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COVID-19 Krizinde Operasyonel Aksaklık Altındaki Havayolu Şirketlerinin Stratejik ve Finansal Karar Faktörlerinin Analizi

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ÖZET

Hava ulaşımının hızlı bir ulaşım türü olması ve kıtalararası transfer imkanı sunması, yeni tip koronovirüs olarak adlandırılan COVID-19'un farklı noktalardan taşınarak daha geniş coğrafyalara yayılmasını artırmıştır. Hava aracılığıyla ve kara parçaları arasında bir yolcu ve yük transfer merkezleri olmasının yanı sıra havalimanlarının yaşam merkezleri olarak yaygınlaşması, bulunduğu bölge başta olmak üzere her bölgede hareketliliği artırmaktadır. Bu nedenle havacılık sektörü, hava taşımacılığının COVID-19 pandemisi üzerindeki hızlandırıcı etkisi nedeniyle 2020 yılının ilk yarısında faaliyetlerini durdurdu. Operasyonların kesintiye uğraması birçok havayolunu finansal krize soktu ve finansal düzenlerini bozdu. Bu çalışmada, farklı operasyonel stratejiler (FSC, LCC) ile ABD'de faaliyet gösteren havayolu şirketlerinin finansal kararlarını etkileyen faktörler incelenmiştir. En önemli finansal faktörler entropi tabanlı MAUT yöntemi ile belirlenmiş ve veri zarflama analizi (DEA) yöntemi ile havayolu şirketlerinin verimliliği araştırılmıştır. LCC ve FSC havayolu şirketlerinin mali yapıları incelenmiştir. Kriz durumu altında sağlam bir finansal yapı kurabilmek için ihtiyaç duyulan faktörler belirlenmiştir. Çalışma, sektör hakkında bilgiler içerir, faydalı bulguları önerir ve açıklar. Ayrıca gelecekte buna benzer bir durumun yaşanması halinde alınabilecek önlemler hakkında fikir verir.

Anahtar Kelimeler: Havayolu, Kriz, COVID-19, Finansal Karar, Stratejik Faktör

Analysis of Strategic and Financial Decision Factors of Airline Companies under Operational Disruption on COVID-19 Crisis

ABSTRACT

The fact that air transportation is a fast type of transportation and offers intercontinental transfer has increased the spread of COVID-19, which is called the new type of coronovirus, to wider geographies by being carried from different points. In addition to being a passenger transfer center between air and land, the expansion of airports as life, shopping and trade centers increases mobility in every region. Therefore, the aviation industry stopped its operations in the first half of 2020 due to the accelerating effect of air transport on the COVID-19 pandemic. The interruption of operations plunged many airlines into financial crisis and disrupted their financial order. In this study, different operational strategies (FSC, LCC) and the factors affecting the financial decisions of airline companies operating in the USA were examined. The most important financial factors were determined by the entropy-based MAUT method and the efficiency of the airline companies was investigated with the data envelopment analysis (DEA) method. Financial structures of LCC and FSC airline companies were examined. The factors needed to establish a sound financial structure under the crisis situation have been determined. The study contains information about the industry, recommends and explains useful findings. Also gives an idea about the measures that can be taken in case of a similar situation in the future.

Keywords: Airlines, Crisis, COVID-19, Financial Decision, Strategic Factor

1. INTRODUCTION

Nowadays, natural disasters cause more deaths and injuries than in the past, and this situation puts more costs on countries exposed to disaster (O'Brien et al., 2006). The natural resources that decreased with the rapidly increasing consumption caused the economic sustainability studies to become widespread. On the basis of the concept of sustainability; preserving environmental balance, preserving natural diversity and proper functioning of the ecosystem. The movement of products within the chain extending from the supplier to the end consumer reveals the importance of the logistics management system for the concept of sustainability (Christopher, 2011). From this point of view, logistics activities are included in the scope of the concept of sustainability like many economic activities.

Sustainability is an institutional attitude that societies increasingly demand in our age. In this context, important duties fall on the logistics businesses. However, the design, planning and operation of sustainable logistics networks is a difficult process for any company. In order to respond to such challenges, companies should effectively manage their logistics structures, taking into account economic, environmental and social goals (Ramos et al.,

2014). Due to such negativities, the importance of the concept of operational and economic sustainability in logistics management and more particularly in the event of a disaster emerges.

