, 1, 1)

The extent of 6 categories is calculated by equation 3.7 in chapter 3:

The results obtained are:

S (OP) = $(8.58, 11.83, 15.5) \otimes [40.83, 57.25, 75.67]^{-1}$

= $(0.113, 0.206, 0.38)$

S (EG) = $(7.53, 10.75, 14.33) \otimes [40.83, 57.25, 75.67]^{-1}$

= $(0.099, 0.188, 0.351)$

S (PRF) = $(5.58, 8.83, 12.5\ ) \otimes [40.83, 57.25, 75.67]^{-1}$

= $(0.073, 0.154, 0.306)$

S (FF) = $(10.2, 14.25, 18.33\ ) \otimes [40.83, 57.25, 75.67]^{-1}$

= $(0.135, 0.249, 0.449)$

S (MRF) = $(5.03, 6.42, 8.33\ ) \otimes [40.83, 57.25, 75.67]^{-1}$

= $(0.066, 0.112, 0.204)$

S (EX) = $(3.9, 5.17, 6.67\ ) \otimes [40.83, 57.25, 75.67]^{-1}$

= $(0.055, 0.09, 0.163)$

“Minimum values of each factor are determined by deploying 3.8, 3.9 respectively”.

“m(OP) = minV($S_1 \geq S_k$) = 0.8529”

“and other values are” m(EG) = 0.7795, m(PRF) = 0.6442, m(FF) = 1, m(MRF) = 0.3361, m(EX) = 0.1521.

Weights of factors are calculated by:

$W_v = (0.8529, 0.7795, 0.6442, 1, 0.3361, 0.1521)^T$

Normalized weights are determined by -

W = (0.2265, 0.2071, 0.1711, 0.2656, 0.0893, 0.0404)

The result of the above steps leads to the following ranks of each category (Table 4.4):

Table 4.4: Ranking of categories of specific factors

Specific factors	Weights	Rank
OP	0.2265	2
EG	0.2071	3
PRF	0.1711	4
FF	0.2656	1
MRF	0.0893	5
EX	0.0404	6

A similar method is used to arrive at the weights of the sub-factors. The final weights of factors for each category are given in Table 4.5, 4.6, 4.7, 4.8, 4.9 and 4. 10.

Table 4.5: "Operational factors ranking

Factors		Weights	Ranking
OP1	Load factor	0.1764	1
OP2	Average number of passengers carried per departure	0.1168	6
OP3	Average Number of hours flown per pilot	0.1180	5
OP4	Number of departures per aircraft	0.1059	7
OP5	Number of pilots per aircraft	0.1443	2
OP6	The average age of the aircraft fleet	0.1279	3
OP7	Number of different brands of aircraft operated	0.1240	4
OP8	International operations	0.0866	8"

Table 4.6: Economic/Government factors ranking

Factors		Weights	Ranking
EG1	Annual inflation	0.2625	2
EG2	GDP Growth Rate	0.2429	3
EG3	Aviation Fuel price (INR per liter)	0.3006	1
EG4	Average Growth in the number of passengers carried in the country	0.1941	4

Table 4.7: Performance-related factors ranking

Factors		Weights	Ranking
PRF1	Available Seat Kilometer (ASK)	0.1327	5
PRF2	Revenue passenger kilometer (RPK)	0.1582	2
PRF3	Available Seat KM per employee	0.1492	3
PRF4	Average Stage Length Flown in Kilometer	0.1448	4
PRF5	Fuel Efficiency (liters per KM flown)	0.1611	1
PRF6	Break Even Load Factor	0.1292	6
PRF7	Labor cost per KM flown	0.1248	7

Table 4.8: "Ranking of categories of financial factors

Factors		Weights	Ranking
FF1	Operating revenues/total assets	0.0954	7
FF2	Operating Profit/ Total Assets	0.0967	6
FF3	Retained earnings/total assets	0.1093	3
FF4	Market Value (Or Book Value where not listed) of Equity/Total Book value of debt	0.1026	5"

Factors		Weights	Ranking
FF5	Current assets/current liabilities	0.0949	8
FF6	Earnings before interest and taxes/operating revenues	0.0907	9
FF7	Interest/total liabilities or Debt Service	0.0836	10
FF8	Operating revenues per air kilometer	0.1139	1
FF9	Earnings stability (the deviation around a 10-year trend line of return on assets)	0.1098	2
FF10	"Firm size (measured by the log of the firm's total assets)".	0.1031	4

Table 4.9: Market-related factors ranking

Factors		Weights	Ranking
MRF1	Number of airlines operating	0.1665	5
MRF2	Individual Airline Passenger growth (%) / Industry passenger growth (%)	0.2346	1
MRF3	Market share	0.2139	2
MRF4	Govt. policies regarding slot allocation	0.2005	3
MRF5	Airport preference of airlines	0.1845	4

Table 4.10: External factors ranking

Factors		Weights	Ranking
EX1	Environment or weather conditions	0.2374	4
EX2	Geographical location	0.2552	2
EX3	Threats to National security	0.2585	1
EX4	Political influence	0.2489	3

"The overall ranks of the factors are determined by multiplying the global weights of the category and the weight of the individual factor. For instance,

operational factor OP1: The weight of OP1 in its category is 0.1764 (Table 4.5) and the weight of the operational category is 0.2265 (Table 4.4). A product of these two values gives the final global weightage which is 0.0400 (Table 4.11). The same method is applied to determine the weights and rankings of all other factors as presented in table 4.11".

Table 4.11: "List of ranking for specific factors

Factors category	**Relative preference weights**	**Relative Rank**	**Factor Code**	**Relative preference weights**	**Relative ranking**	**Global preference weights**	**Global ranking**
OP	0.2265	2	OP1	0.1764	1	0.0400	5
			OP2	0.1168	6	0.0265	17
			OP3	0.1180	5	0.0267	16
			OP4	0.1059	7	0.0240	24
			OP5	0.1443	2	0.0327	6
			OP6	0.1279	3	0.0290	10
			OP7	0.1240	4	0.0281	11
			OP8	0.0866	8	0.0196	30
EG	0.2071	3	EG1	0.2625	2	0.0543	2
			EG2	0.2429	3	0.0503	3
			EG3	0.3006	1	0.0622	1
			EG4	0.1941	4	0.0402	4
PRF	0.1711	4	PRF1	0.1327	5	0.0227	25
			PRF2	0.1582	2	0.0271	15
			PRF3	0.1492	3	0.0255	19
			PRF4	0.1448	4	0.0248	22
			PRF5	0.1611	1	0.0276	12
			PRF6	0.1292	6	0.0221	27
			PRF7	0.1248	7	0.0214	28
FF	0.2656	1	FF1	0.0954	7	0.0253	20"

"Factors category	Relative preference weights	Relative Rank	Factor Code	Relative preference weights	Relative ranking	Global preference weights	Global ranking "
			FF2	0.0967	6	0.0257	18
			FF3	0.1093	3	0.0290	9
			FF4	0.1026	5	0.0273	14
			FF5	0.0949	8	0.0252	21
			FF6	0.0907	9	0.0241	23
			FF7	0.0836	10	0.0222	26
			FF8	0.1139	1	0.0303	7
			FF9	0.1098	2	0.0292	8
			FF10	0.1031	4	0.0274	13
MRF	0.0893	5	MRF1	0.1665	5	0.0149	34
			MRF2	0.2346	1	0.0209	29
			MRF3	0.2139	2	0.0191	31
			MRF4	0.2005	3	0.0179	32
			MRF5	0.1845	4	0.0165	33
EX	0.0404	6	EX1	0.2374	4	0.0096	38
			EX2	0.2552	2	0.0103	36
			EX3	0.2585	1	0.0104	35
			EX4	0.2489	3	0.0101	37

4.5 Analysis of results and discussions

Results of the analysis using the AHP technique under fuzzy conditions are shown in Table 4. 11.

The results establish the following:

1. Rank of the categories
2. Global ranks of all factors across all the categories
3. Rank of the factors within each category

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4.5.1 Rank of the Categories

The results indicate that the factors under the financial category are the major parameters, which influence the financial condition of the airlines. These are followed by Operational, Economic/Government, Performance, Market-related and lastly External.

The financial factors are key to keeping track of the financial health of the airline. The second category is operational, which measures the operational efficiency of the airlines. Higher efficiency will lead to better utilization of resources and ensure the company is able to maintain significant profit margins.

Economic and government factors are next in importance and impact the financial viability of the airlines through the different laws, regulations, economic conditions and taxes.

Performance-related factors occupy the fourth place and are a reflection of the type of cost structure the company operates in. Market related and external factors have the lowest influence on the financials of airlines.

4.5.2 Global rank of individual factors

The results give the global ranks for each individual factor as shown in Table 4.11. The top four individual factors under global ranks belong to economic or government-related factors. These are aviation fuel price, annual inflation, GDP growth rate and the average growth of the number of passengers carried by airlines in the country. This is in line with prior studies (Gudmundsson, 2002, Tinoco et al., 2013, Chi et al., 2011) which have shown that the financial performance of airlines is highly impacted by government policies and the growth of the local country`s economy. Similarly, fuel prices form a major component of the cost structure of an airline in India, and an increase in the rate due to global fluctuations or on account of the taxes levied by the government impact the company`s profitability.

The fifth global rank belongs to the load factor which is indicative of the capacity utilization of the airlines. The number of pilots per aircraft is the next factor which influences the cost structure of the airlines in a major way.

4.5.3 Rank of Individual factors in each category

Financial category factors: Individual analysis of financial factors shows that operating revenues per air kilometer has the highest rank. This ratio has been used earlier in financial analytical models for airlines (Chow et al., 1991). This is a critical aspect of the earning capacity of the airlines with a high impact on the revenue. Higher the revenue earned per distance flown indicates that the company has been able to generate maximum sales per kilometer flown. The next ranked financial factor is the stability of the earnings over a 10 year period. The factor is key to sustained financial performance and indicates whether the company is able to maintain its expected financial performance (Altman et al., 1977). The next in criticality is the ratio of retained earnings by total assets which provides information on how the company has been able to utilize its assets to generate profits and which have accumulated over the years (Altman 1968, Pilarski and Dinh, 1999). The other financial factors which are important and ranked next are the firm size, market (or book) value of equity by the recorded value of debt, operating profit by sum of all assets and operating revenue by total assets. These factors have been used in several models for evaluations of financial distress in generic models and also specific to the airline industry ((Altman, 1968, Altman et al., 1977, Pilarski and Dinh, 1999, Chow et al.,1991).

Operation Category factors: The operation performance factors are ranked second and are key to ensuring the airline operates productively and efficiently. The load factor occupies the top rank and is an important factor which confirms the capacity of the airlines is maximized (Chow and Tsui, 2017; Chang and Yeh, 2001). Airlines and regulatory agencies monitor this factor periodically to make sure that the company is able to maintain high load factor and hence a lower fixed cost per seat (Behn and Riley, 1999, Zhu, 2011). The next in importance

is the number of pilots per aircraft which the airline has employed. Pilots are the most expensive resource among the different types of staff hired and constitute a large component of the labor cost of the airlines (Gudmundsson, 2002). The average age of the aircraft fleet is next in importance as older aircraft lead to higher maintenance cost (Gudmundsson, 2002). The factor which denotes the number of different brands of aircraft employed by airlines is next in rank and is found to have a major impact on cost on account of the higher maintenance and spares to be maintained for the different aircraft brands (Gudmundsson, 2002). The fifth rank was the average number of hours flown by each pilot which signifies the utilization of this expensive resource. This has an impact on the cost structure of the airlines (Gudmundsson, 2002). Capacity utilization is also measured by the average number of passengers carried per departure and this is the sixth rank (Gudmundsson, 2002). The number of departures per aircraft constitute the next rank and are important as they are an indication of the utilization of the aircraft by the airlines. The last rank is occupied by the extent of the international operations that the airline runs as part of its routes.

Government/economics category factors: This category has the aviation fuel price per liter as the highest rank. This factor is extremely important for Indian airlines as this constitutes 30% of the total operating cost. Aviation fuel is imported in India and is dependent on the exchange rate, government taxes, and the international crude price. Annual inflation is ranked second and is a major factor influencing the cost structure of the airline as well as the demand for the airline (Gudmundsson, 2002, Tinoco et al., 2013, Chi et al., 2011). Airline fares in India are highly priced sensitive and companies find it difficult to increase fares when the operating costs increase because of inflation. GDP growth rate is ranked third in this category and is important as it influences the overall demand for the growth of passengers traveling by air (Xie et al, 2011). “The last factor in this category is the average growth in the number of passengers carried and is an indicator of the growing market size for airlines”.

Performance category factors: The performance factors indicate the efficiency with which the individual airlines are operating. “The primary factor here is the fuel efficiency of the airline and the factor indicates the operational cost structure for the airline (Hand Book On Civil Aviation Statistics 2016-17 DGCA report)”. The next factor is the revenue per kilometer indicating the revenue generated per passenger kilometer flown. The available seat kilometer per employee is ranked next and is a measure of the employee deployed per seat available. Average stage length flown is the fourth-ranked factor and measures the utilization of the aircraft by the airline. The factors, which are lowest in terms of influence in this category, are available seat kilometer, breakeven load factor, and labor cost per kilometer flown.

Market-related category factors: This category is a part of the external environment, in which the airline operates. The primary factor in this category is the passenger growth as compared to the total passenger growth in the industry. This factor is significant as it shows that the market share of the airlines is growing faster or at the same rate as the total industry growth (Kocher, 2010, Krishnan, 2008). Market share is the next rank and is important for the airlines as it signifies the position of the company in the market in terms of the passengers it flies. Government policies are next in ranking and are important as they often specify the routes to be run by the airlines or the fares to be charged which restrict the growth and revenue of the company. Airport preference of airlines is the next in importance and is key to the cost structure of the airlines as it indicates the cost that the company has to bear for parking its airlines when not in use. The last rank in this category is the number of airlines operating and is an indication of how intense the competition is and whether the company is able to command fares on certain routes.

External Category factors: The last category in the ranking is the external factor over which the airline has no control. The primary factor here is the threat to national security, which necessitates increased security checking at airports. This often leads to delays in flights taking off and prevents the airlines from

reaching its optimum number of flights flown in a day. Geographical location is the next factor, which constitutes certain restrictions in the flights that can be flown in the country. If there are less number of airports, the airlines will not be able to use their aircraft for a higher number of flights. Political influence is the next factor in the ranking and denotes the extent of political influence in the aviation industry in the country (Gudmundsson, 2002). The last rank is the environment or weather conditions which lead to disruption of flights, and reduces the number of kilometers flown in a day and hence impacts the revenue of the airlines.

