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Determinants of Financial Risk: An Empirical Application on Low-Cost Carriers

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Abstract

The airline industry has entered a rapid development and transformation process, especially after the Second World War. In this process, it is seen that the market structure changed and many private airlines were established. Due to increased competition, airlines have begun to follow various strategies and business models in order to gain a competitive advantage over each other. One of the business models successfully applied recently is the low-cost business model. Therefore, this study focuses on airline companies that applied the low-cost business model. The study aims to reveal the factors that determine the financial risk in airlines, which implements the low-cost business model. For this purpose, firstly, airline companies that implement the low-cost business model have been identified according to the classification in the literature. The study included an analysis of 13 airlines with the low-cost business model that was fully accessible to financial data for the 2004-2017 period. Panel data analysis was used in the study and Altman (1968) Z-Score and Springate (1978) S-Score were used in measuring financial risk. Empirical findings of the study reveal that firm leverage, asset structure, firm size, firm profitability, and liquidity ratio have an effect on financial risk.

Keywords: financial risk; Altman Z-Score; Springate S-Score; airlines; panel data analysis.

JEL classification: G32, L93, C12.

1. INTRODUCTION

The airline industry has become one of the sectors with the most intensive competitions as a result of the deregulation movement which started in the US in 1978 before finding its way to many countries, leading to relatively easy market entry and exit. Airlines have had to implement a number of competitive strategies to compete against each other in this intense competitive environment. In the competitive strategies first proposed by Porter (1980; 1985), a company can achieve a competitive advantage over the others by choosing and implementing one of the three strategic choices of focus, cost leadership or differentiation (Taşçı and Yalçınkaya, 2015, p. 180). Airlines have started to implement business models that follow

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these competitive strategies. These models could be categorized as either charter, low-cost or traditional. According to Kuyucak Şengür and Şengür (2012), the value created, the customer profile served and the way of doing business are the main components of the airline business model. These also include the income and expenditure structure, which is the economic component of the way of doing business, as well as and the competencies required of the resources needed to obtain them. As a result, there are some differences between the airlines that employ different business models in terms of how they operate, the customer profiles they serve, the income-expense components, the cost structure, and the value created or image.

In the low-cost business model, firms seek to earn above-average returns by operating at lower costs, as well as reduce the effects of the systematic risks that they may encounter. In this business model, therefore, airlines adopt many methods that will minimize their costs (such as not using agents in ticket sales and booking transactions, preferring secondary airports and including similar aircraft in their fleet structures).

The low-cost airlines are faced with a lot of systematic and non-systematic risks as a result of the various methods they employ to reduce their costs. Studies also exist in the literature that has considered such risks (Flouris and Walker, 2005; Malighetti *et al.*, 2009). However, there are rare studies that focus on the financial risks of the airlines implements the low-cost business model. The rest of this study, which analyses the factors affecting the financial risk of airlines applied the low-cost business model, is organized as follows. In the second section, the studies in the literature are discussed while the third section mentions research models and established hypotheses. In the fourth section, data and methods of the study are mentioned and the application of the study and the findings are given in the fifth section. In the last section, the results of the analysis are evaluated.

2. LITERATURE

In financial literature, many studies have been conducted to determine or measure risk. The focus of these studies is on whether the financial risks of the companies can be determined using predetermined financial variables or ratios (such as the Altman Z score or Springate S score), or whether the financial ratios were below the critical values for companies that went bankrupt. An example is a study by Kulali (2016) on the period 2000-2013 on companies listed in Istanbul Stock Exchange (BIST) that went bankrupt. Poyraz and Ucma (2006) investigated the performance of the basic manufacturing sectors in the face of crisis and financial risks. Toraman and Karaca (2016) analyzed the financial failures of firms in the chemical industry listed in Istanbul Stock Exchange for the period from 2010 to 2013. Koç and Ulucan (2016) analyzed the firms in the textile and technology index in the BIST for the period 2006-2013. In addition to the studies measuring financial failure, there are also many studies that investigated the credit risk or credit rating of the companies based on financial failure score (Elliott *et al.*, 2014; Nadirli, 2015; Yıldız, 2014).