The last of these disasters has emerged as the COVID-19 pandemic. The International Air Transport Association (IATA, 2020) assumes that the COVID-19 pandemic will impact airline companies as airline passenger revenues drop by $314 billion in 2020, which is nearly 55 percent decline compared to 2019. This assumption is based on a scenario with vigorous travel restrictions lasting three months (IATA, 2020). It is also clear that severe passenger and travel restrictions affect the revenues and financial sustainability of airlines. Under these circumstances, it is important to examine airlines' fin
ancial resource management in case of crisis and to identify the most important financial resources under pandemic conditions. Analyzing the economic situations of current aviation , it may be useful to examine flight cancellations to see how devastating impact the pandemic has had on airlines in U.S.

Figure 1 shows the cancellation amounts for domestic flights in the U.S. Even the scary level of cancellations on domestic flights presents a bad scenario for airline companies. Airlines are now introduced around the world have introduced new regulations for ticket changes and returns in the current situation (Bandyopathyay et al., 2020). Some airlines are thought to strategically cancel their flights, not due to legal requirements imposed by the state. In both cases, it is clear that airlines suffered losses. Travel restrictions and regulations have forced airlines to make some decisions. While some airlines are downsizing their fleets, others have arranged their cargo operations. Some airlines have tried to find solutions by reducing the number of employees and limiting the number of flights (Albers & Rundshagen,2020). Most of the responses to the current crisis situation have developed under retrenchment, preserving or exit conditions. Also innovative approaches were tried to implement. Innovative approaches have generally been created in order to preserve existing employment and create an active workforce in other operations. This situation is thought to play a role in balancing the unemployment rate in airline industry.

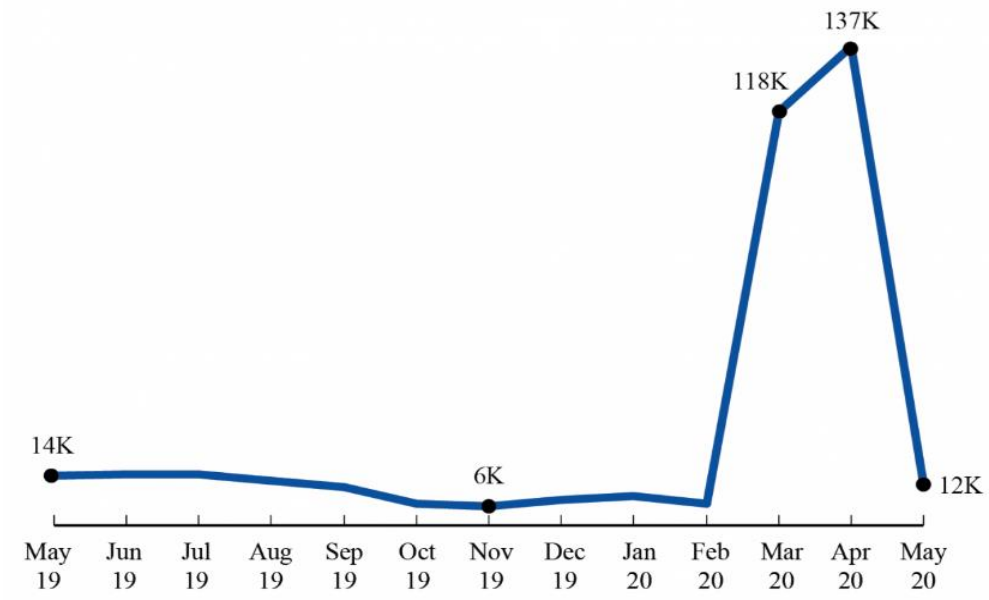

Figure 1: U.S Airlines Cancelled Domestic Flights (BTS, 2020)

There is a study examines the impact of COVID-19 on employment in the airline industry recently (Sobieralski, 2020), but the impact of the COVID-19 on airline financial factor has not yet been investigated. In order to fill this gap, we aim to examine the airline critic financial factors during the spread of the COVID-19 pandemic by considering both FSC and LCC comperatively.