4.6 Sensitivity analysis

"The robustness of the proposed framework can be assessed by sensitivity analysis. Ranking of specific factors in table 4.11 indicates that the financial category (FF) acquires the first rank with high priority weights. Hence, this category may possibly affect the ranking pattern of the other categories (Kumar & Garg, 2017; Kumari et al., 2017). Therefore, it would be helpful to review the new ranking pattern by varying the weights of all categories (Luthra et al., 2016; Prakash & Barua, 2016; Prakash et al, 2015a, 2015b). The effect of an incremental change in the value of the financial category (FF) from 0.1 to 0.9 and its impact on the other categories ranking was established through a sensitivity run (Table 4.12). The result of the sensitivity runs indicates that the highest relative change was displayed in the market-related category (Table 4.12). Further, as financial categories weights vary, those identified factor weights and their final list are impacted. In the sensitivity test, by changing the value of the financial category to 0.1, EG2 (GDP Growth Rate) acquires the first rank, while, the last rank is held by FF7 (Interest/total liabilities or Debt Service). The factor EG2 holds the first rank when financial category value is 0.2, while EX1 (Environment or weather conditions) holds the last rank. At normalized level when financial category value is 0.2656, EG2 occupies the first rank, while, EX1 acquired the last rank. Again, the EG2 factor holds the first rank when financial category value is 0.3 and 0.4, while EX1 holds the last

rank. Further changes in financial category value from 0.5 to 0.9, have FF8 (Operating revenues per air kilometer) with the first rank and the last rank is held by EX1. The placing of other dimensions in the ranking also varies as shown in Table 4.13 and figure 4.2. As a result of this exercise, it may be conclusive to say that financial category is most crucial in financial distress evaluation of airlines in India, and so, greater focus is needed for this category".

Management can review and keep in check these ranked categories and factors, as shown using the Fuzzy AHP technique, it can diminish the possibility of financial distress at an early stage.

Table 4.12: Values of specific factors when increasing financial factor

Listed category	**Specific weights**									
OP	0.2597	0.2397	0.2265	0.2197	0.1997	0.1737	0.1492	0.1202	0.1016	0.0673
EG	0.2402	0.2202	0.2071	0.2002	0.1802	0.1602	0.1380	0.1015	0.0670	0.0220
PRF	0.2042	0.1842	0.1711	0.1642	0.1442	0.1211	0.0922	0.0642	0.0212	0.0074
FF	0.1	0.2	0.2656	0.3	0.4	0.5	0.6	0.7	0.8	0.9
MRF	0.1224	0.1024	0.0893	0.0824	0.0624	0.0400	0.0194	0.0131	0.0098	0.0033
EX	0.0735	0.0535	0.0404	0.0335	0.0135	0.0050	0.0012	0.0010	0.0004	0.0001
Total	1	1	1	1	1	1	1	1	1	1

Table 4.13: Revised ranks for factors using sensitivity analysis and changing only the financial category

Factors	0.1	0.2	Normalized (0.2656)	0.3	0.4	0.5	0.6	0.7	0.8	0.9
OP1	11	11	16	20	19	19	19	19	19	15
OP2	23	24	30	30	29	29	26	22	22	19
OP3	6	6	6	9	16	16	16	16	15	12
OP4	10	8	11	16	18	18	18	18	18	14
OP5	16	15	24	25	24	23	21	21	21	17
OP6	13	12	17	21	20	20	20	20	20	16
OP7	7	7	10	15	17	17	17	17	17	13
OP8	5	5	5	5	13	15	15	14	12	11
EG1	4	4	4	4	14	14	14	15	16	22
EG2	1	1	1	1	1	7	11	11	11	18
EG3	2	2	2	2	2	11	12	12	13	20
EG4	3	3	3	3	5	13	13	13	14	21
PRF1	14	14	22	24	25	25	25	26	26	26
PRF2	18	18	27	27	27	27	28	28	28	28
PRF3	20	19	28	28	28	28	29	29	29	29
PRF4	17	16	25	26	26	26	27	27	27	27
PRF5	12	13	19	23	23	24	24	25	25	25
PRF6	9	10	15	19	22	22	23	24	24	24

Factors	0.1	0.2	Normalized	0.3	0.4	0.5	0.6	0.7	0.8	0.9
PRF7	8	9	12	18	21	21	22	23	23	23
FF1	35	29	20	13	10	8	7	7	7	7
FF2	34	28	18	12	9	6	6	6	6	6
FF3	31	23	9	8	6	3	3	3	3	3
FF4	33	26	14	11	8	5	5	5	5	5
FF5	36	30	21	14	11	9	8	8	8	8
FF6	37	32	23	17	12	10	9	9	9	9
FF7	38	34	26	22	15	12	10	10	10	10
FF8	29	20	7	6	3	1	1	1	1	1
FF9	30	21	8	7	4	2	2	2	2	2
FF10	32	25	13	10	7	4	4	4	4	4
MRF1	22	31	33	33	33	33	33	33	33	33
MRF2	15	17	29	29	30	30	30	30	30	30
MRF3	21	27	32	32	32	32	32	32	32	32
MRF4	24	33	34	34	34	34	34	34	34	34
MRF5	19	22	31	31	31	31	31	31	31	31
EX1	28	38	38	38	38	38	38	38	38	38
EX2	26	36	36	36	36	36	36	36	36	36
EX3	25	35	35	35	35	35	35	35	35	35
EX4	27	37	37	37	37	37	37	37	37	37

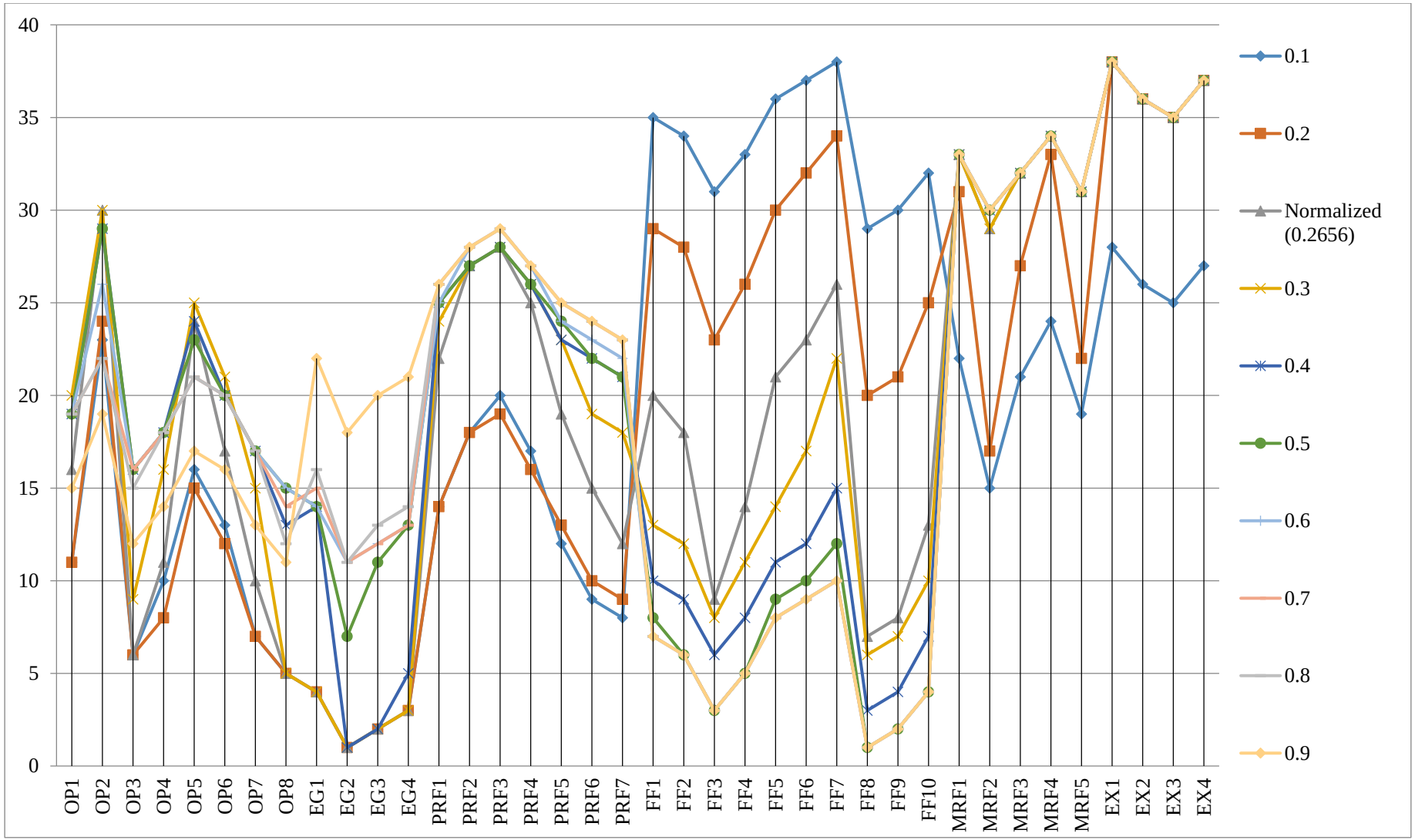

Figure 4.2: Sensitivity analysis results

4.7 Chapter Summary

This chapter discusses the methodology for arriving at the prioritization of factors impacting the distress situation of airlines in India. To obtain the ranking list, the Fuzzy AHP method has been adopted. The results achieved at each step are described in complete detail. The final rank for each criterion and factor are further discussed based on the impact they have on the financial situation of the airline.

“The next chapter discusses the process of testing airlines operating in India for their financial distress or bankruptcy condition using existing models available globally”.

Chapter 5

Assessment of financial bankruptcy/distress models in the airline industry

Overview

"This chapter examines six models which are used globally for the prediction/assessment of financial bankruptcy and distress condition in the airline industry. These models are tested using the published data of six airlines in India. The results are discussed and analyzed for each of these airlines".

5.1 Test of existing models on the data of airlines operating in India

Six global models which assess financial bankruptcy or distress were selected for review using the data of the airlines in India.

The six models selected are:

1. Altman Z" score model
2. Airscore model
3. Pilarski or P score model
4. Gudmundsson model
5. HFSAT model
6. Kroeze model

The above models have been widely used globally for testing the financial bankruptcy or distress condition in airline industries. Six airlines operating in India were selected for the tests on the basis of the data available. These airlines are Kingfisher, Jet Airways, Jetlite, Indigo, Go Air and Spicejet.

5.2 Altman Z" score model

Altman (1968) was a pioneer in the design of insolvency expectation models using the MDA method. The model was developed using financial ratios which measured the following: liquidity, profitability, leverage, solvency, and activity of the company. The model utilized the data from failed and non-failed manufacturing companies (thirty-three of each), and used the MDA method to build the following equation:

$Z= 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5$……..Eq 5.1

Where X1 to X5 are financial ratios as explained below:

"X1 = net working capital divided by total assets (a measure of liquidity)

X2 = retained earnings divided by total assets (a measure of profitability)

X3 = operating profit divided by total assets (a measure of profitability)

X4 = Equity value as per the market divided by recorded value of debt (a measure of leverage or solvency)

X5 = operating revenues divided by total assets (measures turnover or activity)"

The value of Z was found to be lower than 1.81 for bankrupt companies and greater than 2.99 for financially stable companies. Any value in the middle region was considered a grey zone which did not give a clear indication of the status of the company.

The value of Z would increase as the measure of the ratios increases. Higher the value of Z, lower would be the risk of failure.

The model's prediction rate was 76% for the sample tested.

The above model was later (Altman 1983) modified to suit the airlines and other service industries and was termed as Z" model. This model has been adopted in America by the regulatory agencies to review the financial atatus of airlines operating in US.

The changes incorporated in this revised model pertain to the operating revenues to total assets ratio as this can be inaccurate, specifically where an airline is using operating leases extensively and which are reported on the revenue part in the income statement (Gritta et al., 1994). This accounting treatment leads to

higher revenue and distorts the Z score. The original model was changed to the Z" score model (Altman, 1983) and expressed as follows:

$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$……Eq 5.2

X_1 = net working capital divided by total assets (measures liquidity)

X_2 = retained earnings divided by total assets (measures profitability)

X_3 = operating profit divided by total assets (measures profitability)

X_4 = Equity value as per the market divided by recorded value of debt (measures leverage) or Book value of equity/Book value of total liabilities for private companies. For the airlines in India, the book value of equity is taken in the calculations.

The Z" score as defined above shows a value of less than 1.1 for a company which has a higher probability of financial failure. A score of 2.6, however, indicates that the company is financially stable. Scores in the range of 1.1 to 2.6 are considered to be in the grey zone where the financial status cannot be clearly classified.

Table 5.1 shows the derived Z" Scores for six airlines in India for the period 2006 to 2017 based on the data published in their financial statements.

Table 5.1: Z" score values for airlines in India

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spice jet**	**Go air**	**Indigo**
2006	0.02	1.35	2.48	0.18		
2007	(0.36)	0.89	(1.46)	(0.21)		
2008	(1.15)	0.42	(2.14)	(0.08)		
2009	(0.91)	0.46	(3.55)	(1.22)		
2010	(0.80)	0.42	(1.43)	1.00	(0.89)	2.01
2011	(0.61)	0.36	(1.33)	1.80	0.56	1.61
2012	(1.98)	0.15	(3.07)	(0.19)	(0.60)	1.44
2013	(12.30)	0.28	(3.59)	0.84	0.76	1.97
2014		(0.44)	(7.62)	(0.51)	0.83	1.35

	Kingfisher Airlines	Jet Airways	Jetlite	Spice jet	Go air	Indigo
2015		(0.28)	(9.24)	(1.00)	0.76	1.88
2016		0.48	(10.93)	0.41	0.69	1.99
2017		0.46	(15.04)	1.06	1.31	1.56

Using the above data the financial condition of the above airlines can be specified for every year based on the Z" score and its interpretation as follows:

Table 5.2: Z" Score value definitions:

Financial Condition	Scores
Distress	A score less than 1.81
Grey Zone	Between 1.81 and 2.99
Non Distress	A score greater than 2.99

Table 5.3: Financial Status based on Z" score values for airlines in India

	Kingfisher Airlines	Jet Airways	Jetlite	Spicejet	Goair	Indigo
2006	"FD"	"FD"	GZ	"FD"		
2007	"FD"	"FD"	"FD"	"FD"		
2008	"FD"	"FD"	"FD"	"FD"		
2009	"FD"	"FD"	"FD"	"FD"		
2010	"FD"	"FD"	"FD"	"FD"	"FD"	GZ
2011	"FD"	"FD"	"FD"	"FD"	"FD"	"FD"
2012	"FD"	"FD"	"FD"	"FD"	"FD"	"FD"
2013	"FD"	"FD"	"FD"	"FD"	"FD"	GZ
2014	"FD"	"FD"	"FD"	"FD"	"FD"	"FD"
2015	"FD"	"FD"	"FD"	"FD"	"FD"	GZ
2016	"FD"	"FD"	"FD"	"FD"	"FD"	GZ
2017	"FD"	"FD"	"FD"	"FD"	"FD"	"FD"

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

As per the Altman Z" model, the tests show that for the majority of the years from 2006 to 2017, the six airlines are under distress condition. These financial predictions would be misleading as the airlines are shown to be under distress, even when the company has just started operations, for example, GoAir in 2010.