There are many systematic and non-systemic risks affecting the risks of the enterprises. In the aviation literature, Lee and Jang (2007) examined the factors that determine the financial risk of the airlines in the US, while Lee *et al.* (2011) examined the factors affecting the systematic risks of the airlines operating in North America, Europe, and Asia. Airlines may face financial hardships and bankruptcy depending on their levels of market and non-systematic risks. In addition to the studies on the relationship between the financial risk of airlines and their capital structure decisions (Chou *et al.*, 2010; Lee *et al.*, 2011; Muigai,

2016), there are also studies on the impact of financial and operational hedging policies on the risk level of airlines (Berghofer and Lucey, 2014).

One of the most important indicators used in the measurement of the risks of airlines is the share of foreign resources in total resources, i.e. the ratio of foreign resources in the capital structure. In this context, it is observed that there are also studies that examined the capital structure and the factors that determine the capital structure of airlines (Capobianco and Fernandes, 2004; Kiracı and Aydin, 2018b, 2018a). These studies concluded that the size of the firm, asset structure, and liquidity position have an effect on the debt level.

There are also studies in the literature that examined the relationship between financial risk and capital structure decisions (Charalambakis *et al.*, 2008; Oliveira *et al.*, 2017; Turaboglu *et al.*, 2017). For instance, Turaboglu *et al.* (2017) used Altman Z-Score and Springate S-Score values as dependent variables in their study. The predictive variables used in this study including the debt/equity ratio, short term/ total debt ratio, total assets/fixed asset ratio. The findings of the study revealed that all the variables except the short-term debt ratio affected the financial failure score. Another study that examined the determining factors of financial risk uses the firm leverage level as the dependent variable (Charalambakis *et al.*, 2008). The independent variables include profitability level, tax rate, size of the firm, fixed asset ratio and industry leverage level. The findings of the study show that the profitability level variable is negatively affected while the other variables (tax rate, size of the firm, fixed asset ratio and industry leverage level) are positively affected by the financial risk level. Oliveira *et al.* (2017) examined the factors determining the financial risks of firms in the US that underwent financial distress in the period 1980-2013. In the study, three different models, which included the sales ratio, short-term debt level and long-term debt level as the dependent variables, were used. As for independent variables, the study used profitability level, size of the firm, asset structure, cash ratio, growth opportunities, R & D investment and industry debt level. Although the findings obtained in the study vary according to the model, it shows that many variables significantly affect the company risk.

In other studies, the determinants of financial risk have been examined (Halpern *et al.*, 2009; Kristanti *et al.*, 2016; Miglani *et al.*, 2015). In one of these studies, Halpern *et al.* (2009) examined the determinants of financial risks for a sample made of companies that had encountered financial difficulties and went bankruptcy and a group of companies who had not had any financial difficulties. The study, which used data of firms from different sectors, used the size of the firm, debt level, market value/book value ratio and tax rate as independent variables. The findings of the study revealed a relationship between the cost of debt and leveraged purchasing activities and emphasized that the debt level increases the financial risk. Kristanti *et al.* (2016), empirically examined the relationship between financial risk and managers' competencies and financial ratios. In the study, it was concluded that in addition to the managers' competence and independence, the leverage level and current ratio variables had an impact on the financial risk level. Miglani *et al.* (2015) examined the factors affecting the financial risk for a mix of 171 firms undergoing financial distress and 106 financially well-performing firms. The ratio of independent directors, ownership structure, the relationship between the CEO and the board of directors and whether or not there is an audit committee were used as the explanatory variables. In addition to these variables, firm size and leverage level are also used as independent variables. The findings of the study show that the leverage level increases the financial risk and the size of the firms decreases the financial risk.

In the literature, many studies have examined the different dimensions of the factors affecting the financial risks of the enterprises. There are similar studies on the airline industry regarding financial risk. However, there are very few studies on the determinants of financial risk considering the business models applied by airlines. As a result, this study is expected to contribute to the literature in several ways. First, as pointed out, there are few studies on the determinants of financial risk in air transport literature. This study is expected to contribute to the literature in this sense. Secondly, there is a limited number of studies on the financial aspects of airlines that apply low-cost business models. Finally, no study was found that examines the financial risk by considering the business models applied by airlines. This study, therefore, seeks to fill these gaps in literature and make a contribution.