With this study, policies that should be produced and followed will be determined if any disruption that is contagious and may lead to a global pandemic occurs in the future. With the analyzes carried out, we will reveal the most important factors according to the type of service adopted by the airline companies from the cost structures in the USA under crisis conditions. The main reason for the application of the study for the USA is the accessibility and diversity of the data. The main point to be brought to the literature is to be able to explain the comparative analysis of financial data for airline companies and the production of policies through effectiveness. As a result of the examinations, different strategies and income sources can be created and different service strategies can be created.

2. LITERATURE REVIEW

Since the airline sector consists of a dynamic environment, it is very sensitive to many changes. This high precision makes this industry difficult to manage and operate. Especially financial crises or other environmental and political events that may lead to financial crisis easily affect the aviation industry. COVID-19, one of the epidemic diseases in history, has caused an unrivaled crisis for airlines in the world (Albers and Rundshagen, 2020). All states

around the world have taken measures in the aviation industry to deal with this epidemic, as in many other industries. As a result of these precautions the tourism industry and airlines in general are in trouble of great recession: more than %60 of the commercial aircrafts have been landed in the world particularly (Hollinger, 2020). According to an estimate by IATA, revenues from the airline industry are expected to halve in 2020 (IATA, 2020).

Moreover, as the aviation industry is seen as the main source of income for many countries, many government support packages and assistance have also been announced (Rushe, 2020). Therefore, most researchers assume that in the post-COVID-19 era, airlines will not revert to the status of state-owned companies or even departments of national transport administrations (Albers & Rundshagen, 2020). From this point of view, finding cost resources and taking measures in airline sectors play a key role in ensuring continuity during the crisis period. However, the profitability factors in the airline sector have changed and differentiated in the world over time (Scotti & Volta, 2017). Another study documented that COVID-19 outbreak is directly affected the stock prices of every company nearly (Ding et al. 2020). Discriminant study held on by (Ru et al. 2020) revelaed that has significant policy intimations for economic assistance programs and containment precautions worldwide, as early responses to COVID-19 can denote the difference between life and death. In this context, in a study on the economic impact of COVID-19 as an inclusive study, countries and routes were examined separately and data were presented (Bureau, A.T. 2020.)

Beyond all these studies, there are also studies carried out to prevent economic and prestige losses of airline companies by some economic policies. They put on reveal that a country's awareness to support airlines and their magnitude related with revenue degeneracy and interconnection on international aviation market (Abate et al. 2020). In this process, some legal policies held by the governments like forced confinements and travel bans are also affected this situation on airlines which suffering economically. In this point, there is a study exists which shed lights weak economic performance and sustained reliance on State aid of aviation(Gössling, S. 2020). Study states that State aid is given to airlines to ensure that it is equivalent to profits that could be made over many years, especially without considering the cost of further cuts and negative externalities. In addition to these studies, this study is expected to contribute to the following points:

- To be able to reveal the factors for the economic standing of the airline companies in the periods when they are not operational,
- Gaining insight into the differences in financial structures and sustainability of LCC and FSC airlines in case of crisis,

- Understanding the impact of flight and service policies on cost structures under crisis situations,
- Lastly, gaining insight into which economic factors can make airline companies profit on the ground.

3. METHODOLOGY

In this study, Entropy and MAUT methods, which are among multi-criteria decision making methods, are used. Entropy method was used to calculate the criterion weights initally, then MAUT and DEA methods were used for performance evaluation. The data titles used are described in the Table 1 below.

Table 1: Used variables and their definitions

Variable	Definition	Data Source	Period
Current Assets	**cash and other assets that are expected to be converted to cash within a year.**	SEC Form 10-Q	03.2020-07.2020
Current Liabilities	**amounts due to be paid to creditors within twelve months**	SEC Form 10-Q	03.2020-07.2020
Sales	**the exchange of a commodity for money; the action of selling something inside company.**	SEC Form 10-Q	03.2020-07.2020
Total Assets	**total amount of assets owned by a person or entit**	SEC Form 10-Q	03.2020-07.2020
Total Liabilities	**the combined debts that an individual or company owes**	SEC Form 10-Q	03.2020-07.2020
Net Income	**also called net earnings, is sales minus cost of goods sold, general expenses, taxes, and interest.**	SEC Form 10-Q	03.2020-07.2020
Stockholders Equity	**remaining amount of assets available to shareholders after all liabilities have been paid**	SEC Form 10-Q	03.2020-07.2020

3.1. ENTROPHY METHOD

When the data of the decision matrix is known to calculate objective weights, the Entropy method can be used. In the method based on the concept of entropy taken from physics and information sciences, it is thought that the decision matrix contains information about the importance of quality. The basic idea of this method is which this information flows from the contrasts between data sets. Accordingly, the objective weights of the attributes are determined by how separate or differentiated the outputs of the alternatives according to each attribute. The greater this contrast, the more information covered and transmitted by the relevant attribute. The steps of the entropy method are as follows (Wang and Lee, 2009).