5.3 The AIRSCORE Model:

Generic models used to assess the financial condition of companies are generally found to be poor in accuracy in their assessment. The current trend is therefore to build industry-specific models which provide higher accuracy in their assessment. With this objective, several models have been designed and used specifically for the airline industry. The model defined as AIRSCORE has been developed using financial data from the airline industry (Chow et al., 1991). The companies included in designing this model were both large and small low-cost airlines. The model was built using the MDA regression method and the following equation was derived:

AIRSCORE= -.34140X1 + .00003X2 +.36134X3…….Eq 5.3

"The three ratios used in the above equation are:
X1 = interest/ total liabilities (gives the interest rate charged on the debt taken)
X2 =operating revenues per air mile (a measure of revenue for the airlines)
X3 = shareholders' equity/ total liabilities (similar to the Altman Z" model)"
The model defines that if the air score is greater than 0.03 the company is considered as financially healthy whereas less than -0.095 it is in financial distress. Any value between 0.03 and -0.095 is considered a grey zone which cannot be interpreted for either condition. This model showed an accuracy rate of between 76% to 83 %. However, the results showed a bias towards large airline companies.

Using this model on the six airlines in India the following were the results:

Table 5.4: Airscore model values for airlines in India

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	0.05	(0.06)	0.16	0.15		
2007	0.03	(0.04)	0.28	0.20		
2008	0.03	(0.04)	0.23	0.16		
2009	(0.04)	(0.07)	0.20	0.18		
2010	(0.08)	(0.09)	0.21	0.20	0.04	0.02
2011	0.02	(0.02)	0.16	1.72	(0.03)	0.01
2012	0.02	(0.01)	0.19	0.15	(0.03)	0.01
2013	0.02	(0.01)	0.18	0.09	(0.06)	0.00
2014		(0.01)	0.13	0.11	(0.04)	0.00
2015		(0.01)	0.12	0.13	(0.04)	0.00
2016		(0.01)	0.11	0.17	(0.04)	0.03
2017		(0.01)	0.11	0.18	(0.01)	0.04

Table 5.5: Airscore value definitions:

Financial Condition	**Scores**
Distress	Score less than -0.095
Grey Zone	Between -0.095 and 0.03
Non Distress	A score greater than 0.03

Based on the cutoff values defined above "the status of the financial condition of the six airlines is shown in Table 5.6":

Table 5.6:"Financial Status based on Airscore score values for airlines in India"

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	Non "FD"	GZ	Non "FD"	Non "FD"		
2007	GZ	GZ	Non "FD"	Non "FD"		
2008	GZ	GZ	Non "FD"	Non "FD"		
2009	GZ	GZ	Non "FD"	Non "FD"		
2010	GZ	GZ	Non "FD"	Non "FD"	Non "FD"	GZ
2011	GZ	GZ	Non "FD"	Non "FD"	GZ	GZ
2012	GZ	GZ	Non "FD"	Non "FD"	GZ	GZ
2013	GZ	GZ	Non "FD"	Non "FD"	GZ	GZ
2014		GZ	Non "FD"	Non "FD"	GZ	GZ
2015		GZ	Non "FD"	Non "FD"	GZ	GZ
2016		GZ	"Non "FD""	"Non "FD""	GZ	"Non "FD""
2017		GZ	"Non "FD""	Non "FD"	GZ	Non "FD"

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

A review of the above financial status of the airlines shows inconsistent results for each year. For example, all the airlines are either not in distress or are in the

grey zone which is contrary to the actual condition of the airlines such as Kingfisher Airlines which filed for bankruptcy in 2014.

5.4 The Pilarski Score Model

The Pilarski model uses logistic regression to design the financial distress assessment model for airlines (Pilarski and Dinh, 1999]. Logistic models lead to a probability of a financial failure occurring and provide an indication of the financial stability of the company.

The model takes the form of

$W = -1.98X1 – 4.95X2 – 1.96X3 – 0.14X4 – 2.38X5$……Eq 5.4

Where:

X1 = operating revenues/total assets (similar to the Altman model)

X2 = retained earnings/total assets (similar to the Altman model

X3 = equity/total debt obligations (similar to the Altman model)

X4 = liquid assets divided by current maturities of total debt obligations

X5 = earnings before interest and taxes divided by operating revenues

The output is the P score and is measured as $P = 1/[1+e^{-W}]$. This gives the probability value of distress occurring for airlines. A high value of P will show that there is a high chance of the company facing bankruptcy or distress. The model has been found to give similar results to the Altman Z" score model (Goodfriend et al., 2004).

Using the data of the six airlines in India, the P score has been calculated and shown in Table 5.7.

Table 5.7: P score values for airlines in India (in %)

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	32.78	8.92	1.66	63.24		
2007	62.00	13.80	47.33	38.53		
2008	85.44	25.51	98.79	33.64		
2009	71.11	26.17	99.98	66.49		

	Kingfisher Airlines	Jet Airways	Jetlite	Spicejet	Goair	Indigo
2010	84.37	27.60	99.79	17.47	90.45	3.79
2011	78.31	22.41	99.68	0.00	40.43	5.28
2012	96.23	28.07	99.99	22.06	51.06	4.31
2013	100.00	22.93	100.00	14.12	18.44	2.95
2014	-	49.84	100.00	39.68	14.86	6.91
2015	-	51.96	100.00	77.81	15.61	4.93
2016	-	30.35	100.00	44.21	15.04	3.32
2017	-	29.83	100.00	15.02	8.27	3.60

The above probabilities in percentage terms show the risk of financial distress occurring in the company.

The low risk of failure can be indicated where the probability is below 25% while the high risk would be higher than 75%. A P-score percentage value in between these two boundaries could be in the grey zone. Based on this classification and the above probability scores the financial state could be classified as distress, non-distress and grey area and are shown for each airline and each year in Table 5.8.

Table 5.8: Financial Status based on P score values for airlines in India

	Kingfisher Airlines	Jet Airways	Jetlite	Spice jet	Go air	Indigo
2006	GZ	Non “FD”	Non “FD”	GZ		
2007	GZ	Non “FD”	GZ	GZ		
2008	“FD”	GZ	“FD”	GZ		
2009	GZ	GZ	“FD”	GZ		
2010	““FD””	GZ	“FD”	“Non “FD”	“FD”	“Non “FD””
2011	“FD”	Non “FD”	“FD”	Non “FD”	GZ	Non “FD”
2012	“FD”	GZ	“FD”	Non “FD”	GZ	Non “FD”

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spice jet**	**Go air**	**Indigo**
2013	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	Non "FD"
2014		GZ	"FD"	GZ	Non "FD"	Non "FD"
2015		GZ	"FD"	"FD"	Non "FD"	Non "FD"
2016		GZ	"FD"	GZ	Non "FD"	Non "FD"
2017		GZ	"FD"	Non "FD"	Non "FD"	Non "FD"

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

The above state of financial condition is not a true indicator with Jet Airways projected to be in financial distress condition from 2007 onwards which is highly unlikely for an airline to continue for the next 10 years in the financially distressed state.

5.5 The Gudmundsson Model

Gudmundsson (2002) developed a model for the airline industry with a blend of accounting and operational variables. This usage of non-financial variables was adopted as research had found that industry-specific models for financial distress assessment were more accurate in their prediction when these factors were incorporated in the model. This model was designed using the logistic regression method and expressed as the following equation:

$$Z=6.757-0.329X1-0.052X2+0.016X3-0.002X4+0.047X5+0.685X6+0.157X7+0.651X8-1.518X9 \quad \text{Eq 5.7}$$

The Z score was converted to a probability of bankruptcy using the following equation:

$P = 1/[1+e^{-z}]$……..Eq 5.8

The factors adopted in the model are:

"X1 =load factor (this is measured in percentage terms and indicates the percentage filled)

X2 = number of passengers per departure

X3 =number of hours flown per pilot

X4 =number of departures per aircraft

X5=number of employees per aircraft

X6 =average age of aircraft fleet

X7 =annual inflation rate in the carrier's home economy

X8 =number of different brands of aircraft operated

X9=political influence (a dummy variable: yes=1; no=0)"

This model was developed using the data of 41 commercial companies globally and gave a 90.2% accuracy rate.

Using the data of the six airlines in India, the P score based on the above model has been calculated and shown in Table 5.9.

Table 5.9: Probability of distress for airlines in India (in %) as per Gudmundsson (2002) Model

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spice jet**	**Go air**	**Indigo**
2006	2.83	51.14	42.98	0.06		
2007	1.60	103.49	90.40	0.10		
2008	1.73	126.06	2.84	0.68		
2009	17.69	422.85	6.07	25.77		
2010	41.80	18.99	0.37	0.35	0.02	0.00
2011	1.03	47.91	0.16	0.03	0.04	0.00

	Kingfisher Airlines	Jet Airways	Jetlite	Spice jet	Go air	Indigo
2012	5.77	3.13	0.01	0.15	0.02	0.00
2013	442.41	7.82	0.04	0.04	0.06	0.00
2014		15.82	0.09	0.17	0.05	0.01
2015		1.89	0.00	0.00	0.01	0.00
2016		1.20	0.00	0.00	0.00	0.00
2017		5.31	0.00	0.00	0.00	0.00

The above probabilities in percentage terms show the risk of financial distress occurring in the company.

A similar categorization can be projected as the P-score model where there is a low risk of failure when the probability is below 25% while the high risk would be indicated when it is higher than 75%. A probability (%) value in between these two boundaries could be in the grey zone.

Based on this classification and the probability scores in Table 5.9 the financial state could be classified as distress, non-distress, and grey area. This data is shown for each airline and each year in Table 5.10 for the Gudmundsson (2002) model.

Table 5.10: Financial Status based on Probability values (percentage) for airlines in India using the Gudmundsson (2002) model.

	Kingfisher Airlines	Jet Airways	Jetlite	Spicejet	Goair	Indigo
2006	Non "FD"	GZ	GZ	Non "FD"		
2007	Non "FD"	"FD"	"FD"	Non "FD"		
2008	Non "FD"	"FD"	Non "FD"	Non "FD"		
2009	Non "FD"	"FD"	Non "FD"	GZ		
2010	GZ	Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"

	Kingfisher Airlines	Jet Airways	Jetlite	Spicejet	Goair	Indigo
2011	Non "FD"	GZ	Non "FD"	Non "FD"	Non "FD"	Non "FD"
2012	Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"
2013	"FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"
2014		Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"
2015		Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"
2016		Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"
2017		Non "FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

The above data shows inconsistent results with almost all the airlines appearing to be in a non-distress state in almost all the years. The condition does not truly depict the financial status considering that Kingfisher declared bankruptcy in 2014, but is shown as non-distress in 2012.

5.6 Hybrid Financial Statement Analysis (HFSAT) based Model

Silva et al. (2005) used a multivariate technique to create a model for airlines in the USA and Brazil. The model was based on Hybrid Financial Statement Analysis (HFSAT) and it tested the financial condition of airlines and estimated the risk of insolvency. The method was based on Discriminant analysis and applied using Fuzzy Logic methodology to the financial data of an airline.

The discriminate analysis is utilized to classify a data set and identify if it belongs to a particular group. The discriminant method is suitable where the

data can be divided into groups which have similar characteristics. These characteristics can be represented by variables which can have two or more values and represent a particular state such as bankrupt/non-bankrupt or high/medium/low etc (Hair, 1995).

This discriminant technique, when combined with Fuzzy Logic, provides the HFSAT model. Fuzzy Logic methodology attempts to provide a result simulating the fuzziness in human thinking. Fuzzy logic measures the membership in a group through a method which accounts for haziness and indistinctness.

To arrive at a model Silva et al. 2005, divided the airline database into three groups: healthy, high risk and insolvent using an economic and financial index. Twenty-nine ratios were extracted from this database which represented profitability, liquidity, turnover, etc. A stepwise multiple regression method was adopted and the result was the following equation:

"Z = 2.637 - 0.879X1 + 0.466X2 – 0.268X3 – 0.28X4……..Eq 5.9

Where:

X1 = Shareholder Funds by Total Assets (Equity ÷ Total Asset)
X2 = Liquidity ((Current Liabilities + Long Term Liabilities) ÷ Total Asset)
X3 = Net Operating Revenue by Total Assets (Net Op. Revenue ÷ Total Asset)
X4 = Fixed Assets by Total Assets (Fixed Assets ÷ Total Asset)"

The authors identified five groups: healthy, low risk, moderate risk, high risk and insolvent. With the method as proposed by Tanaka (1997), the authors used a fuzzy logic model to arrive at a set of equations which used the derived Z value and identified the financial state of the company. The derived Z values for each category was based on the results of using Fuzzy logic equations. These categories and the corresponding range of Z value are given in table 5.11:

Table 5.11: "HFSAT model categories

Classification	Limit of Z
Healthy (Non-Distress)	Z <= 1.862
Low Risk	1.862 < Z <= 2.2
Moderate Risk	2.2 <Z <= 2.515
High Risk	2.515 < Z <= 2.73
Insolvent	Z > 2.73"

With the data of six airlines in India, the HFSAT model was used to arrive at "the Z score and define the financial state of the company. The Z scores calculated are in Table 5.12":

Table 5.12: Z score values for airlines in India as per HFSAT Model

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	2.32	2.45	1.92	2.26		
2007	2.38	2.45	-0.26	-0.14		
2008	2.48	2.42	-0.28	-0.17		
2009	2.56	2.38	-0.27	-0.20		
2010	2.58	2.40	0.02	0.04	2.39	2.29
2011	2.90	2.72	-0.04	0.04	2.81	2.68
2012	3.05	2.72	-0.14	-0.13	2.81	2.62
2013	4.60	2.72	-0.10	-0.01	2.79	2.58
2014		2.78	-0.24	-0.12	2.74	2.65
2015		2.81	-0.14	-0.10	2.80	2.64
2016		2.76	0.01	0.12	2.85	2.61
2017		2.77	-0.01	0.10	2.77	2.65

Based on the categorization and the Z score values as given in Table 5.12 the financial state for each airline and for each year is shown in Table 5.13.

Table 5. 13: Financial Status based on Z score values for airlines in India using the HFSAT model

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	Moderate Risk	Moderate Risk	Low Risk	Moderate Risk		
2007	Moderate Risk	Moderate Risk	Non "FD"	Non "FD"		
2008	Moderate Risk	Moderate Risk	Non "FD"	Non "FD"		
2009	High Risk	Moderate Risk	Non "FD"	Non "FD"		
2010	High Risk	Moderate Risk	Non "FD"	Non "FD"	Moderate Risk	Moderate Risk
2011	Insolvent	High Risk	Non "FD"	Non "FD"	Insolvent	High Risk
2012	Insolvent	High Risk	Non "FD"	Non "FD"	Insolvent	High Risk
2013	Insolvent	High Risk	Non "FD"	Non "FD"	Insolvent	High Risk
2014		Insolvent	Non "FD"	Non "FD"	Insolvent	High Risk
2015		Insolvent	Non "FD"	Non "FD"	Insolvent	High Risk
2016		Insolvent	Non "FD"	Non "FD"	Insolvent	High Risk
2017		Insolvent	Non "FD"	Non "FD"	Insolvent	High Risk

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

The above results are inconsistent as some airlines such as Jet Airways and GoAir are shown as insolvent, but have been in operations for a number of years.