3. RESEARCH MODEL

An examination of studies in the literature reveals that many financial indicators are used as dependent variables in the measurement of financial failure. A review of recent studies indicated that the scores obtained from the analysis of financial ratios such as Altman Z-Score, Springate S-Score, Zmijewski J-Score and Ohlson O-Score are used as indicators of financial failure. This study uses Altman Z-Score and Springate S-Score as indicators of financial risk as done by similar studies in literature (Ahmad, 2013; Chou *et al.*, 2010; Lee *et al.*, 2011; Muigai, 2016; Turaboglu *et al.*, 2017). The models created in this context are as follows:

Model 1:

$$Z - S_{it} = \beta_0 + \beta_1 STDR_{it} + \beta_2 FAR_{it} + \beta_3 PR_{it} + \beta_4 CFR_{it} + \beta_5 FS_{it} + \beta_6 CR_{it} + \beta_7 LR_{it} + \varepsilon_{it} \quad (1)$$

Model 2:

$$S - S_{it} = \beta_0 + \beta_1 STDR_{it} + \beta_2 FAR_{it} + \beta_3 PR_{it} + \beta_4 CFR_{it} + \beta_5 FS_{it} + \beta_6 CR_{it} + \beta_7 LR_{it} + \varepsilon_{it} \quad (2)$$

In the above models, the Altman Z-Score of the airlines was used as the dependent variable in the first model (Model 1), while the Springate S-Score was used as the dependent variable the second model. The dependent, independent variables as well the control variables used in the study and their related abbreviations are shown in Table no. 1.

Table no. 1 – Variables used in the study

Variables		Abbreviations
Dependent Variables	Altman Z-Score	Z-S
	Springate S- Score	S-S
Independent Variables	Short Term Debt Ratio	STDR
	Fixed Asset Ratio	FAR
	Profitability Ratio	PR
	Cash Flow Ratio	CFR
Control Variables	Firm Size	FS
	Current Ratio	CR
	Leverage Rate	LR

Table no. 1 above shows information about the variables used in the study. Altman Z-Score and Springate S-Score were used as dependent variables. Four different independent variables were included in the study; short-term debt ratio, fixed asset ratio, firm profitability ratio and cash flow ratio. Based on the studies in the literature, three control variables were also included; firm size, current ratio and leverage ratio. The effect of the independent and control variables used in the study on the financial risk score and the expectation of a possible sign of variable will also be included in the study.

3.1 Short-Term Debt Ratio

The ratio of liability in the capital structure of the firm and the maturity structure of the debts are assumed to affect the company risk. Therefore, the short-term debt level can be said to have an impact on the risk of financial failure. Studies point to the presence of a significant relationship between short-term debt level and the financial failure score. Turaboglu *et al.* (2017) found a negative relationship between short-term debt ratio and the firm failure score. In addition, when the relationship between debt level and financial risk is evaluated in the context of capital structure theories, the company risk is expected to increase with the increase in debt levels according to both the Pecking Order Theory and the Trade-Off Theory. Consequently, the short-term debt level is expected to have a negative impact on the financial failure score.

H1. There is a negative relationship between the short-term debt ratio and the financial failure score.

Measurement method = short-term debt / total assets

3.2 Fixed Asset Rate (Asset Structure)

There is a close relationship between the level of tangible fixed assets and the risk of the financial failure of firms. According to Kiracı and Aydin (2018a), the fact that fixed assets can create value even after bankruptcy and that tangible assets can be used as collateral when borrowing enables firms to obtain debt under more favorable conditions. Therefore, firms with tangible assets are less likely to experience financial problems. On the other hand, owing to the fact they can use their asset structure as collateral, there are studies that emphasize that the consequent borrowing at a lower cost by the firm will lead to an increased debt level and that the firm may experience financial failure as a result (Muigai, 2016, p. 32).

H2. There is a negative/positive relationship between the short-term debt ratio and the financial failure score.

Measurement method = fixed assets / total assets

3.3 Firm Profitability Ratio

There are very few studies in the literature examining the relationship between the level of profitability and the rate of financial failure (Oliveira *et al.*, 2017; Kristanti *et al.*, 2016). There is a general non-consensus in the existing studies on the impact of profitability on financial failure score. In the context of the Capital Structure Theory, there is an emphasis on the fact that that firms with higher profitability have the opportunity to obtain

debt at lower costs (lower interest rate) resulting to lower financial distress and bankruptcy costs (Kiracı and Aydin, 2018b, p. 233).