Step 1: Normalization of the decision matrix is calculated with the help of equation (1).

$$p_{ij} = \frac{x_{ij}}{\sum_{x=1}^{m} x_{ij}} \quad (1)$$

i: alternatives

j: criteria

pij: normalized values

xij: given utility values

Step 2: Entropy value for each criterion is calculated by equation (2).

$$e_j = -k \sum_{j=1}^{n} p_{ij} \, lnp_{ij} \quad (2)$$

k: entropy coefficient ($(\ln(n)^{-1}$))

ej:. entropy value

pij: normalized values

Step 3: Calculating the weight value of each criterion is as in equation [3].

$$\sum_{j=1}^{m} w_j = 1 \quad \text{where} \quad w_j = \frac{1-e_j}{\sum_{1}^{m} 1-e_j} \quad (3)$$

wj: weight values

ej: entropy values

3.2. MAUT METHOD

Multi-Criteria Decision Making is a general expression given to the solution of the problems in which multiple and conflicting criteria are desired to be realized (Zionts, 1979: 94). Multi Attribute Utility theory (MAUT), one of the multi-criteria decision making methods, has been started to be applied by Fisburn (1967) and Keeney (1974). Loken developed this method in 2007 after Keeney. In recent years, it has become commonplace to use the MAUT method to make a real analysis in the developing world. Multi-attribute utility theory (MAUT) is a very useful method for heuristic formulation and decision-making problems. MAUT method provides a logical and solvable way to choose between conflicting goals. This method works systematically to decide on variables and to provide a common

basis (Kim & Song, 2009). Theoretically and practically, MAUT method has application procedures. These procedures consist of five stages (Kim et al., 2007);

- Setting goal and setting features for the purpose,
- Establishing qualifications with quantitative figures,
- Derivation of utility functions of individual quality,
- Calculation of weighting factors of individual quality,
- Multiple criteria utility function derivation.

Basic idea is that every decision maker seeks to optimize, consciously or indirectly, by bringing together all his perspectives. Choices of decision maker mean represented utility function. Decision maker does not need to know this function at the beginning of the decision-making process, so first he has to build the function. Utility function is a way of measuring preferability or alternatives. This function can be consumer goods or services. Thanks to the function, it is possible to learn the welfare level of the decision maker.

Table 2: Financial Values of Selected Airlines in Millions

	2020(Q2) ('000)						
	Current Assets	**Current Liabilities**	**Sales**	**Total Assets**	**Total Liabilities**	**Net Income**	**Stockholders Equity**
American	13789	18000	10136	64544	73105	4137	3169
Delta	18915	20150	10060	72261	72261	6251	8690
Southwest	15872	9361	6879	14785	35596	1009	10878
United	10041	16395	9454	54901	54901	3311	8517
Jetblue	3777	3985	1083	14027	14027	4094	4094
Alaska	3244	4120	124	13998	13998	446	3861
Hawaiian	962	1037	60	3996	3996	250	825
Spirit	1667	1271	909	7767	7767	172	2343
Allegiant	937	859	495	3272	2536	127	736

Utility function creates various criteria that will enable us to evaluate an alternative. For example, if a smartphone is purchased, it is necessary to measure global utility of the available ones in order to choose the most suitable smartphone. For this, it is usually necessary to make an evaluation based on various criteria such as price, customer comments, size, camera, battery. For each criterion the decision maker will give a score, called marginal utility score. Marginal utility points of criteria are obtained in second stage of global utility score (Ishizaka and Nemery, 2012). Data required for the study were compiled from SEC 10-

Q reports periodically announced by each airline company. Samples from both groups were selected to reflect Low Cost Carrier and Full Service Carrier trends when selecting those airline companies. Steps of MAUT is expressed as;

Step 1: The criteria (moment) subject to the decision problem and the qualities / criteria (xm) that will help in selecting the criteria should be determined.