5.7 Kroeze Model

Kroeze (2005) used the Multiple Discriminant Analysis (MDA) to develop the financial distress prediction model for the airline industry. The data was collected for the airline operating in the USA for the period from 1998 to 2003. The model uses three ratios extracted from the financial statements and which measure liquidity, profitability, and solvency for these companies. These ratios when built into a model gave the following equation:

$K = .268(X1) + .838(X2) + .111(X3) + \acute{\varepsilon}$ ……..Eq 5.10

where X1 = working capital divided by sum of all assets,

X2 = Profits or earnings retained divided by sum of all assets,

X3 = book value of equity divided by total liabilities,

$\acute{\varepsilon}$ = error term

The K score model was found to have higher accuracy than the Z" score Altman model with predictions giving precise results even four years before the filing of bankruptcy for the airline companies in America.

Classifying the companies based on the K score is simpler with those companies with a positive score as non-bankrupt and those with a negative or zero score as bankrupt. This model does not classify the companies in a grey area.

Using the data of the six airlines in India, the K score model was used to arrive at the K score and define the financial state of the company. The K scores calculated are shown in Table 5.14.

Table 5. 14: K score values for airlines in India

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	-0.24	0.10	-0.07	-0.44		
2007	-0.28	0.04	-1.08	-0.24		
2008	-0.45	0.01	-1.54	-0.30		
2009	-0.38	-0.01	-2.37	-1.05		
2010	-0.53	-0.03	-1.94	-0.75	-1.06	0.06
2011	-0.63	-0.03	-1.70	-0.14	-0.82	-0.06
2012	-0.89	-0.07	-2.60	-0.63	-0.95	0.03
2013	-5.23	-0.10	-2.99	-0.46	-0.53	0.02
2014		-0.26	-4.73	-0.75	-0.39	0.00
2015		-0.33	-6.51	-1.01	-0.29	0.03
2016		-0.27	-8.35	-0.92	-0.22	0.10
2017		-0.29	-11.67	-0.72	-0.09	0.12

Based on the categorization method and the K score values as given in Table 5.14 the financial state for each airline and for each year is shown in Table 5.15.

Table 5.15: Financial Status based on K score values for airlines in India

	Kingfisher Airlines	**Jet Airways**	**Jetlite**	**Spicejet**	**Goair**	**Indigo**
2006	“FD”	Non “FD”	“FD”	“FD”		
2007	“FD”	Non “FD”	“FD”	“FD”		
2008	“FD”	Non “FD”	“FD”	“FD”		
2009	“FD”	“FD”	“FD”	“FD”		
2010	“FD”	“FD”	“FD”	“FD”	“FD”	Non “FD”
2011	“FD”	“FD”	“FD”	“FD”	“FD”	“FD”
2012	“FD”	“FD”	“FD”	“FD”	“FD”	Non “FD”
2013	“FD”	“FD”	“FD”	“FD”	“FD”	Non “FD”

	Kingfisher Airlines	Jet Airways	Jetlite	Spicejet	Goair	Indigo
2014		"FD"	"FD"	"FD"	"FD"	"FD"
2015		"FD"	"FD"	"FD"	"FD"	Non "FD"
2016		"FD"	"FD"	"FD"	"FD"	Non "FD"
2017		"FD"	"FD"	"FD"	"FD"	Non "FD"

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

The results are not consistent for the airlines operating in India. The above data shows that except for Indigo all the other airlines are in distress which does not reflect their true state.

5.8 Results and discussions

The tests show that none of the six tested models accurately identifies the financial condition of airlines operating in India. The results for each model and each year give conflicting assessments of distress. The results for each year and each airline are summarized for all models and shown in Tables 5.16 to 5.21.

Table 5.16: Kingfisher Airlines financial condition as evaluated by six models

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2006	"FD"	Non "FD"	GZ	Moderate Risk	Non "FD"	"FD"
2007	GZ	GZ	GZ	Moderate Risk	Non "FD"	"FD"
2008	"FD"	GZ	"FD"	Moderate Risk	Non "FD"	"FD"
2009	"FD"	GZ	GZ	High Risk	Non "FD"	"FD"
2010	"FD"	GZ	"FD"	High Risk	GZ	"FD"

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2011	“FD”	GZ	“FD”	Insolvent	Non “FD”	“FD”
2012	“FD”	GZ	“FD”	Insolvent	Non “FD”	“FD”
2013	“FD”	GZ	“FD”	Insolvent	“FD”	“FD”
2014						
2015						
2016						
2017						

“FD”-Financial Distress; Non “FD”- Non-Financial Distress; GZ – Grey Zone

Table 5.17: Jet Airways financial condition as evaluated by six models

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2006	Non “FD”	GZ	Non “FD”	Moderate Risk	GZ	Non “FD”
2007	Non “FD”	GZ	Non “FD”	Moderate Risk	“FD”	Non “FD”
2008	Non “FD”	GZ	GZ	Moderate Risk	“FD”	Non “FD”
2009	Non “FD”	GZ	GZ	Moderate Risk	“FD”	“FD”
2010	Non “FD”	GZ	GZ	Moderate Risk	Non “FD”	“FD”
2011	GZ	GZ	Non “FD”	High Risk	GZ	“FD”

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2012	"FD"	GZ	GZ	High Risk	Non "FD"	"FD"
2013	"FD"	GZ	Non "FD"	High Risk	Non "FD"	"FD"
2014	"FD"	GZ	GZ	Insolvent	Non "FD"	"FD"
2015	"FD"	GZ	GZ	Insolvent	Non "FD"	"FD"
2016	"FD"	GZ	GZ	Insolvent	Non "FD"	"FD"
2017	"FD"	GZ	GZ	Insolvent	Non "FD"	"FD"

"FD"-Financial Distress; Non "FD"- Non Financial Distress; GZ – Grey Zone

Table 5.18: Jetlite Airlines financial condition as evaluated by six models

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2006	Non "FD"	Non "FD"	Non "FD"	Low Risk	GZ	"FD"
2007	"FD"	Non "FD"	GZ	Non "FD"	"FD"	"FD"
2008	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2009	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2010	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2011	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2012	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2013	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2014	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2015	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2016	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2017	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"

"FD"-Financial Distress; Non "FD"- Non Financial Distress; GZ – Grey Zone

Table 5.19: Spicejet Airlines financial condition as evaluated by six models

	Z" Score	Airscore	P-score	HFSAT	Gundmundsson	Kroeze
2006	"FD"	Non "FD"	GZ	Moderate Risk	Non "FD"	"FD"
2007	"FD"	Non "FD"	GZ	Non "FD"	Non "FD"	"FD"
2008	"FD"	Non "FD"	GZ	Non "FD"	Non "FD"	"FD"
2009	"FD"	Non "FD"	GZ	Non "FD"	GZ	"FD"
2010	"FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	"FD"
2011	"FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	"FD"

	Z" Score	Airscore	P-score	HFSAT	Gudmundsson	Kroeze
2012	"FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	"FD"
2013	"FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	"FD"
2014	"FD"	Non "FD"	GZ	Non "FD"	Non "FD"	"FD"
2015	"FD"	Non "FD"	"FD"	Non "FD"	Non "FD"	"FD"
2016	"FD"	Non "FD"	GZ	Non "FD"	Non "FD"	"FD"
2017	"FD"	Non "FD"	Non "FD"	Non "FD"	Non "FD"	"FD"

"FD"-Financial Distress; Non "FD"- Non Financial Distress; GZ – Grey Zone

Table 5.20: Goair Airlines financial condition as evaluated by six models

	Z" Score	Airscore	P-score	HFSAT	Gundmundsson	Kroeze
2006						
2007						
2008						
2009						
2010	"FD"	Non "FD"	"FD"	Moderate Risk	Non "FD"	"FD"
2011	"FD"	GZ	GZ	Insolvent	Non "FD"	"FD"
2012	"FD"	GZ	GZ	Insolvent	Non "FD"	"FD"

	Z" Score	Airscore	P-score	HFSAT	Gundmundsson	Kroeze
2013	"FD"	GZ	Non "FD"	Insolvent	Non "FD"	"FD"
2014	"FD"	GZ	Non "FD"	Insolvent	Non "FD"	"FD"
2015	"FD"	GZ	Non "FD"	Insolvent	Non "FD"	"FD"
2016	"FD"	GZ	Non "FD"	Insolvent	Non "FD"	"FD"
2017	Non "FD"	GZ	Non "FD"	Insolvent	Non "FD"	"FD"

"FD"-Financial Distress; Non "FD"- Non Financial Distress; GZ – Grey Zone

Table 5.21: Indigo Airlines financial condition as evaluated by six models

	Z" Score	Airscore	P-score	HFSAT	Gundmundsson	Kroeze
2006						
2007						
2008						
2009						
2010	Non "FD"	GZ	Non "FD"	Moderate Risk	Non "FD"	Non "FD"
2011	Non "FD"	GZ	Non "FD"	High Risk	Non "FD"	"FD"
2012	Non "FD"	GZ	Non "FD"	High Risk	Non "FD"	Non "FD"

	Z" Score	**Airscore**	**P-score**	**HFSAT**	**Gundmundsson**	**Kroeze**
2013	Non "FD"	GZ	Non "FD"	High Risk	Non "FD"	Non "FD"
2014	Non "FD"	GZ	Non "FD"	High Risk	Non "FD"	"FD"
2015	Non "FD"	GZ	Non "FD"	High Risk	Non "FD"	Non "FD"
2016	Non "FD"	Non "FD"	Non "FD"	High Risk	Non "FD"	Non "FD"
2017	Non "FD"	Non "FD"	Non "FD"	High Risk	Non "FD"	Non "FD"

"FD"-Financial Distress; Non "FD"- Non-Financial Distress; GZ – Grey Zone

The above results show the inconsistency in the determination of the status of financial failure as predicted by the different models for the six airlines for the period 2006 to 2017. Kingfisher Airlines which was declared insolvent in 2013 had varying results as shown by the six different models (Table 5.16). Similar inconsistencies are visible in the results for all the airlines from Table 5.17 to 5.21.

The above analysis using existing global models when applied to airlines operating in India, shows that existing models do not provide the accurate status of the financial condition for these companies. There is, therefore, a need to

develop a model using data from airlines operating in India and which can then be applied to assess the financial condition of the Indian airline industry.

5.9 Chapter Summary

This chapter uses six global models, used by the airline industry worldwide for predicting or assessing their financial distress condition and applies the data of six airlines in India to predict their financial condition. The results show an inconsistency in the results by the six models for the airlines operating in India.

The next chapter describes the methodology used for the development of the financial distress assessment model using data from airlines operating in India and with the logistic regression technique.

Chapter 6

Development of the financial distress assessment model

Overview

This chapter explains the steps adopted for building the financial distress assessment model for airlines in India. The factors from operating, performance, financial and other conditions are used in the trials and the final model (airline financial distress assessment model-AFDA) is designed. Tests are conducted to evaluate the validity of the design and its advantage over the model using only financial factors.

6.1 Introduction

The aviation industry in India is a very volatile sector, with various input parameters playing a key role in the performance of individual airline companies. This sector has shown phenomenal growth in passenger travel and as per the IATA report of 2019 "in 2017 more than 158 million passengers flew on domestic and foreign routes of Indian airline companies". However individual airlines have struggled with the dynamic conditions, which had a direct impact on the company`s financial performance.

This chapter identifies the factors from the financial and operating conditions and tests them in a model for the assessment of financial distress in airlines in India.

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- International Journal of Business Excellence (2019) [in press]

Similar studies have been conducted in the past in other countries, where financial and non-financial indicators have been combined together to build a specific model for the airlines operating in that country.

This chapter aims to achieving the second and third objective (In chapter 1), mentioned as below:

Objective 2: To develop a model for the assessment of financial distress in airline companies in India with the identified factors.

Objective 3: To test the models developed in step 2 with different factors, and select the one which has the highest assessment accuracy.

A company facing continuous financial distress inevitably ends up in insolvency and bankruptcy. With the changing internal and external conditions, companies have to constantly monitor their operations and their financial status to ensure they are financially healthy. Several studies have been conducted in India analyzing the airline industry and the individual airlines. These studies have identified several key parameters which influence the financial performance of a company in this sector (Krishnan, 2008, Pathak, 2015, Behera, 2016). The research has been focused on the reasons for individual airlines or broadly on the issues that the industry faces. These studies have been specific in time and are an analysis of the conditions prevailing at that point in time. They do not use any framework or a model to evaluate the causes of failures in the industry.

Distress or bankruptcy predictions models are used globally and are generally based on financial factors or ratios. In India, these generic bankruptcy prediction models have been used to test the financial condition of companies in the cement, pharmaceutical or cement sectors (Barki and Halageri, 2014; Vimala and Saranya, 2014; Bapat and Nagale, 2014).

However these models are standardized in form and can be applied to any industry globally. In this aspect, they suffer in their prediction accuracy, specifically when used for prediction of companies' failure several years in advance. They are focused on the use of financial data only, have poor

applicability in many industries, and do not consider factors which are more relevant to a specific industry or country.

Previous studies have found that the prediction of financial distress (or of bankruptcy) improves when the model incorporates factors from the various external and internal environment, specific to that industry or country. The factors tested in these research have been selected from financial, operational, and external conditions ("Chow et al., 1991; Pilarski and Dinh, 1999; Gudmundsson, 2002; Silva et al., 2005").

A company is often considered insolvent or in distress when its total liabilities surpass the fair value of its assets (Altman, 1968). Several other definitions exist which categorize a company in distress. For example, when the company is highly leveraged or has excessive debt. A company is also considered to be in financial distress if it has three consecutive years of negative net income or is unable to pay its debts or has cash shortages to run its operation (Altman, 1994; Gudmundsson, 2002; Lin et al., 2016). Negative net worth on account of continuous losses is a financial distress condition even if the company is operational, as its existence is continuously funded by its investors and shareholders. This is prevalent in the e-commerce startup companies which have huge losses in their initial years but continue to operate with support from various investors.

In research conducted on the bankruptcy prediction models, the emphasis is to design models which test the occurrence of bankruptcy or the complete financial failure of the company.

This research focuses on those conditions and factors which pre-exist the closure of the company. The study tests the potential prediction power of a use of operating, accounting/financial and other variables which assesses the risk of financial distress occurring in airlines in India.

6.2 Methodology

6.2.1 Data Collection and analysis:

Secondary data for the past 12 years (2006 to 2017) was collected for all the privately owned airline companies operating in India. The financial data is taken from the annual reports published by the companies and from the CMIE-Prowess database. Operating data is obtained from data published by the Directorate General of Civil Aviation (DGCA).

The data collected from the specified sources were reviewed for missing information. Those airlines which do not have their complete data published were not considered for analysis. A final sample of seven privately owned airlines was selected for the study for the twelve years. The airlines selected are Kingfisher Airlines, Jet Airways, Jetlite, Spicejet, GoAir, Paramount Airlines, and Indigo airlines.