H3. There is a negative / positive relationship between firm profitability and financial failure score.

Measurement method = net profit / total assets

3.4 Cash Flow Ratio

It has been observed that in companies with higher risks of financial failure or those that have undergone financial failures, cash flows become irregular, cash flows become difficult to manage and a series of problems are encountered in meeting short term liabilities (Kulali, 2014, p. 156; Uzun, 2005, p. 165). As a result, it can be said that there is a relationship between cash flow ratio risk and financial failure. The cash flow ratio is expected to have a positive effect on the financial failure score.

H4. There is a positive relationship between the cash flow ratio and the financial failure score.

Measurement method = (net profit + depreciation) / equity

3.5 Firm Size

In the literature, firm size is often expressed in terms of the company's production or service capacity, quantity and variety. Therefore, firm size also gives important clues about the robustness of the financial structure (Muigai, 2016, p. 26). In addition, it is assumed that large-scale companies generally have stable and diversified cash flows, and therefore these firms will have a lower probability of bankruptcy (Kiracı and Aydin, 2018b, p. 233). Therefore, it is expected that there will be a positive relationship between the firm size variable and financial failure score.

H5. There is a positive relationship between firm size and financial failure score.

Measurement method = log (total assets)

3.6 Current Ratio

There is a close relationship between the level of short-term funding needs of firms and the current ratio. Accordingly, firms with a high liquidity ratio prefer to use internal funds instead of debt to fulfill their short-term liabilities. In the literature, there are studies that use the leverage/debt ratio as an indicator of financial risk in firms (Charalambakis *et al.*, 2008; Oliveira *et al.*, 2017). In this case, a negative relationship can be said to exist between the current ratio and the financial risk level because it is assumed that the firms with high current ratio will use less debt. In this study, since the financial failure score is used as the indicator for financial risk, the risk of financial failure of firms with a high current ratio is expected to be low.

H6. There is a positive relationship between the current ratio and financial failure score.

Measurement method = current assets / short term liabilities

3.7 Leverage Ratio

As mentioned in the previous parts of the study, there are studies in literature in which the leverage levels of firms are used to measure financial risk. However, since the Altman Z-Score and Springate S-Score were used as indicators of financial failure in this study, the leverage ratio was included as a control variable. According to Muigai (2016), there is a close relationship between firm performance and debt level. Accordingly, a higher total debt ratio or long-term debt ratio in the capital structure negatively affects firm performance. This may be due to the high cost of debt for firms with a high leverage ratio and an increase in financial difficulties and bankruptcy probabilities. Therefore, in this study, a negative relationship is expected between leverage level and financial risk score.

H6. There is a negative relationship between leverage ratio and financial failure score.
Measurement method = total liabilities / total assets

4. DATA AND METHODOLOGY

This study was intended to find out the factors that determine the financial risks of the airlines that apply the low-cost business model. In this regard, 13 airlines (the list of airlines included in the analysis is given in Annex 1) with complete financial data for the period from 2004 to 2017 were included in the analysis. The secondary data of the study were taken from the Thomson Reuters Datastream database. Altman Z-Score and Springate S-Score were used as dependent variables, and the panel data analysis method was used.

4.1 Altman Z-Score Model

One of the most commonly used methods in the estimation of the financial failure of firms or in the determination of their financial status is the Z-Score method developed by Altman in 1968. Altman (1968) examined firms that filed for bankruptcy in the US between 1946 and 1965. The method, which yields very successful results in the estimation of financial failure, has been applied to different firms and sectors since. The Z-Score developed by Altman (1968) refers to a positive linear function that consists of four to five financial ratios as variables which are then multiplied with specific coefficients. The model developed for the calculation of the Altman Z-Score for services sector firms that are not included in the manufacturing sector is as follows (Hayes *et al.*, 2010, p. 125; Kulali, 2016, p. 287).