Step 2: Assignment of weight values (wj), which ensures the correct evaluation of the qualities and for which priorities are determined. The sum of all wj values must equal 1.

Step 3: Assignment of the value measures of the criteria. This assignment is made by considering the quantitative values for the quantitative criteria and binary comparisons for the qualitative criteria. In the light of all these, 5, 100 etc. value assignments are made in the system (xm).

Step 4: The assigned values are placed in the decision matrix and the normalization process is started. In the normalization process, first the best and worst values are determined for each feature and a value of 1 is assigned to the best value and 0 to the worst value.

Step 5: After the normalization process, the process of determining the benefit values starts. The utility function formula is as in equation (4).

$$U(a_i) = \sum_{j=1}^{q} f_i\,(a_i).w_j \qquad (4)$$

$U(a_i)$ = utility value of the alternative

$f_i(a_i)$ = Normalized utility values for each criterion and each alternative

w_j = weight values

3.3. DATA ENVELOPMENT ANALYSIS

DEA is a non-parametric method based on linear programming principles, designed to measure the relative efficiency of decision-making (DM) units that produce the identical type of output using the same type of inputs. DM unit mentioned here is the units whose effectiveness is examined such as enterprises, institutions, firms, companies that produce similar outputs with the help of similar inputs. For this, DEA has all the features on programming of linear models. DEA models could be in the form of both maximization or minimization for the objective function under some circumstances.

DEA has the feature of using two-way for input and output. DEA models for Input; It investigates how the most suitable input combination could be created in order to produce a obvious output combination in the most effective way. On the other hand, out put oriented

models investigate how much output combination can be gathered with a certain input combination. That is, for any combination of inputs, it tries to detect how much output should be increased in order to make non effective DM units effective. The aim is to maximize outputs (Charnes et al, 1997). Joint feature of all models in DEA is to determine which DM units constitute the efficiency boundary, thus specify the effective and noneffective DM units by establishing the efficiency boundary. The disparity between the models shows in the graph of this surface pursuant to the model used. With the creation of the boundary, surplus resources can be identified for noneffective DM units below the boundary. It is familiar that the resolution of dual and primal models in linear programming problems gives the same result.

Charnes Cooper Rhodes (CCR) model, which is the first proposed model of DEA, technical efficiency is measured under the consideration of constant returns to the scale. In this type of DEA models, boundary of efficiency is stated by a line starting from the origin and routing to the effective DM units. CCR model can be identfied in two ways as Input or Output oriented. Input-oriented CCR model is a model that tries to determine the format to which nonefficient DM units should decrease their inputs for any output level, while keeping outputs constant. In dual model, it is pointed to maximize the weighted average of the outputs of the DM unit whose efficiency is desired to be computed. In the constraints, the average of the inputs of the DM unit whose efficiency is satisfied to be calculated as 1. Another constraint specifies that the weighted average of outputs for all DM units is smaller than the weighted average of inputs. In this circumstance, ratio htat output to input could be at most 1 for each DM unit. After then, optimum output average for a DM unit could be 1 at most. A DM unit that is effective with the input-oriented CCR model is also effective in the output-oriented CCR model.

Banker et al. (1984), the Banker Charnes Cooper (BCC) model measures the efficiency of decision-making units under the consideration of switching returns to scale. In this model, contrary of the CCR model, just the convexity constraint is seems extra to the envelopment model. Input-oriented BCC model is seeks the minimum input level to gain the same ampunt of possinle output (Kocisova, 2014).

$$Min \quad \theta_q$$

$$s.t. \sum_{j=1}^{m} x_{ij}\lambda \leq \theta_q x_{iq} \qquad i = 1,2,\dots m,$$

$$\sum_{j=1}^{n} y_{rj}\,\lambda_j \geq y_{rq} \qquad r = 1,2,\dots s,$$

$$\sum_{j=1}^{n} \lambda_j = 1 \quad , \qquad \lambda_j \geq 0 \quad , \qquad j = 1,2,\dots n,$$

θ_q is technical efficiency of DMU_q, y_{rq} is produced amounts of r^{th} output of DMU_q, x_{iq} is consumed amounts of i^{th} input of DMU_q; y_{rj} is produced amounts of r^{th} output of DMU_j , x_{ij} is consumed amounts of i^{th} input of DMU_j , λ_j is weight assigned to the DMU_j in input oriented BCC model.