The financial data obtained from the Prowess database was also checked from published financial reports. The data collated for each of the seven airlines for the twelve years consists of the following variables collated from the CMIE-Prowess database:

1. Current Assets
2. Retained Earnings
3. Book Value
4. Total Assets
5. Total Liabilities
6. Interest Expenses
7. Sales
8. Operating Profit

Operational data collated from reports published by DGCA (Directorate General of Civil Aviation) was:

1. RPK (Revenue passenger kilometer)
2. Operating expenses per RPK
3. Labor cost per air KM (kilometer)

4. Passenger Load factor (%)
5. Number of different brands operated by the airlines

Other data required was collected from the following sources:

1. GDP growth rate for each year from 2006 to 2017 in percentage (https://data.worldbank.org/indicator/ny.gdp.mktp.kd.zg).
2. Aviation fuel price for each year from 2006 to 2017 in Rupees per gallon (https://www.indexmundi.com/commodities)

All the key factors ranked in Chapter 4 were reviewed for their impact on the financial status of the company in a particular year. From the final rank of factors derived in this chapter, thirteen factors were selected for incorporating into the model. These factors were selected based on their ranks (as per the analysis conducted in Chapter 4), prior studies, and the accessibility and availability of data.

A company was classified as financially distressed in a particular year if there existed operational losses for three years continuously or the company has been declared insolvent during the period 2006 to 2017.

To further review the suitability of these factors, a t-test was conducted to confirm if the mean of these factors was statistically different between distressed and non-distressed companies (Table 6.2). These results have been analyzed in the following sections. Statistic software SPSS and STATA, have been used for carrying out the regressions and other tests.

6.2.2 Development of models

6.2.2.1 Model 1: Using financial/accounting factors

Model 1 is developed using only financial/accounting factors for its development. These factors are selected based on the original Altman Z-score model (1968) developed to predict financial distress.

The Altman model used five accounting variables as shown in equation 6.1

$$Z = 1.2\,WC/TA + 1.4\,RE/TA + 3.30\,EBIT/TA + 0.60\,LEV + 0.99SA/TA \ldots \text{Eq. } 6.1$$

The variables in the above equation are:

1. Working Capital (WC) divided by Total Assets (TA)
2. Retained Earnings (RE) divided by Total Assets (TA)
3. Earnings before Interest and Taxes (EBIT) divided by Total Assets (TA)
4. The ratio of the equity as recorded in the books by the recorded value of debt (LEV) and
5. Revenue/Sales (SA) divided by sum of Assets.

Model 1 is developed using data for the above five variables and for the selected seven airlines. It is formulated as per equation 6.2 as defined by the study of Lin et al. (2016).

$$\text{“FD”}_{it} = \beta0 + \beta1\ (WC_{it-1} / TA_{it-1}) + \beta2\ (RE_{it-1} / TA_{it-1}) + \beta3\ (EBIT_{it-1} / TA_{it-1}) + \beta4\ (BVE_{it-1}/TL_{it-1}) + \beta5\ (SA_{it-1}/ TA_{it-1}) + \varepsilon_{it} \quad \text{.....Eq. 6.2}$$

Where

“FD_{it} is a dummy variable that equals 1 when the company i suffers financial distress in year t”. The company is categorized as financially distressed if the company has negative earnings in the previous three years or has been declared as insolvent during the year under review.

WC_{it-1} is the Working capital of the company i in the year t-1

RE_{it-1} is the retained earnings of company i in the year t-1

$EBIT_{it-1}$ is the earnings before interest and taxes for the company i in the year t-1

BVE_{it-1} is the leverage measured by the ratio of the book value of equity to the value of book debt for company i in the year t-1. Since some of the airline companies in India are privately owned and hence the book value of equity has been taken in this calculation.

SA_{it-1} is the value of the sales for the company i in the year t-1

TA_{it-1} is the value of the total assets for the company i in the year t-1

$\beta0$ is the Intercept and εit is the error term and are > 0.

The model is constructed using logistic regression, through which it derives the values of the coefficients ($\beta0$, $\beta1$, $\beta2$, $\beta3$, $\beta4$, and $\beta5$) for each of the variables. It is next analyzed for accuracy and goodness of fit through various statistical

tests. The model in its final form provides the Z value which is the linear combination of the resulting equation. The probability of financial distress is generated using the form:

p(failure) =1/(1+ e^{-z})……..…….Eq 6.3

where Z is the output from the model (as per equation 6.2) and e = 2.718 (the base of the natural logarithms).

6.2.2.2 Model 2: Airline Financial Distress Assessment (AFDA) Model

Model 2 identified as the Airline Financial Distress Assessment (AFDA) model incorporates factors from operating, financial, performance and other external conditions. This model is developed using a logistic regression technique. Several regression runs are made and those factors are finally selected in the model which provides the highest accuracy and fit.

The above two models designed are compared for accuracy and goodness of fit in different tests.

6.3 Identification of financial, operational and performance factors affecting the financial condition in airlines

Factors used in the development of the model analysis have been selected from operational, economic, performance and financial conditions which impact the financial condition of the airlines. The final list of factors for use in the model have been shortlisted based on prior studies, industry expert opinion, and availability of data. These selected factors are explained in the following sections.

6.3.1 Operational factors (2 factors)

The *passenger load factor* (PLF) is a key ratio which specifies the utilization of the airline capacity. This ratio is calculated as the percentage of seats sold against the total available seats. Every airline operates with an objective of ensuring that its capacity is maximized and fixed costs are recovered from each seat sold. Studies have found that as the passenger load factor increases, the

airline shows higher margins and higher financial stability (Chow and Tsui, 2017; Chang and Yeh, 2001). Airlines strive to improve their load factor through various marketing strategies and with the use of technology which can predict the correct demand for seats in the period (Behn and Riley, 1999; Zhu, 2011).

Another factor selected is the *number of brands* of aircraft used by airlines. This is an important factor as it increases the cost structure of an airline on account of the higher expenses incurred towards the maintenance crew for the additional brands (Gudmundsson, 2002, Merkert and Gudmundsson, 2013).

6.3.2 Economic or Government policy related Factors (1 factor)

Change in aviation fuel price per liter is a vital cost parameter for an airline and has a large influence on the profitability of the company (Krishnan, 2008; Behera, 2016; Kochher, 2015). Aviation fuel cost comprises around thirty percent of the total cost of an airline in India (Hand Book On Civil Aviation Statistics 2016-17 DGCA report). If the aviation fuel price increases, airlines have to ensure their profit margins are maintained through, either an increase in fares or through the reduction of other costs. Aviation fuel is largely imported in India and taxes and duties levied by the government increase the cost of this critical input periodically.

6.3.3 Performance Related Factors (3 factors)

Operating Revenue per revenue passenger kilometer performed (RPK): This ratio provides the operating revenue of the airlines per kilometer flown for each passenger. "This indicates the revenue generating a capacity of the airlines. It is calculated by dividing the passenger revenues by the passenger-kilometers performed/available. A passenger kilometer is performed when a passenger is carried one kilometer. Director-General of Civil Aviation in India (DGCA) defines RPK as the sum of the product obtained by multiplying the number of revenue passengers carried on each flight stage by the stage distance". Here stage distance flown is computed by dividing the aircraft kilometers flown by

the related number of aircraft departures. “The result of the product of these two variables provides the number of kilometers traveled by all passengers. RPK relates passenger traffic to passenger revenues”. A higher ratio will indicate the level of rates an airline can charge for its seats. This was used in the airline industry-specific model called the Air score Model (Chow et al., 1991).

Operating expenses per revenue passenger kilometer performed: Operating expenses per revenue passenger kilometer performed is calculated from the operating expenses incurred per kilometer flown per passenger.

Labor cost per air kilometer: Labor cost per air km indicates the labor expenses incurred by the company over the distance flown.

6.3.4 Financial Factors (7 Factors):

The financial strength of a company is measured through accounting or financial ratios which are focused on profitability, liquidity, and solvency. Ratio analysis has been used in several studies and has been able to identify the company`s business condition. These ratios are published in company reports and used by analysts, investors, suppliers and other regulatory bodies to evaluate the company`s financial health.

The financial ratios tested in this study have been shortlisted based on past studies and those most relevant for use in prediction models.

“Working Capital/Total Assets (WC/TA): This ratio measures the liquidity of the company and is a part of the original Altman (1968) model”. Working capital is computed by subtracting current liabilities from current assets. This ratio provides an indication of how the company is managing its current assets and a company in financial distress often reports the value of current assets lower than its current liabilities.

Current Assets by current liabilities (CA/CL): This is another measure of liquidity and has been used extensively in various models globally (Altman et al., 1977; Pilarski and Dinh, 1999). The ratio measures the value of the current assets available to fund the current liabilities when they are due. A higher ratio

indicates that the company has a higher value of current assets and can easily pay off its current liabilities.

Total liabilities by total assets (TL/TA): This was used in the model developed for the airline industry by Silva et al. (2005). This ratio measures the value of the total liabilities which consist of both long-term and short term (current) liabilities. This ratio which provides an indication of the outstanding debt is compared to the total value of assets in the balance sheet. The lower the ratio, lesser is the leverage, and hence higher the solvency of the company.

"The book value of equity by total Liabilities (BV /TL): This ratio is used in the Air score Model for airlines (Chow et al., 1991) and in this research uses the book value of equity of the company". In the original Altman Z-score model, the market value of equity was utilized, but since most of the airline's companies in India are privately owned, the book value of equity has been taken in the calculation of this ratio (Altman 1983).

Retained earnings by total assets (RE/TA): This ratio was a part of the original Altman Z-score and measures the profits which are retained by the company. This ratio gives an indication of the surplus generated and which is available to the company for its operations. The lower the ratio the higher is the probability of financial distress (Altman 1968, Pilarski and Dinh, 1999).

Operation Profit (EBIT)/Total assets (TA) or EBIT/TA: This ratio is a part of the Altman Z-score model Altman (1968) and consists of earnings before interest and taxes which is divided by total assets. The ratio is a measure of the profit generated by the company through the utilization of its assets. The ratio is also used in the Z" score model developed by Altman (1983) and adopted by the transportation industry in the USA for testing of companies in this sector.

Total Sales/Total Assets (Sales/TA): This ratio is a part of the Altman (1968) Z-score model and is a ratio of the total sales by total assets.

The list of the factors and the prior literature where they were referred to is given in Table 6.1.

Table 6.1: List of the factors affecting the financial condition of airlines

S.No	Factor Category	Factors	References
1	Operational Factors (OP)	Passenger Load factor (PLF)	Chow and Tsui (2017), DGCA(2006-2017), Zhu (2011), Gudmundsson, (1999, 2002), Chang and Yeh (2001), Behn and Riley (1999).
		Number of different brands of aircraft operated	
2	Economic/ Government Factors (EG)	Change in Aviation Fuel price (ratio)	Xie et al. (2011), Krishnan (2008), Behera (2016), DGCA (2006-2017), Kochher (2015)
3	Performance Related Factors (PRF)	Operating revenues per revenue passenger kilometer performed (RPK)	Chow et al. (1991), DGCA (2006-2017), Merket and Gudmundsson (2013).
		Operating Expenses per revenue passenger kilometer performed	
		Labor cost per air KM flown	

S.No	Factor Category	Factors	References
4	Financial Factors (FF)	Working Capital/ Total Assets (WC/TA)	Altman (1968), Pilarski, and Dinh (1999), Altman et al. (1977), Chow et al. (1991),Silva et al. (2005), Hsu (2017), Behera (2016), Krishnan (2008), Stepanyan (2014), Lu et al. (2015), Pineda et al. (2017).
		Current assets/current liabilities (CA/CL)	
		Total Liabilities by total assets (TL/TA)	
		Book Value of Equity/Total Book value of debt (BV of equity/TL)	
		"Retained earnings/total assets (RE/TA)	
		Operating Profits (EBIT) / sum of all assets (EBIT/TA)"	
		Total rev or sales by sum of all assets (Sales/TA)	

A total of 13 Factors are selected from 4 categories for the design of Model 2 (AFDA).

6.4 Data Description and correlation tests

The data for the factors listed in the previous section have been collected for the period 2006 to 2017, from performance annual reports published by DGCA and from the financial data provided by the CMIE-Prowess database.

Table 6.2 lists the descriptive statistics with data on means, and variances for the chosen variables for the distress and non-distress companies:

A company was classified as financially distressed in a particular year if there existed operational losses for three years continuously or the company has been declared insolvent during the period 2006 to 2017.

A t-test conducted for the factors shows that RE/TA, EBITA/TA, BV of Equity/TL, TL/TA; Operating Expenses per RPK, passenger load factor, changes in aviation fuel price and Sales/TA are statistically significant between distressed and non-distressed airlines in the data set (Table 6.2). The factors confirm that a distressed company will have lower profits and hence lower retained earnings (lower RE/TA). Similarly, a higher value of TL/TA for distressed companies indicates a higher value of liabilities for a company facing financial distress.

Table 6.2: Analysis of variables between distressed and non-distressed airlines in the sample.

Factor/Variable	Status	Mean	Variance	t-test	Significance
WC/TA	Distressed	(0.58)	1.57	(1.40)	
	Non Distressed	(0.28)	0.10		
RE/TA	Distressed	(1.72)	10.49	(2.85)	***
	Non Distressed	(0.18)	0.09		

Factor/Variable	Status	Mean	Variance	t-test	Significance
EBIT/TA (Op Profit/TA)	Distressed	(0.09)	0.39	(1.58)	*
	Non Distressed	0.08	0.01		
BV of Equity/ TL	Distressed	2.58	138.45	1.29	*
	Non Distressed	0.04	0.00		
TL/TA	Distressed	2.70	27.57	2.37	**
	Non Distressed	0.87	0.16		
CA/CL	Distressed	0.67	0.51	0.05	
	Non Distressed	0.66	0.25		
RPK (revenue passenger kilometer)-DGCA	Distressed	5.39	8.92	1.06	
	Non Distressed	4.83	0.60		
OP expenses per RPK	Distressed	7.45	112.77	1.55	*
	Non Distressed	4.69	0.96		
Labor cost per Air KM	Distressed	0.07	0.00	0.38	
	Non Distressed	0.06	0.00		

Factor/Variable	Status	Mean	Variance	t-test	Significance
Passenger Load factor in decimals	Distressed	0.73	0.01	(3.21)	***
	Non Distressed	0.79	0.00		
Number of different brands of aircraft operated	Distressed	3.53	3.34	0.28	
	Non Distressed	3.36	7.94		
Change in Aviation Fuel price	Distressed	0.10	0.05	1.25	*
	Non Distressed	0.03	0.03		
Sales/TA	Distressed	3.31	27.57	2.55	***
	Non Distressed	1.07	0.16		

*10% significant level ** 5% significant Level *** 1% significant level

However prior studies (Altman,1968) have confirmed that such results (as shown in Table 6.2) are not conclusive enough to prove that only those variables which are statistically significant in their values for the two financial conditions are most suitable for use in a distress prediction model.

Correlation test for the independent variables was also conducted to test for collinearity (Table 6.3) among the factors. Vector Inflation Factor (VIF) and Tolerance values calculated for the ratios provided an indication of the level of collinearity between the variables. Those variables found to be highly correlated with each other were rejected for further use in the analysis. The values of tolerance calculated for the factors selected was found to range between 0.33 and 0.84 whereas VIF was between 1.19 to 2.99; which confirmed that collinearity was not a major concern among the factors used in the final model.