$\boldsymbol{\alpha}$ = Working Capital / Total Assets
$\boldsymbol{\beta}$ = Retained profits / Total Assets
$\boldsymbol{\gamma}$ = EBIT /Total Assets
$\boldsymbol{\delta}$ = Market Value / Total Liabilities

$$\text{Z-Score} = 6.5\,\boldsymbol{\alpha} + 3.26\,\boldsymbol{\beta} + 6.72\,\boldsymbol{\gamma} + 1.05\,\boldsymbol{\delta}$$

After the calculation of the Z-Score value, the financial failure of the company can be estimated at certain intervals. Accordingly, if Z <1.1, the company has a financial failure risk. If 1.1 <Z <2.6, then there is no financial failure risk for the company. However, the company is not considered successful either. If Z> 2.6, the company does not have any financial difficulties or risks of financial failure.

4.2 Springate S-Score Model

The Springate S-Score model was developed in 1978 by LV Gorgon Springate. This method, which is similar to Z-Score developed by Altman, is agreed within the scope of multiple discriminant analysis. The S-Score is obtained by calculating the ratios between given financial variables and the resulting ratios multiplied by certain coefficients. The financial ratios and calculation method used in the S-Score developed by Springate (1978) are as follows:

$\boldsymbol{\alpha}$ = Working Capital / Total Assets

$\boldsymbol{\gamma}$ = Retained profits / Total Assets

$\boldsymbol{\varphi}$ = EBT / Short Term Debt

$\boldsymbol{\theta}$ = Sales/ Total Assets

S-Score = 1.03 $\boldsymbol{\alpha}$ + 3.07 $\boldsymbol{\gamma}$ + 0.66 $\boldsymbol{\varphi}$ + 0.4 $\boldsymbol{\theta}$

If the S-score is less than 0.862, the firms are considered to be at risk of financial failure.

4.3 Panel Data Analysis

The panel data equation can be defined in the form of $Y_{it} = \alpha_{it} + \beta_{it}X_{it} + \varepsilon_{it}$ which represents the change of the cross-sectional units, *i* (i = 1,…,N), with respect to time *t* (t = 1,…, N) and dependent variable Y, independent variables X. ε_{it} here show the error terms.

In the panel data analysis, first, a cross-sectional dependence test is conducted on the series. In this way, a decision is made whether to do a first or second level unit root tests when testing for stationarity. After this, the stationary level is determined by conducting unit root tests to the series. After the stability test of the series has been performed, it is necessary to make a choice between the classical, fixed effects and random effects models and determine whether the model to be applied is unidirectional or directional by considering whether the coefficients in the panel data models change according to the unit and/or time. In the next stage, variance and autocorrelation tests should be applied to the appropriate models. At the last stage, certain corrections are applied in order to obtain robust standard errors.

5. APPLICATION AND FINDINGS

The descriptive statistics for the variables used in this study, which examined the factors that determine the financial risks of the airline applies the low-cost business model, are shown in Table no. 2.

Table no. 2 – Descriptive Statistics for Variables

	Z-S	S-S	STDR	FAR	PR	CFR	FS	CR	LR
Average	0.27822	0.63450	0.07183	0.53404	0.04890	0.01935	6.31991	1.14221	0.36393
Maximum	5.60062	2.27243	0.47861	0.92055	0.27613	3.87426	7.39985	5.59678	0.89239
Minimum	-10.1632	-1.10486	0.00000	0.00430	-0.49742	-15.7983	4.15177	0.16544	0.00000
Std. Deviation	2.94077	0.62518	0.07658	0.21862	0.12068	1.37772	0.64367	0.67740	0.21606
Skewness	-1.37921	-0.42950	2.44508	-0.85190	-1.91415	-8.49486	-0.80163	1.94565	0.05353
Kurtosis	4.93721	3.69371	10.5846	3.07991	8.20494	98.4354	3.26393	11.9903	2.05691
Jarque-Bera	86.1594	9.24488	617.588	22.0624	316.584	71257.3	20.0210	727.756	6.83161
Probability	0.0000	0.0098	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0329
Observation	182	182	182	182	182	182	182	182	182

Table no. 2 presents the descriptive statistics of the variables used in the study. The table shows the average Altman Z-Score of the airlines included in the sample is 0.278 and the average Springate S-Score is 0.634. When Altman Z-Score critical values are taken into consideration, it is seen that the sample mean is lower than this critical value. In addition, the minimum values of PR and CFR variables appear to be negative. This shows that some of the airlines included in the sample are financially risky and therefore the average financial risk score of airlines is below the critical value.