The expression $\theta_{BCC} > \theta_{CCR}$ is always true for any DM unit, the technical efficiency found in the Input Charnes Cooper Rhodes model and the technical efficiency value found in the Input Banker Charnes Cooper model. Because the convex set of production possibilities in the Banker Charnes Cooper model is a subset of the production possibilities set in the Charnes Cooper Rhodes model. From this, it can be said that any DM unit that is effective with the Charnes Cooper Rhodes model will definitely be effective with the Banker Charnes Cooper model. However, the reverse is not true.- It is not possible to define a relationship between the input-side BCC model and the output-side BCC model as in the CCR model. However, between the efficiency score of the output-oriented BCC model θ_{BCC} and the efficiency score of the output-oriented CCR model θ_{CCR};

$$\theta_{CCR} \geq \theta_{BCC}$$

There is a relationship in the form of and a DM unit which is effective on BCC model will also be found effectie with the CCR model. The reverse is not true, as indicated by input-side models.

The duality problem of DEA is a new tend in LP problem reproduced by mathematical operation from a given primal LP problem. Both problems are related tightly to each other, and optimal solution of either gives the optimal solution of the other directly. In the

transition from primal to dual, objective is becomes counterwise of another. If primal model seek to be maximisation then dual model becomes minimization. Vital reason to use the dual model in LP problems is that the dual problem needs less computation time and space in some cases compared to the primal problem and could give important extra comments about the data.

3.3.1. Selection of DEA Model

Input-oriented model may be more suitable because the input control is easier in the aviation industry. The goal is to achieve maximum output with minimum input. GAMS software was used for the application of the activity analysis. Financial data on airline companies were collected and applied in the model. Although airline companies do not have the opportunity to directly intervene in these variables, they have a chance to change them with some policy and campaign activities.

4. APPLICATION AND RESULTS

First of all, the weights of the criteria were calculated using the entropy method. In calculating the weights of the criteria, it was aimed to obtain more realistic weight values by using entropy. Entropy-based criterion weights are shown in the Table 3 below.

Table 3: Entorpy-based Criterion Weights

	Current Assets	Current Liabilities	Sales	Total Assets	Total Liabilities	Net Income	Stockholders Equity
American	0,1034	0,1019	0,1004	0,1014	0,1014	0,1023	0,1125
Delta	0,1013	0,1013	0,1005	0,1008	0,1015	0,0999	0,1041
Southwest	0,1024	0,1072	0,1032	0,1129	0,1070	0,1133	0,1026
United	0,1060	0,1026	0,1008	0,1024	0,1034	0,1040	0,1043
Jetblue	0,1138	0,1138	0,1162	0,1133	0,1142	0,1023	0,1105
Alaska	0,1147	0,1136	0,1213	0,1133	0,1142	0,1175	0,1110
Hawaiian	0,1201	0,1199	0,1218	0,1193	0,1199	0,1194	0,1200
Spirit	0,1181	0,1193	0,1169	0,1167	0,1174	0,1203	0,1147
Allegiant	0,1202	0,1204	0,1189	0,1199	0,1210	0,1209	0,1204
TOTAL	1	1	1	1	1	1	1

Following the calculation of the criteria weights, the MAUT method was applied using the calculation steps explained in Section 3.2 and the calculations were carried out. As a

result of the calculations, the utility values of each criterion and factors were revealed. Calculated values are shown in Table 4.

Table 4: MAUT Based Result Matrix

	Current Assets	Current Liabilities	Sales	Total Assets	Total Liabilities	Net Income	Stockholders Equity
American	0,0206	0,0244	0,0260	0,0262	0,0267	0,0214	0,0083
Delta	0,0277	0,0271	0,0258	0,0292	0,0264	0,0316	0,0210
Southwest	0,0235	0,0133	0,0181	0,0067	0,0137	0,0058	0,0259
United	0,0154	0,0224	0,0243	0,0225	0,0204	0,0174	0,0206
Jetblue	0,0062	0,0060	0,0032	0,0064	0,0058	0,0212	0,0105
Alaska	0,0054	0,0062	0,0004	0,0064	0,0057	0,0026	0,0099
Hawaiian	0,0017	0,0017	0,0002	0,0019	0,0017	0,0015	0,0023
Spirit	0,0028	0,0020	0,0027	0,0036	0,0033	0,0010	0,0062
Allegiant	0,0016	0,0014	0,0015	0,0016	0,0011	0,0008	0,0021
TOTAL	0,1049	0,1046	0,1022	0,1045	0,1047	0,1032	0,1068

As a result of the calculations made with the MAUT method, a benefit value is created by adding the values of each criterion. Ranking is done from the highest value to the lowest value. As a result of the ranking, the criterion with the highest utility value is the most important criterion. Ranked criterions and their values are shown below.