Table 6.3: Correlation Matrix

	WC/ TA	**RE/ TA**	**EBIT/ TA**	**BV of Equity/ Total Liabilities**	**RPK**	**OP expenses per RPK**	**Labor cost per Air KM**	**Passenger Load factor in decimals**	**No. of different brands of aircraft operated**	**Change in Fuel price**	**Total Liabilities/ Total Assets**	**CA/ CL**	**Sales/ TA**
WC/ TA	1												
RE/ TA	.653**	1											
EBIT/ TA	0.073	.561**	1										
BV of Equity/ TL	-0.235	-.506**	-.351**	1									
RPK	0.043	.260*	0.061	-.288*	1								
OP expenses per RPK	-0.059	-0.033	-.362**	-0.047	.821**	1							

	WC/ TA	**RE/ TA**	**EBIT/ TA**	**BV of Equity/ Total Liabilities**	**RPK**	**OP expenses per RPK**	**Labor cost per Air KM**	**Passenger Load factor in decimals**	**No.of different brands of aircraft operated**	**Change in Fuel price**	**Total Liabilities/ Total Assets**	**CA/ CL**	**Sales/ TA**
Labour cost per Air KM	-0.073	0.114	0.088	-.401**	.425**	.412**	1						
Passenger Load factor in decimals	-0.103	0.05	.536**	-0.231	-.336**	-.617**	0.042	1					
No. of different brands of aircraft operated	-0.033	-0.205	-.282*	-0.18	.314*	.428**	.343**	-0.23	1				
Change in Fuel price	0.217	0.092	-.260*	0.118	-0.015	0.135	-0.125	-.347**	0.052	1			
TL/ TA	-.587**	-.475**	0.058	0.076	0.09	0.121	0.136	.329**	-0.101	-0.138	1		

	WC/ TA	**RE/ TA**	**EBIT/ TA**	**BV of Equity/ Total Liabilities**	**RPK**	**OP expenses per RPK**	**Labor cost per Air KM**	**Passenger Load factor in decimals**	**No.of different brands of aircraft operated**	**Change in Fuel price**	**Total Liabilities/ Total Assets**	**CA/ CL**	**Sales/ TA**
CA /CL	.862**	.504**	0.049	-0.011	0.099	0.009	-0.091	-0.172	-0.192	0.147	-.399**	1	
Sales/ TA	-.308*	-.391**	0.008	.612**	-0.009	0.03	-0.192	-0.001	-.339**	-0.055	.490**	0.021	1

*10% significant level ** 5% significant Level

6.5 Results and Discussions

Several runs of logistic regression were made using the values of each of the selected factors after the collinearity tests.

Model 1

The first model was designed with five financial factors which were a part of the original Z-score model (Altman, 1968). The statistical significance of these five factors is given in Table 6.4. The classification table shows an accuracy level of 82.8% (Table 6.6).

Table 6.4: Model 1

	Without year effect control			**Measured with for year effect control**		
Factor	Estimated Coefficients	Chi-square Value	Significance	Estimated Coefficients	Chi-square Value	Significance
WC/TA	-0.716	0.908		-0.805	0.76	
RE/TA	0.192	1.152		0.135	0.51	
EBIT/ TA	-7.85	10.698	**	-7.4	8.41	**
BV of Equity/ TL	-3.21	1.577		-3.432	1.09	
Sales/ TA	0.807	11.05	***	0.813	8.71	**
Constant	-2.618	12.971		-2.995	6.48	**

*10% significant level ** 5% significant Level *** 1% significant level

Test results for measuring the association level and the overall fit of the factors in model 1 are shown in Table 6.5. Likelihood tests suggest that the model is a good fit to the data as the p-value is less than 0.05.

Table 6.5: Goodness of Fit test for Model 1

Without year effect control		**Measured with for year effect control**	
-2log likelihood	46.52	-2log likelihood	44.89
p-value	0.0001	p-value	0.004

Table 6.6: Classification Table for Model 1 (using coefficients not controlled for year effect):

Observed	**Predicted**		**Percentage Correct**
	Non Distressed	**Distressed**	
Non Distressed	45	3	93.8
Distressed	8	8	50
Overall Percentage			82.8

The cut of value is set at 0.5 and the probability of failure (as calculated in equation 6.3) when higher than 0.5 indicates the occurrence of financial distress.

Model 2: Airline Financial Distress Assessment (AFDA) model

The second model (AFDA) was built by incorporating specific operational and performance factors along with the financial variables of Model 1. Several test runs were conducted by combing these different factors. In the final selection, those factors which had the highest impact on the accuracy of the model were included. These factors are listed in Table 6.7 with their statistical significance. The factors, when combined together, gave an accuracy of 90.6% (Table 6.9), higher than the values obtained for Model 1.

Table 6.7: Airline Financial Distress Assessment (AFDA) model

	Without year effect control			**Measured with for year effect control**		
Independent Variable	Estimated Coefficient	Chi-square Value	Significance	Estimated Coefficients	Chi-square value	Significance
TL/TA	0.453	3.070	**	0.595	1.330	*
CA/CL	-3.195	-2.180	**	-4.250	-1.650	*
EBIT/TA	-4.652	-2.970	**	-6.987	-1.690	
LF	-2.385	-0.200		0.439	0.030	
Operating expenses per RPK	0.849	1.79		0.467	0.64	
Change in Fuel Price	0.095	0.05		-0.849	-0.31	
Labor cost per air KM	-70.894	-2.19	**	-81.694	-1.35	
Constant	0.416	0.04				
*10% significant level ** 5% significant Level						

Test results for measuring the association level and the overall fit of the factors for model 2 are shown in Table 6.8. Likelihood tests suggest the model is a good fit to the data as the p-value is less than 0.05.

Table 6.8: Goodness of Fit test for AFDA model

Without year effect control		**Measured with for year effect control**	
-2log likelihood	37.30	-2log likelihood	15.17

p-value	0	p-value	0.005

Table 6.9: Classification Table for AFDA model (using coefficients not controlled for year effect):

Observed	Predicted		
	Non Distressed	Distressed	Percentage Correct
Non Distressed	46	2	95.8
Distressed	4	12	75.0
Overall Percentage			90.6

The cut off value is set at 0.5 and the probability of failure (as calculated in equation 6.3) when higher than 0.5 indicates the occurrence of financial distress.

The above results confirm that the model`s accuracy is improved when operation, performance, financial and other external factors are combined together to develop an assessment model.

In the AFDA model, the following coefficients are found to be statistically significant with $p< 0.05$ (not controlled for the year effect):

1. TL/TA which measures the extent of total liabilities compared to the total assets,
2. EBIT/TA, a measure of profitability,
3. CA/CL, a measure of liquidity and solvency,
4. Change in the price of aviation fuel
5. Labor cost per air kilometer.

Empirical tests in earlier studies in bankruptcy prediction models have shown that even though some of the variables may be lower in significance, however when combined with others they have been effective in differentiating between financially distressed and non-distressed conditions (Zavgren, 1983).

The signs in the model are an indication of the impact of the factor on the distress condition of the airlines. The positive coefficient for total liabilities to

total assets shows that as the liabilities increase, there is a higher probability of distress. Similarly, the negative sign for the ratio of current assets to current liabilities indicates that a lower ratio leads “to a higher likelihood of financial distress as the liabilities are higher than the current assets”. A negative coefficient for the ratio of earnings before interest and taxes by total assets shows that as earnings fall the probability of distress conditions rises. A lower passenger load factor and high operating expenses per revenue passenger kilometer indicate a higher probability of financial distress. A high change in fuel price will lead to the occurrence of financial distress. However, the negative sign for the coefficient for labor cost per air kilometer indicates that a lower labor cost will have a higher likelihood of financial distress condition. This can be explained by the fact that airlines operate in the service industry and when there is a lower investment in staff, there is a likelihood of a lower service standard. Poor service quality often leads to a lesser number of passengers preferring to fly the airline.

The above results confirm that a model with financial, operational and performance factors provides higher accuracy in identifying the state of financial distress in airlines in India.

Based on the above results an ideal model to assess the risk of financial distress in an airlines should include the following factors: “Total debt/liabilities by total assets, CA(current assets) by CL(current liabilities), earnings before interest and tax by total assets, operating expenses per passenger revenue kilometer, labor cost per air kilometer and the change in fuel price”.

Analysis using the ROC curve confirms the accuracy results (Fig 6.1 and Fig6.2), with the area under the curve (AUC) for Model 1 reported as 0.8945 as compared to 0.9271 for the AFDA model which has operating, performance and other factors incorporated into it.

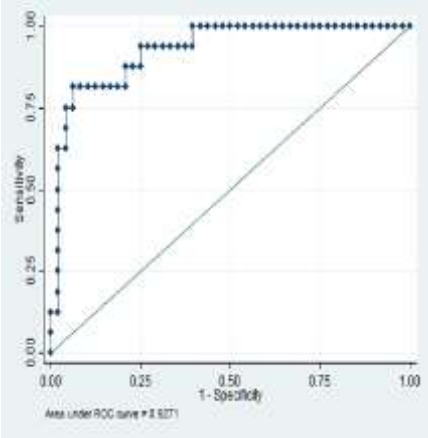

Figure 6.1: ROC curve for Model 1

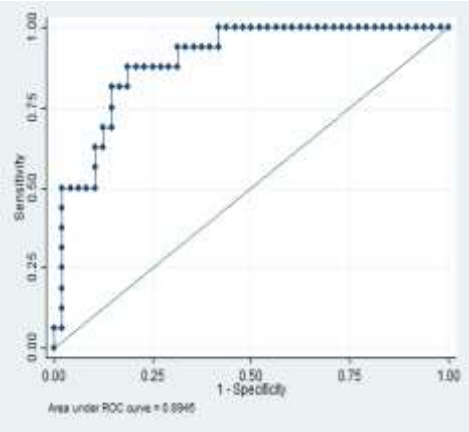

Figure 6.2: ROC Curve for the AFDA model

The study endorses that a change in the aviation fuel price has an influence on the financial performance of the airline as reviewed in earlier studies (Krishnan, 2008, Behera, 2016). The inclusion of this factor improves the accuracy of the model in its assessment of financial distress. The design of the model with a combination of financial, operational and the changes in the aviation fuel price is unique and has not been carried out earlier for airline companies operating in India.

6.7 Chapter Summary

This chapter details out the steps for building the financial distress assessment model for the airlines in India using logistic regression. The factors from operating, performance, financial and other conditions are used in the model and the final model (AFDA model) is designed. Tests are conducted which show that the AFDA model is better in evaluating financial distress or failure as compared to the model with only financial factors.

The next chapter summarizes the findings and explains the contributions, limitations and future scope of the study.

Chapter 7

Conclusion and future research

Overview

This chapter presents a summary of the research carried out in this study. The major outcomes and results have been explained in detail. The contribution to literature and the practical usage of the outcome are presented in the chapter. Limitations of the study and the future scope of the subject are also described.

7.1 Introduction

Financial distress is a condition, which has been occurring frequently in the airline industry in India. This occurrence is a cause of concern to policymakers, government, investors and management of these companies as also the general public.

Aviation is estimated to add US$35 billion to the GDP of India and has contributed to creating more than 40,000 jobs while supporting more than 900,000 persons in indirect employment (IATA Report 2019). Financial failures and closure of an airline, thus lead to a huge impact on the economy and it is imperative that airline companies in India, are alert to any future financial distress condition. An alert mechanism would assist the management and other stakeholders to take action and ensure the distress situation does not become critical.

It is also the responsibility of the management, being the agent for the stakeholders who have invested in the company, to ensure that the company continues to function profitably and provide the expected return to its investors (Gomez-Mejia and Wiseman, 2007; Hasnas, 2013).

To monitor and measure the financial health of a company, management uses various tools and methods. These are published in annual reports and provided to the stakeholders. Financial ratio analysis is a common method used to provide information on various aspects of the company specifically from the profitability, liquidity and solvency condition. However, this system considers only financial information and is unable to report changes in operating and other external conditions, which also have a major impact on the financial sustainability of the company.

This study has identified the key variables from both the external and internal conditions in which an airline operates in India, and used them in a financial distress assessment model, to inform management and other stakeholders about the financial status of the company.

7.2 Summary of research findings

7.2.1 Factor selection and ranking

The airline industry in India has its own specific features, which need to be identified to assess the performance of companies in this sector. These key factors are not only dependent on the internal operations of the company but also on the external environment. “This paper evaluates all those factors, listed by experts, which have a major influence on the financial performance of an airline in India. These factors are analyzed and ranked based on their impact on the financial sustainability of the company. The technique adopted for this ranking is a hybrid multi-criteria decision-making technique using fuzzy AHP. This method is ideal in a fuzzy environment and obtains relative weights of the categories and their factors, based on the maximum impact the variables have on the financial condition of the airline”.

The results of the analysis show the financial category factors as key parameters, which need to be monitored and tracked regularly for the financial stability of the airlines. The order of the criticality of the factors indicates financial factors as the highest followed by operational, economic/government, performance, market-related and lastly external.

Among the individual ranking of factors, the top-ranked is the aviation fuel price per liter, which has a major impact on the total cost structure of an airline and also its financial viability. In a competitive environment, airlines find it difficult to manage their profitability when this input cost increases by a high margin. The next individual factor is inflation in the country followed by GDP growth and the growth of passenger traffic in the country. This ranking shows that among the global ranks, the top four factors belong to the government or economic environment, and confirms that airlines in India, are highly dependent on them for their financial stability. Among the internal environment, the operational factors relating to the load factor and the number of pilots per aircraft, occupy the next two ranks. Operating revenues per kilometer and the earnings stability which are factors from the financial category are the next in importance for the airlines. These results are further tested for their reliability using the sensitivity technique.

Management of airlines in India can focus on tracking these top-ranked factors and ensure they are alerted to a financial condition becoming critical. These ranking factors can be included in different tracking tools such as ratio analysis or distress prediction or assessment models for accurate results.

7.2.2 Model for assessing financial distress in airlines

The airline industry in India has its own characteristics which impact the financial performance and solvency of companies operating in this sector. The study identifies the country (India) airline business-specific factors and builds a financial distress assessment model using those factors which have the highest impact on the financial condition. These factors are incorporated into an airline

financial distress assessment (AFDA) model to provide a probability of financial distress in an airline in India.

The result of the study shows that following seven factors are major contributors to the occurrence of financial distress in an airline in India: Sum of all outstanding debts or loans divided by sum of all assets, CA(current assets) by CL(current liabilities), earnings before interest and tax by total assets, load factor, operating expenses, changes in the cost of aviation fuel and labor cost per air kilometer. Monitoring these factors will enable management to keep a track of the financial health of the company.

Management should develop or set benchmarks for these six factors and then continue to closely review them periodically, to ensure they are within the range set. This type of monitoring could enable management to be alert to the possibility of the factors reaching a critical value.