Table no. 3 – Correlation Matrix for Independent Variables

	STDR	FAR	PR	CFR	FS	CR	LR
STDR	1						
FAR	0.20655	1					
PR	-0.39373	-0.05399	1				
CFR	-0.07440	0.04394	0.49748	1			
FS	-0.24737	-0.17264	0.31277	0.14614	1		
CR	-0.44819	-0.18124	0.26881	0.05814	-0.02300	1	
LR	0.58881	0.09185	-0.21468	-0.13939	0.02528	-0.40682	1

Table no. 3 shows the correlation matrix among the independent variables. The existence of a high correlation between the independent variables included in the regression model (over 0.80) causes the problem of multicollinearity. When the correlation matrix for the independent variables is examined, the correlation coefficients between the variables are found to be well below the critical value.

Table no. 4 – Descriptive Statistics for Variables

	CDLM adj. (PUY, 2013)	
Variables	**Stat**	**Prob.**
Z-S	-0.656	0.7440
S-S	-0.261	0.6030
STDR	-0.065	0.5260
FAR	**3.927**	**0.0000**
PR	-0.935	0.8250
CFR	-0.772	0.780
FS	0.012	0.4950
CR	-1.798	0.9640
LR	1.212	0.1130

Table no. 4 shows the results of the cross-sectional dependency test. Accordingly, hypothesis H0 which states that there is 'no cross-sectional dependency' in all variables except FAR is rejected. This indicates that when conducting the stationarity tests, the second-generation unit should be applied to FAR variable while the first-generation unit tests are applied to the other variables.

Table no. 5 – Panel Unit Root Test Results

	LLC -t-test		IPS -W test	
	Stat	**Prob.**	**Stat**	**Prob.**
Z-S	-11.4194	0.0000	-10.8106	0.0000
S-S	-19.9635	0.0000	-17.7168	0.0000
STDR	-11.8188	0.0000	-9.44519	0.0000
PR	-4.20881	0.0000	-2.16435	0.0000
FS	-15.0049	0.0000	-13.3396	0.0000
CR	-16.6766	0.0000	-12.7267	0.0000
LR	-9.44242	0.0000	-5.51677	0.0000
CADF Unit Root Test				
	Level	**1st difference**		
FAR	-2.524	-3.029**		

Note: The critical values of CADF test of Pesaran (2007) statistics were obtained from Table II (c). The table critical values were -3.09 -2.83 -2.69 at 1%, 5% and 10% significance levels.

Table no. 5 shows the unit root test results for the variables. According to this, all variables except FAR is stationary at level. In this case, variables, other than FAR, can be used in the analysis with level values. FAR variable is included in the model after performing the first difference.

Table no. 6 – Model Determination Results

	F test		LM Test		Hausman	
	Stat.	**Prob.**	**Stat.**	**Prob.**	**Stat.**	**Prob.**
Model 1	19.290	0.0000	167.234	0.0000	85.6400	0.0000
Model 2	3.4001	0.0002	3.1943	-0.0739	16.3000	0.0225

After the stationarity tests for the series have been determined, a decision should be reached on the model to be used between the classical, the fixed effects and the random effects models. To achieve this, the F-test is used to check the validity of the classical model, i.e. whether it has the unit and/or time effects; the Breusch-Pagan LM test to test the suitability of the classical model over the random effects model, and the Hausman test to choose between fixed effects and random effects models. The results in Table no. 6 show that the fixed effects model is suitable for the first model (Model 1) and the second model (Model 2).

Table no. 7 – Variance and Autocorrelation Test Results

	Modified Wald		Durbin Watson	Baltagi–Wu
	Stat.	**Prob.**	**Stat.**	**Stat.**
Model 1	16099.00	0.0000	0.81087	1.03606
Model 2	2416.26	0.0000	1.61385	1.79401

Table no. 7 shows the variance (heteroscedasticity) and autocorrelation test results for Model 1 and Model 2 as predicted by the fixed effects model. In the fixed effects model (Model 1 and Model 2), the Modified Wald test is used to test the heteroskedasticity. The Modified Wald test results show that the H_0 hypothesis was rejected for both models. This shows that the variance is not constant in Model 1 and Model 2 and that there is a

heteroskedasticity problem. In order to test the presence of autocorrelation in the fixed effects models, the DW autocorrelation test of Bhargava, Franzini and Narendranathan, and Baltagi, and Wu's LBI autocorrelation tests are used. Although there is no specified critical value for DW and LBI autocorrelation tests in the literature, a statistical value of less than 2 indicates the presence of autocorrelation. And given that the statistical values obtained for both models are less than 2, both models can be said to have autocorrelation.