Table 5: Ranked Criterions and Values

	Current Assets	Current Liabilities	Sales	Total Assets	Total Liabilities	Net Income	Stockholders Equity
TOTAL	0,1049	0,1046	0,1022	0,1045	0,1047	0,1032	0,1068
RANK	2	4	7	5	3	6	1

As a result of the MAUT analysis, stockholders equity was determined as the most important criterion. This situation is not difficult to understand. However, what is important is the change between the situation before the Covid-19 pandemic. Another method used is Data Envelopment Analysis (DEA). Same data set was used in the data envelopment analysis and the results were investigated. Input values used for data envelopment analysis are Current Liabilities, Total Liabilities, Stockholders Equity, respectively. Output values are

Current Assets, Sales, Total Assets, Net Income. The reason why the sales are taken as output value is to make some inferences about the preferences of the customers by considering the service type they adopt and other resources, not based on the direct sales of the companies since the sales of all airline companies have decreased a lot due to the current crisis situation. If the sales performance of the firms that are seen as efficient in the output-oriented model is good, this will give clues about the importance of the service type (FSC, LCC). However, it will allow the examination of the importance of other company assets and financial structure in airline companies that are efficient in the input-oriented model. Table 6 shows the result of the calculations made using data envelopment analysis.

Table 6: Implementation of Dual DEA Model

	Input		**Output**	
Airlines	**CRS/CCR**	**VRS/BCC**	**CRS/CCR**	**VRS/BCC**
American	1,0000	1,0000	1,0000	1,0000
Delta	1,0000	1,0000	1,0000	1,0000
Southwest	1,0000	1,0000	1,0000	1,0000
United	1,0000	1,0000	1,0000	1,0000
Jetblue	1,0000	1,0000	1,0000	1,0000
Alaska	0,8338	0,9556	1,1993	1,0439
Hawaiian	0,9460	1,0000	1,0571	1,0000
Spirit	1,0000	1,0000	1,0000	1,0000
Allegiant	1,0000	1,0000	1,0000	1,0000

As a result DEA, an efficiency score for each decision making unit is calculated. If value of the efficiency score of the decision making unit is 1, that unit is active; If it is less than 1, we consider it inactive for input oriented models. Even if this value is 0.999, relevant unit is not considered active. Activity score of the observation that wants to be an active unit must also be 1. Thus, in inverse model if its score is 1, it is the worst efficient. If the score is getting higher than 1 means becomes more efficient. CCR input-output and BCC input-output models have been studied in order to show that there is consistency between technical efficiency measurement and models at the local level. While the CCR model calculates the total technical efficiency as a whole, the BCC model provides the opportunity to calculate by separating the technical efficiency and scale efficiency. By considering both analysis, it is possible to say that airline companies have suffered a lot in pandemic

conditions. Especially for airline companies which is operated by sales as a primary financial resource is jeopardised their financial stability. As it can be understood from the results of the MAUT method, stakeholders equity and current assets are the most important factors in measuring the financial dimensions of companies under pandemic conditions. Because the COVID-19 virus, which is an infectious disease, has highly restricted transportation and social interaction, following which flights have been canceled and sales have come to halt.