The study confirms that distress assessment models built with industry-specific factors provide the highest accuracy in its evaluation of the risk of financial distress. This is in line with the studies conducted by earlier authors (Chow et al., 1991; Polanski and Dinh, 1999, Gudmundsson, 2002 and 2004, Silva et al., 2005).

The model can be used by analysts and other stakeholders to assess the risk of financial distress occurring in airlines. This review and analysis will help management to make informed decisions in its operations and reduce the risk of insolvency occurring in the next few years.

The aim of the study was not to develop a forecasting model but to test the potential prediction or assessment capability of operation and industry related ratios combined together and which can differentiate between financially distressed and non-distressed airline companies.

7.3 Contributions of this research to literature

The outcomes of the present study would provide a direction for evaluating the financial health of the company. The research focused on the identification of key factors which have a major influence on the financial sustainability of the airline. These factors are further analyzed and selected for incorporation into a model for assessment of financial distress in airlines in India. This research has used a fuzzy AHP methodology to provide a prioritization of factors which impact the financial health of airlines in India. This method of ranking factors has not been used in earlier studies and is being adopted for the first time.

Further, the key factors are built into an assessment model using logistic regression which has identified the variables which have a major impact on the sustainability of the airlines in India. The model (AFDA) developed can be used by the airlines to review the financial status of the company.

The research will thus assist the management of the airlines to understand the factors and monitor the health of the company before it becomes critical.

The key implications of this study are as follows:

- The present study provides an empirical analysis of the factor affecting the financial distress of airlines and how the factors can be assessed and prioritized. This study has identified six categories of factors and thirty-eight specific factors, which would help the managers in planning and making significant decisions related to financial distress in the organization. These identified factors are then analyzed and prioritized based on the Fuzzy AHP methodology which provides the criticality of the factor through a ranking evaluation.
- The study thereby provides a ranking of the most critical factors which influence the financial condition of airlines in India.
- The research conducted illustrates a framework which is used for the identification of key factors affecting the financial distress of airlines.
- The study also develops a financial distress model for assessing the financial condition of airlines. In this study, the model has been proposed under

realistic conditions. This design could help organizations to create specific models, required for their respective organizations in order to analyze financial distress position.

- The complexity of the model arises from the inclusion of relevant factors which can assess financial distress condition of airlines. Determining the relevant factors and their inclusion in the model is often difficult. Hence, econometric modeling approach has been utilized to represent and analyze the proposed framework and select key factors. The projected model has been supported and verified by taking the case of the Indian airline industry. The benefit of using this approach is that it maintains and analyzes the accuracy level. The presented approach in this study would be useful to managers and other stakeholders to make informed decisions and reduce the risk of insolvency occurring in the next few years.
- The study confirms that distress assessment models built with industry-specific factors provide the highest accuracy in its assessment of the risk of financial distress for the airline's industry in India. This is in line with studies in other countries for various industries by earlier authors (Chow et al. 1991, Pilarski, and Dinh, 1999, Gudmundsson, 2002 and 2004, Silva et al., 2005).
- The design of the model with a combination of financial, operational and economic factors (such as the change in the aviation fuel price) is unique and has not been carried out earlier for airline companies operating in India.
- The study contributes to literature, clearly showing that the financial condition of the airline company in India is dependent on both the external and internal factors which combine together to ensure its financial stability. This has been arrived at a systematic evaluation and isolation of the factors.
- The work has identified the combination of those internal and external factors from financial, operational, regulatory, market, economic and external conditions which can evaluate the risk of the future distressed situation. Identification and understanding of the factors justify Porter’s

forces in an industry that can affect airlines performance and profitability in the Indian context.

- The study further also adds to literature that the interpretation of Porter`s five forces theory is not only applicable for taking a decision on the growth strategy for the industry as highlighted in previous studies (Ortega et al., 2014; Jaradat et al., 2013; Hassan & Arfaj, 2016; Boora, 2016 etc) but also can be applied to design strategies to ensure future financial sustenance of a particular industry. This was in line with the research objectives.
- The outcomes of the study further validate Porters theory, which states that an initial thorough evaluation of the factors affecting an industry, is necessary to identify the areas of strength and to reduce its weaknesses. The findings are consistent with this approach to evaluate the sustainability of the Indian airline industry.
- The listed references in the literature review would provide scope and guideline for future research on this theme.
- The discussed advantages and the weaknesses of the integrated MCDM technique (Fuzzy AHP), econometric models using logistic regression would assist researchers to select the appropriate and suitable technique for their research.

7.4 Implications for practice

The key implications for practice are:

- India is projected to become the third largest air transportation market. However many of the airlines continue showing poor financial results. There is a need to analyze these results and identify those conditions and factors which play a major role in leading to such distressed situation. This systematic analysis of the Indian aviation industry using a well-established technique (Fuzzy AHP) has identified critical financial distress factors with respect to Operational, Economic, Performance, Financial, Market, and

External. Managers can focus on these identified critical factors for designing their future strategies.

- The AFDA model can be used by analysts and other stakeholders to assess the risk of financial distress occurring in airlines. This analysis will help potential investors to make informed decisions before investing in a company in the airline industry in India.
- Management of airlines in India can focus on tracking the identified top-ranked factors using various techniques such as ratio analysis or other methods.
- The key factors which have been identified and incorporated into the model are:
    - Sum of all debts and loans/ sum of all assets,
    - CA by CL(current liabilities),
    - Earnings before interest and tax by total assets,
    - Load Factor
    - Operating expenses,
    - Changes in the cost of aviation fuel and
    - Labor cost per air kilometer.
- The analysis for each of the above variables should be carried out as detailed below:
    - *Total liabilities by total assets*: Management will need to ensure that the liabilities of the company do not increase by a certain level. All short and long term loans will need to be kept in control and ensure they are below a level which does not trigger financial instability. Companies should try to fund their growth ideally from equity rather than borrowings so as to keep the ratio of total liabilities by total assets at low values.
    - *Current assets by current liabilities*: This ratio is an indicator of the source of working capital. The company should strive to keep the current liabilities at a minimum level to fund its daily operations.

Working capital for the company should be funded from operations rather than from borrowings. This would require management to focus on faster collections from travel agents and other customers and plan for a reasonable time in paying the suppliers.

- *Earnings before interest and tax by total assets*: This is a key ratio and measures the profitability of the airlines. The ratio will need to be positive to ensure future sustainability. Continuous losses will lead to financial instability and insolvency in the long run. Management will need to devise strategies to ensure earnings from passengers and cargo is higher than the breakeven level to prevent future losses.
- *Load factor*: This is an important operational variable which measures the efficiency of the operations and leads to maximization of the capacity utilization. Strategies need to be adopted which will ensure maximum number of seats are sold per flight and the load factor is kept at a high level. This will enable the airline to cover its variable costs per flight and contribute towards meeting its fixed costs.
- *Operating expenses*: Detailed analysis of this factor will provide information on how the costs and expenses of the airline are structured. Monitoring this variable is important to confirm that the airline is able to keep its costs under control and maintain profitability.
- *Changes in the cost of aviation fuel*: This is a key component of the cost structure in India contributing to over 30 % of the operational cost. Management will need to continuously monitor this variable and ensure that revenues are dynamically increased as the fuel cost goes up. Fuel price fluctuates due to the variations in the global fuel supply market and also on account of the changes in taxes levied by the Indian government. Airline companies thus have limited control on this factor. In this scenario, management will need to adopt

strategies to reduce consumption by acquiring fuel-efficient aircraft. Revenue earned from routes will need to be reviewed constantly and loss-making routes kept at a minimum. Hedging against fuel price will need to be adopted to smoothen the frequent changes in the international price of this factor.

- *Labor cost per air kilometer*: This is a key variable to ensure that the airline is able to keep its costs under control and provide a minimum service level. If these costs are too low they could lead to poor customer experience and impact their loyalty. High salaries paid to critical staff such as pilots and cabin crew, will ensure service and safety levels are maintained. There will be lower attrition levels among these employees and minimum disruption of flights.

7.5 Limitations and future research

7.5.1 Limitations in the selection of factors

This study attempts to identify, analyze and prioritize key factors influencing the financial condition of airline companies in India. This study is based on the opinion of an expert panel that is familiar with the Indian aviation industry. The results of the study may not be bias-free as they are an outcome of the understanding and judgment of the experts. There could also be a bias in the ranking of factors as it is dependent on the experience and knowledge of the decision group and also the decision-making process.

In the Fuzzy AHP procedure, an initial list of thirty-eight factors and six categories is identified and which are considered as a major influence on the financial status of airlines. There may be other variables which may also impact the sustainability of the airlines and can be added to this list before the fuzzy AHP methodology is carried out.

7.5.2 Limitations in the design of the financial assessment model

The aim of this study has been to develop a financial assessment model to test the potential prediction power of operation and industry related ratios which

differentiate between financially distressed and non-distressed airline companies. There are inherent limitations in the use of the logistic regression method to develop the model. Hence the model is restricted by these limitations.

Further owing to the non-availability of complete data for some of the privately held companies which have closed down, the number of airlines evaluated is limited to seven. This, therefore, does not allow for carrying out an out-of-sample test.

7.5.3 Limitations of the sample

Several airlines in India are privately held and do not publish their financial performance reports. This has limited the sample to the data from seven airlines. To reduce this limitation, data has been taken for 12 years for these airlines in the study.

The secondary data has been sourced from the financial database of CMIE-Prowess while operational and other data are obtained from airline and industry performance reports as published by DGCA.

7.6 Future scope of work

Future studies can test the Fuzzy AHP method for analyzing and ranking factors for airlines in other countries. A study can provide a comparison of the results for the airlines from different countries and show the variation of the top ten ranks of key factors among them.

Other AHP (Analytic Hierarchy Process) techniques such as VIKOR, DEMATEL (Decision-Making Trial and Evaluation Laboratory), and TOPSIS can also be used for the ranking of key parameters in this industry. A comparison of the output from different MCDM techniques can also be made to show the most suitable for the industry.

Future research in the development of assessment models can be made using other non-parametric methods such as neural network, decision tree analysis,

Case-based Reasoning, etc to confirm the results obtained from logistic regression. Airline data from other countries can also be used to test whether there is uniformity in the influencing factors which have been identified in this study for use in the model.

7.7 Chapter Summary

This chapter highlights the results of the study and examines the contribution of the research to the subject under review. The section also explains how the method of ranking used and the model developed can be used by airline management and practitioners in the evaluation of financial distress in their company in India. The chapter explains the limitations and future scope of study in this area.

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APPENDIX A
Questionnaire Sample

University of Petroleum & Energy Studies

Dear Sir/Madam,

I am Umesh S Mahtani, a Ph.D. scholar at the Department of Transportation Management, School of Business, UPES, Dehradun. The title of the thesis is "Developing a model to assess the financial condition of Airline companies in India".

To carry out my research work and to make it more fruitful, I seek your kind cooperation. All information/data collected during the study will be confidential and used only for academic research work. I will be grateful for your support.

Thank you for your valuable time.

Yours Sincerely,

Umesh S Mahtani
UPES, Dehradun

APPENDIX B

Dear Sir/Madam,

My name is Umesh S Mahtani, a Ph.D. scholar at the Department of Transportation Management, School of Business, UPES, Dehradun. The title of my Ph.D. work is "Developing a model to assess the financial condition of Airline companies in India".

I would be highly thankful to you if you can spare your valuable time in filling up this questionnaire. I would be happy to share the survey research findings if you would like to know.

Below form is to assist in the comparison of the categories with each other. The same form is required to be filled for each factor and compared to the other factors in the same category.

"Category	OPe		EG		PRF		FI		MRF		EX	
	Equal	(1, 1, 1)	Equal	(1, 1, 1)	Equal	(1, 1, 1)	Equal	(1, 1, 1)	Equal	(1, 1, 1)	Equal	(1, 1, 1)
	Very Poor	(1, 2, 3)	Very Poor	(1, 2, 3)	Very Poor	(1, 2, 3)	Very Poor	(1, 2, 3)	Very Poor	(1, 2, 3)	Very Poor	(1, 2, 3)
	Poor	(2, 3, 4)	Poor	(2, 3, 4)	Poor	(2, 3, 4)	Poor	(2, 3, 4)	Poor	(2, 3, 4)	Poor	(2, 3, 4)
	Average	(3, 4, 5)	Average	(3, 4, 5)	Average	(3, 4, 5)	Average	(3, 4, 5)	Average	(3, 4, 5)	Average	(3, 4, 5)
	Good	(4, 5, 6)	Good	(4, 5, 6)	Good	(4, 5, 6)	Good	(4, 5, 6)	Good	(4, 5, 6)	Good	(4, 5, 6)
	Very Good	(5, 6, 7)	Very Good	(5, 6, 7)	Very Good	(5, 6, 7)	Very Good	(5, 6, 7)	Very Good	(5, 6, 7)	Very Good	(5, 6, 7)
	Outstanding	(7, 8, 9)	Outstanding	(7, 8, 9)	Outstanding	(7, 8, 9)	Outstanding	(7, 8, 9)	Outstanding	(7, 8, 9)	Outstanding	(7, 8, 9)"
Operational Factors (OP)	--											
Economic/Government Factors (EG)			--									
Performance Related Factors (PRF)					--							
Financial Factors (FI)							--					
Market-Related Factors (MRF)									--			
External Factors (EX)											--	

Operational Factors (OP)

"Criteria code	Sub criteria	OP1 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP2 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP3 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP4 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP5 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP6 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP7 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP8 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)	OP9 Equal (1, 1, 1) Very Poor (1, 2, 3) Poor (2, 3, 4) Average (3, 4, 5) Good (4, 5, 6) Very Good (5, 6, 7) Outstanding (7, 8, 9)"
OP1	Load factor	--								
OP2	Average number of passengers carried per departure		--							
OP3	Average Number of hours flown per pilot			--						
OP4	Number of departures per aircraft				--					
OP5	Number of pilots per aircraft					--				
OP6	Number of employees per aircraft						--			
OP7	The average age of the aircraft fleet							--		
OP8	Number of different brands of aircraft operated								--	
OP9	International operations									--