If there is a heteroskedasticity, autocorrelation, and/or cross-sectional dependence in the model, then the standard errors must be corrected (to obtain robust standard errors) before the estimation of the parameters, or more appropriate methods which could eliminate the errors should be used in the estimation. Here, we will discuss the estimators used to obtain robust standard errors in the fixed effects (Model 1 and Model 2) models.

In the case of heteroskedasticity and autocorrelation problems in the fixed effects models, Driscoll and Kraay corrections can be applied. The Driscoll and Kraay (1998) method make a Newey-West type correction for the cross-sectional mean series. It was created as an alternative to the Parks-Kmenta or PCSE approaches that produce consistent covariance matrix estimators, especially encountered in microeconomic panels, only in cases where the size dimensions of the cross-sectional are weak and the time dimension, T is large. This method has been shown to achieve consistency even in cases where N is infinite. In addition, it shows that the standard errors obtained from the estimated covariance matrix are also robust to very general forms of spatial and periodic correlation. Driscoll and Kraay (1998) corrections are used to obtain robust standard errors in the classical model and fixed effects model (Tatoglu, 2016, pp. 256-278; Driscoll and Kraay, 1998, p. 1).

This study, which examined the financial risks of airline companies which apply the low-cost business model, the parameters were estimated using two different models. The Altman Z-Score was used in the first model (Model 1) and the Springate S-Score used in the second model (Model 2) as dependent variables. The results obtained in the study are shown in the tables below.

Table no. 8 – Model 1 Panel Regression Results

Dependent Variables: Z-Score						
Variable	**Estimation of Coefficient**	**Driscoll-Kraay Standard Error**	**t**	**Prob.**	**[%95 Confidence Interval]**	
STDR	-6.08147	1.98963	-3.06	0.0100	-10.4165	-1.74643
D_FAR	1.91963	0.97171	1.98	0.0720	-0.19754	4.03679
PR	8.73842	1.3351	6.55	0.0000	5.82949	11.6474
CFR	-0.15742	0.01828	-8.61	0.0000	-0.19725	-0.11759
FS	1.12581	0.56384	2.0	0.0690	-0.10269	2.3543
CR	1.73305	0.38566	4.49	0.0010	0.89276	2.57333
LR	-0.74128	0.78041	-0.95	0.3610	-2.44165	0.95908
C	-8.58267	3.98383	-2.15	0.0520	-17.2627	0.09736
R-Square: 0.7640			Sample Period: 2004-2017			
F-Statistics: 215.55			Cross-Section No: 13			
Prob (F- Statistics): 0.0000			Observations: 169			

Table no. 8 shows the results of the robust estimator of Model 1 in which the Altman Z-Score is used as a dependent variable. According to the results of the fixed effects model,

short-term debt levels and cash flow ratio variables of the airlines have a negative effect on the financial failure score. The results also show that the ratio of fixed assets, firm profitability, firm size and current ratio affect the financial failure score positively.

Table no. 9 – Model 2 Panel Regression Results

Dependent Variable: S-Score						
Variables	**Estimation of Coefficient**	**Driscoll-Kraay Standard Error**	**t**	**Prob.**	**[%95 Confidence Interval]**	
STDR	-0.72385	0.37666	-1.92	0.0790	-1.54452	0.09682
D_FAR	-0.00027	0.07801	0.00	0.9970	-0.17024	0.16970
PR	4.33535	0.16866	25.70	0.0000	3.96787	4.70283
CFR	-0.02714	0.00726	-3.74	0.0030	-0.04295	-0.01133
FS	-0.28518	0.03899	-7.31	0.0000	-0.37013	-0.20023
CR	0.11443	0.04044	2.83	0.0150	0.02632	0.20254
LR	-0.66490	0.14178	-4.69	0.0010	-0.97380	-0.35599
C	2.39025	0.25357	9.43	0.0000	1.83776	2.94273
R-Square: 0.9228			Sample Period: 2004-2017			
F-Statistics: 1114.52			Cross-Section No: 13			
Prob (F- Statistics): 0.0000			Observations: 169			