Although governments have announced financial support packages for airline companies under these conditions, it is debatable that they have been successful in saving the gravity of the situation (Abate et al, 202). From another point of view, Full service carrier (FSC) and Low cost carrier (LCC) airlines have reactions that differ from each other during the recession. One of them is the funds and resources used to provide the financial flow needed to remove the current costs in the absence of customer demand. As can be understood from the data envelopment analysis, Alaska and Hawaaian Airlines, which are representatives of LCC airlines, could not show efficiency in input-oriented models. Although LCC airlines do not suffer from a lack of equity capital, they mostly profit from operating costs, so in the absence of sales and demand, costs accumulate as there will be no operation. On the contrary, when looking at output-oriented models, it can be understood that LCC representatives perform better and are more efficient. Because in the model used, net income and current assets are specified as output and companies are judged by their effectiveness characteristics according to their financial outputs. In capital intensive industries, such as airlines, liquidity plays an important role in boosting profts (Merkert and Swidan 2019). However, the forced closure due to the pandemic led to the cessation of requests. Passenger transport has stopped and liquidity has decreased. Airline companies that carry cargo at the same time as passengers can be excluded from this situation. Although the forced confinement had a major impact on passenger logistics, it significantly increased the cargo logistics (Li, 2020).

5. CONCLUSION AND DISCUSSION

The positive advantages of air transport logistics in terms of delivery speed, time consumption, system reliability and overall safety plays an significant role in the choice of users by both domestic and international lines. For this reason, factors such as the transportation of passenger mobility around the world destinations with airline networks, the crowded areas of airports, easier spread of infectious diseases by respiratory tract in the aircraft have accelerated the emergence of the epidemic in a wide geography with the effect

of air transportation (Craig et al., 2020). Following the recognition of COVID-19, changes in the world order have occurred, economic bottlenecks have begun, and many sectors have faced problems that have not been experienced before. However, great changes have occurred in the way people live and organizations function. The aviation sector has also taken its place among the sectors most affected by COVID-19.

The main reason why the airline sector is among the most affected sectors is that it is a sector that operates directly with people. It cannot be mechanized with today's technology, it is not possible to maintain the entire process automatically. Disaster and crisis plans have an important place in order for the process to survive in shock situations such as pandemics and to be in good shape financially under recession conditions. Since cost structures are also directly affected by the change in service type, it is obvious that every airline company should create strategies related to effective and different financial management concepts. Strategies that can be created and policies that can be followed can be grouped under certain headings. These can be ;

- Fleet standardization and management,
- Income distribution and management,
- Operation efficiency and management,
- Crisis funds and resource management.

Fleet management and strategy is one of the most important issues as revenue and operations are directly linked. Because the maintenance of the fleets is an important cost as much as the operation. Since the inoperable fleet will not be able to generate revenue, direct maintenance costs are incurred and cut off liquidity. It is clear that the most important factor is always the business that will provide liquidity, regardless of the operation types of airline companies (FSC and LCC) nevertheless. In financial conditions where liquidity is disrupted and income is discontinuous, asset ownership and equity capital are the most important saviors under mitigation of operations. During the study, it was aimed to investigate the most important factors for the survival of airline companies under pandemic conditions. Study aimed to give an idea to explain the current situation with a limited data set. As a result of the study, it may be possible to make some inferences. These;

- Stockholder equity and total assets play an important role as liquidity is interrupted in an environment where there is no operation.

- According to the airline operating strategy, financial structure changes and the reactions differ.
- In non-operational environments, low-cost strategies cannot perform very well.
- Not only with operation, but also with ancillary income sources and capital increase are necessary and sufficient to cope with crisis situations.

Thus, at the end of the study, it was determined that low-cost airline companies could not show an effective presence in case of congestion active income sources, since their incomes are directly based on operational activities. However, it has been observed that low-cost airline companies, which host side income sources, have not lost their current financial stability, but have not been able to make progress. So it's neither good nor bad. On the other hand, the passive income generated by the real estate and facilities owned by the full service carrier airline companies was enough to keep these companies afloat. However, it cannot be said that they were not harmed. As shown in Figure 1, due to the total reduction of domestic flights, many airline companies have reduced the number of personnel and adopted policies to manage the current situation only with passive income. Finally, in order to overcome such situations more easily, crisis management investments should be increased as much as technological investments and crisis budgets should be created. Future crises can be predicted and an idea about the crisis budget can be obtained by making estimations in the light of the information and data sources.

As in every sector, it is necessary to allocate crisis budgets and to create crisis management plans under different scenarios in the airline sector, which operates with a human-oriented approach. Considering the unpredictability of the crises like pandemics, the fact that the activities continue in an increasingly complex environment causes different financial and operational problems. For this reason, measures should be taken before it is too late and implemented before a future crisis occurs. Time is cash.

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