Appendix C

Data Collated For 6 Privately Owned Airlines In India From 2006 To 2017

			"WC/ TA	RE/ TA	EBIT/ TA (Op Profit/ TA)	BV of Equity/ Total Liabilities"	RPK	OP expenses per RPK	Labour cost per Air KM in 000	Passenger Load factor in decimals	Number of different brands of aircraft operated	Aviation Fuel price (INR per gallon)	GDP Growth Rate	Total Liabilities/Total Assets	CA/ CL	Distress state - 0 is No and 1 is Yes for 3 yrs losses	Passenger Load factor (%)	Fuel price increase
1	Kingfisher	2006	0.09	(0.34)	(0.30)	0.21	3.65	5.65	0.15	0.59	2.00	80.24	9.26	0.33	1.25	0	59.30	0.41
		2007	0.26	(0.43)	(0.37)	0.15	5.00	6.80	0.06	0.68	4.00	86.25	9.80	0.27	1.95	0	68.20	0.07
		2008	(0.08)	(0.53)	(0.37)	0.14	5.23	6.82	0.04	0.68	4.00	96.39	3.89	0.36	0.75	1	68.10	0.12
		2009	(0.37)	(0.35)	(0.23)	0.06	6.60	9.30	0.08	0.63	6.00	115.77	8.48	0.47	0.21	1	63.00	0.20
		2010	(0.33)	(0.54)	(0.11)	0.05	4.80	5.80	0.07	0.72	6.00	86.97	10.26	0.44	0.25	1	71.80	(0.25)
		2011	(0.46)	(0.62)	0.00	0.15	4.90	5.10	0.06	0.81	6.00	106.87	6.64	1.34	0.19	1	81.00	0.23
		2012	(0.82)	(0.82)	(0.15)	0.12	4.65	5.83	0.07	0.77	6.00	147.29	5.46	1.54	0.09	1	76.80	0.38
		2013	(2.79)	(5.37)	(0.50)	0.13	4.50	68.01	0.29	0.64	6.00	164.86	6.39	5.33	0.05	1	63.70	0.12
2	Jet Airways	2006	0.20	0.06	0.11	0.02	5.95	5.39	0.06	0.72	6.00	80.24	9.26	0.14	2.42	0	72.00	0.41
		2007	0.02	0.04	0.04	0.01	5.72	5.76	0.08	0.70	8.00	86.25	9.80	0.18	1.10	0	69.90	0.07
		2008	(0.06)	0.01	0.01	0.01	5.21	5.55	0.08	0.69	8.00	96.39	3.89	0.19	0.70	0	69.20	0.12

			"WC/ TA	RE/ TA	EBIT/ TA (Op Profit/ TA)	BV of Equity/ Total Liabilities"	RPK	OP expenses per RPK	Labour cost per Air KM in 000	Passenger Load factor in decimals	Number of different brands of aircraft operated	Aviation Fuel price (INR per gallon)	GDP Growth Rate	Total Liabilities/Total Assets	CA/ CL	Distress state - 0 is No and 1 is Yes for 3 yrs losses	Passenger Load factor (%)	Fuel price increase
		2009	(0.03)	(0.01)	0.00	0.01	5.92	5.87	0.08	0.68	7.00	115.77	8.48	0.15	0.80	0	67.80	0.20
		2010	(0.07)	(0.03)	0.02	0.01	4.58	4.49	0.07	0.77	7.00	86.97	10.26	0.18	0.59	0	77.40	(0.25)
		2011	(0.28)	(0.03)	0.05	0.01	4.71	4.46	0.06	0.79	6.00	106.87	6.64	0.88	0.32	0	78.60	0.23
		2012	(0.33)	(0.09)	(0.00)	0.01	4.82	5.04	0.06	0.79	6.00	147.29	5.46	0.95	0.30	0	79.30	0.38
		2013	(0.40)	(0.12)	0.02	0.01	5.79	5.75	0.07	0.79	6.00	164.86	6.39	1.02	0.33	0	78.80	0.12
		2014	(0.50)	(0.31)	(0.09)	0.01	5.80	6.80	0.08	0.78	6.00	174.55	7.51	1.11	0.28	0	78.20	0.06
		2015	(0.48)	(0.39)	(0.03)	0.01	5.68	6.25	0.09	0.82	6.00	144.50	8.01	1.20	0.36	0	82.40	(0.17)
		2016	(0.45)	(0.33)	0.13	0.01	5.39	5.08	0.08	0.83	6.00	88.92	7.11	1.15	0.37	0	82.60	(0.38)
		2017	(0.39)	(0.35)	0.06	0.01	5.18	5.16	0.10	0.81	6.00	92.36	7.62	1.15	0.39	0	81.40	0.04
3	Jet Lite	2006	0.27	(0.25)	(0.05)	0.58	5.83	6.00	0.05	0.70	6.00	80.24	9.26	0.29	1.94	0	69.90	0.41
		2007	(0.28)	(1.30)	(0.72)	0.83	5.20	6.60	0.05	0.68	6.00	86.25	9.80	0.84	0.67	0	67.50	0.07
		2008	(0.32)	(1.83)	(0.55)	0.68	3.80	4.80	0.04	0.71	5.00	96.39	3.89	0.75	0.57	1	70.80	0.12
		2009	(0.54)	(2.75)	(0.59)	0.65	4.20	5.30	0.04	0.68	5.00	115.77	8.48	0.93	0.42	1	67.50	0.20

			"WC/ TA	RE/ TA	EBIT/ TA (Op Profit/ TA)	BV of Equity/ Total Liabilities"	RPK	OP expenses per RPK	Labour cost per Air KM in 000	Passenger Load factor in decimals	Number of different brands of aircraft operated	Aviation Fuel price (INR per gallon)	GDP Growth Rate	Total Liabilities/Total Assets	CA/ CL	Distress state - 0 is No and 1 is Yes for 3 yrs losses	Passenger Load factor (%)	Fuel price increase
		2010	(0.63)	(2.21)	0.03	0.66	4.30	4.20	0.04	0.75	5.00	86.97	10.26	0.90	0.30	0	75.00	(0.25)
		2011	(0.18)	(2.03)	(0.06)	0.46	4.10	4.20	0.04	0.79	5.00	106.87	6.64	2.21	0.74	0	79.20	0.23
		2012	(0.34)	(3.07)	(0.36)	0.55	4.10	4.80	0.04	0.78	3.00	147.29	5.46	2.93	0.71	0	77.90	0.38
		2013	(0.63)	(3.44)	(0.29)	0.52	5.80	6.50	0.06	0.75	3.00	164.86	6.39	3.30	0.57	1	74.90	0.12
		2014	(0.60)	(5.51)	(0.78)	0.38	5.90	7.50	0.07	0.73	3.00	174.55	7.51	4.95	0.52	1	72.70	0.06
		2015	(0.44)	(7.67)	(0.47)	0.34	4.70	5.54	0.09	0.80	3.00	144.50	8.01	6.70	0.64	1	80.10	(0.17)
		2016	(0.67)	(9.79)	0.03	0.33	5.24	5.25	0.08	0.79	2.00	88.92	7.11	8.29	0.36	0	79.30	(0.38)
		2017	(0.77)	(13.72)	(0.03)	0.33	5.11	5.16	0.10	0.79	2.00	92.36	7.62	11.28	0.37	0	79.20	0.04
4	GoAIR	2010	(0.62)	(1.08)	(0.06)	0.10	3.70	3.80	0.04	0.78	1.00	86.97	10.26	0.63	0.03	0	78.20	(0.25)
		2011	(0.82)	(0.72)	0.21	0.09	4.14	3.67	0.05	0.80	1.00	106.87	6.64	1.63	0.22	0	80.20	0.23
		2012	(1.03)	(0.82)	(0.09)	0.09	4.34	4.55	0.06	0.77	1.00	147.29	5.46	1.73	0.06	0	77.30	0.38
		2013	(0.77)	(0.39)	0.19	0.07	6.20	5.90	0.05	0.75	1.00	164.86	6.39	1.30	0.26	0	75.10	0.12

			"WC/ TA	RE/ TA	EBIT/ TA (Op Profit/ TA)	BV of Equity/ Total Liabilities"	RPK	OP expenses per RPK	Labour cost per Air KM in 000	Passenger Load factor in decimals	Number of different brands of aircraft operated	Aviation Fuel price (INR per gallon)	GDP Growth Rate	Total Liabilities/Total Assets	CA/ CL	Distress state - 0 is No and 1 is Yes for 3 yrs losses	Passenger Load factor (%)	Fuel price increase
		2014	(0.51)	(0.31)	0.08	0.07	5.00	4.80	0.05	0.74	1.00	174.55	7.51	1.23	0.43	0	74.30	0.06
		2015	(0.43)	(0.22)	0.09	0.05	4.93	4.62	0.05	0.79	1.00	144.50	8.01	1.15	0.46	0	79.10	(0.17)
		2016	(0.47)	(0.12)	0.12	0.04	4.26	3.95	0.06	0.84	1.00	88.92	7.11	1.07	0.42	0	83.70	(0.38)
		2017	(0.21)	(0.05)	0.16	0.06	4.50	4.00	0.06	0.88	1.00	92.36	7.62	0.99	0.64	0	88.00	0.04
5	INDIGO	2010	(0.03)	0.07	0.21	0.12	3.50	2.90	0.04	0.80	1.00	86.97	10.26	0.20	0.83	0	80.00	(0.25)
		2011	(0.22)	-	0.21	0.04	3.60	3.00	0.04	0.85	1.00	106.87	6.64	0.92	0.55	0	85.10	0.23
		2012	(0.00)	0.03	0.00	0.03	3.70	3.80	0.05	0.82	1.00	147.29	5.46	0.91	1.00	0	82.30	0.38
		2013	(0.02)	0.03	0.14	0.02	4.50	4.10	0.06	0.81	1.00	164.86	6.39	0.92	0.93	0	81.10	0.12
		2014	(0.01)	0.00	0.06	0.01	4.80	4.70	0.06	0.77	1.00	174.55	7.51	0.96	0.95	0	77.20	0.06
		2015	0.09	0.00	0.17	0.01	4.94	4.39	0.06	0.80	1.00	144.50	8.01	0.96	1.33	0	79.80	(0.17)
		2016	0.10	0.07	0.20	0.11	4.49	3.79	0.08	0.84	1.00	88.92	7.11	0.81	1.33	0	84.00	(0.38)
		2017	0.02	0.12	0.10	0.14	4.01	3.65	0.07	0.85	1.00	92.36	7.62	0.79	1.04	0	84.80	0.04
6	Spicejet	2006	(0.15)	(0.53)	(0.09)	0.44	2.91	3.33	0.05	0.83	1.00	80.24	9.26	0.29	0.46	0	82.90	0.41

			"WC/ TA	RE/ TA	EBIT/ TA (Op Profit/ TA)	BV of Equity/ Total Liabilities"	RPK	OP expenses per RPK	Labour cost per Air KM in 000	Passenger Load factor in decimals	Number of different brands of aircraft operated	Aviation Fuel price (INR per gallon)	GDP Growth Rate	Total Liabilities/Total Assets	CA/ CL	Distress state - 0 is No and 1 is Yes for 3 yrs losses	Passenger Load factor (%)	Fuel price increase
		2007	(0.25)	(0.29)	(0.08)	0.56	2.80	3.41	0.04	0.77	1.00	86.25	9.80	0.53	0.53	0	76.60	0.07
		2008	(0.14)	(0.37)	(0.16)	0.45	3.00	3.60	0.04	0.72	2.00	96.39	3.89	0.59	0.76	1	72.20	0.12
		2009	(0.48)	(1.17)	(0.45)	0.51	3.55	4.45	0.03	0.66	2.00	115.77	8.48	0.92	0.48	1	66.10	0.20
		2010	(0.41)	(0.83)	0.08	0.57	3.25	3.16	0.03	0.78	2.00	86.97	10.26	0.90	0.54	0	78.20	(0.25)
		2011	(0.48)	(0.65)	0.11	4.76	3.39	3.33	0.06	0.81	2.00	106.87	6.64	0.71	0.31	0	81.30	0.23
		2012	(0.44)	(0.67)	(0.27)	0.43	3.86	4.47	0.06	0.71	3.00	147.29	5.46	1.07	0.37	0	70.60	0.38
		2013	(0.29)	(0.49)	(0.02)	0.27	4.65	4.89	0.04	0.75	3.00	164.86	6.39	1.07	0.49	0	74.70	0.12
		2014	(0.58)	(0.76)	(0.22)	0.32	4.72	5.46	0.04	0.72	3.00	174.55	7.51	1.30	0.25	1	72.30	0.06
		2015	(0.64)	(1.05)	(0.17)	0.39	4.40	5.15	0.05	0.81	3.00	144.50	8.01	1.36	0.18	1	81.40	(0.17)
		2016	(0.74)	(0.92)	0.22	0.49	4.35	4.08	0.05	0.91	6.00	88.92	7.11	1.36	0.20	0	90.60	(0.38)
		2017	(0.61)	(0.74)	0.20	0.52	4.11	3.88	0.07	0.92	6.00	92.36	7.62	1.20	0.26	0	91.60	0.04
7	Paramount	2006	1.23	2.04	(1.48)	70.96	15.10	6.64	0.04	0.44	1.00	80.24	9.26	0.03	3.92	1.00	44.10	0.41

			“WC/ TA	RE/ TA	EBIT/ TA (Op Profit/ TA)	BV of Equity/ Total Liabilities”	RPK	OP expenses per RPK	Lab-our cost per Air KM in 000	Passenger Load factor in decimals	Number of different brands of aircraft operated	Aviation Fuel price (INR per gallon)	GDP Growth Rate	Total Liabilities/Total Assets	CA/ CL	Distress state - 0 is No and 1 is Yes for 3 yrs losses	Passenger Load factor (%)	Fuel price increase
		2007	(7.14)	2.23	1.52	4.67	16.50	14.90	0.07	0.53	1.00	86.25	9.80	0.34	0.34	1	53.10	0.07
		2008	(0.17)	2.23	1.44	0.22	9.34	8.53	0.11	0.71	1.00	96.39	3.89	7.30	0.95	1	70.80	0.12
		2009	3.46	2.49	1.98	0.07	10.40	9.60	0.05	0.78	2.00	115.77	8.48	24.63	1.35	1	77.60	0.20

Research Publications

Journals:

1. Mahtani Umesh S. (2017), Related Party Transactions: "Analysis of Related Party Transactions in India: A Group and Non-Group company perspective, Corporate Ownership and Control (COC)" ISSN - 1727-9232, volume 15 (2018)
2. Mahtani Umesh S. (2018), Related Party Transactions in India and their impact on reported Earnings, Publication by University of Tennessee (USA) in their Journal of Developing Areas, Volume 53, Number 1, Winter 2019
3. Mahtani Umesh S, and Dr. C.P. Garg (2018), "An analysis of key factors of financial distress in airline companies in India using fuzzy AHP framework, Transportation Research Part A: Policy and Practice. Vol 117" Nov 2018 Pgs 87-102. **(SCI Indexed Impact Factor 3.04, A*, ABDC)**
4. Mahtani Umesh S. and Dr. C.P. Garg (2019), An analysis of factors affecting financial distress of airline companies: Case of India, International Journal of Business Excellence [In press] **(C, ABDC list)**

Conferences:

1. Mahtani Umesh S. and Dr. C.P. Garg (2018), Analysis of Related Party Payments in Financially Distressed Companies in India, Presented at the PANIITM conference at IIT Roorkee – Nov 30 to Dec 02 2018.

Brief Background

Name: Umesh S. Mahtani

Qualifications:

- Pursuing PhD at the UPES – Dehradun – India
- CPA – Qualified from AICPA – USA (2009)
- ACMA – Qualified as an Associate Member of the Chartered Institute of Management Accountants (CIMA) U.K.
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The industry experience spans over 20 years, which involved managing corporate finance in various industries across different countries (India, Singapore Malaysia and Nigeria). The responsibilities in these companies included performance analysis and optimization, cash management, foreign exchange transactions, tax planning, cost analysis, budgeting, new business evaluation, systems design and implementation, and finance and accounting back office processing .