Table no. 9 shows the results of a robust estimator of Model 2, where the Springate S-Score is used as the dependent variable. The findings show that short-term debt level, cash flow ratio, firm size and leverage ratio of airlines have a negative effect on their financial failure score. The results also show that the firm profitability ratio and current ratio variables affect the financial failure score positively.

6. CONCLUSION

Within the scope of the study, the financial data for the period of 2004-2017 of the 13 airlines applied the low-cost business model were empirically analyzed. In the study, two different models were formed, and Altman Z-Score and Springate S-Score were used as indicators of financial risk. The independent variables and the control variables used in the study included short-term debt ratio, fixed asset ratio, firm profitability ratio, cash flow ratio, firm size, current ratio and leverage ratio.

An examination of the results of Model 1, which used the Altman Z-Score as the dependent variable, reveals that short-term debt levels of the airlines have a negative effect on the Altman Z-Score. This shows that by increasing their short-term debt levels, firms also increase their financial risk. These findings are consistent with both established hypotheses and studies in the literature. As a matter of fact, Turaboglu *et al.* (2017) found that short term debt level increased the financial risk. The results of the study show that the fixed asset ratio, firm profitability ratio, firm size and current ratio variables have a positive effect on financial failure score for Model 1. In other words, the fixed assets ratio, firm profitability ratio, firm size and current ratio decrease the financial risk in the airlines that implement a low-cost business model. The findings are in line with both the theoretical expectations mentioned in the previous sections of the study as well as the studies in the literature

(Halpern *et al.*, 2009; Oliveira *et al.*, 2017). Cash flow ratio variable, on the other hand, increased the financial risk.

In the second model of the study (Model 2), the Springate S-Score was used as a dependent variable. The findings for Model 2 show that the variables of short-term debt ratio, cash flow ratio, firm size and leverage ratio significantly affect the Springate S-Score. Accordingly, the findings suggest that the increase in the short-term debt ratio and leverage level have a negative impact on the financial failure score. It is, therefore, possible to say that an increase in the short-term or total debt ratio of airlines negatively affects the financial failure score and increases the financial risk. Studies in the literature also indicate that total debt ratio (Muigai, 2016) and short-term debt level (Turaboglu *et al.*, 2017) increase the risk of financial failure. The results of the second model also show that firm size and cash flow ratio variables negatively affect the financial failure score. These results are not consistent with theoretical expectations. The study findings also show that the current ratio variable positively affects the financial failure score. Therefore, these findings are consistent with the studies in the literature and the hypotheses established.

When the findings of this study, which examines the factors affecting the financial risk score of the airlines applying the low-cost business model, are evaluated, a significant part of the results is found to be consistent with the theoretical expectations and the hypotheses established. Given that most airlines have only recently begun to implement the low-cost business model, the number of companies whose financial data can be reached, and the period of analysis that is quantitatively limited. Nevertheless, the findings can be seen to provide important clues about the determinants of financial risk for airlines applied the low-cost business model.

Future studies could examine the risk of financial failure for airlines that adopt Porter's other competitive strategies (differentiation or focus strategy). In this way, the factors affecting the financial risks of traditional airlines can also be revealed. Thus, it may be possible to identify differences in the determinants of financial risk among the groups of airlines with different competitive strategies or business models.

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ANNEX 1

Airline Companies Included in the Analysis

ID	Airline	ID	Airline
1	SOUTHWEST AIRLINES	**7**	AIRASIA GROUP
2	WESTJET AIRLINES	**8**	EASYJET PLC
3	ALLEGIANT TRAVEL	**9**	GOL LINHAS AEREAS
4	CEBU AIR INC	**10**	JET AIRWAYS
5	SPICEJET LIMITED	**11**	JETBLUE AIRWAYS CORP
6	VUELING AIRLINES, SA	**12**	NORWEGIAN AIR
		13	RYANAIR HOLDINGS PLC