An Empirical Test of Theories of Capital Structure in Member Airlines of Global Alliances

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Abstract

Airline companies have developed global alliances to adapt to dynamic competition conditions and gain competitive advantage over each other. Many legacy airlines have been members of these global alliances. In this way, the number of destinations and network structures of the airline companies have expanded. In this study, the financial factors affecting the capital structure of the airline companies which are members of global alliances are examined. In this context, it is aimed to reveal the financing behaviors of airline companies by using the theories related to the structure of capital. In the study, the financial data of the member airlines of the world, the largest global alliances (Star Alliance, OneWorld and SkyTeam) were used. In the scope of the study, the period of 2000-2017 was examined and panel data analysis method was used. The results of the study show that short-term, long-term and total debt behaviors in member airlines of global alliances are different. In addition, the findings show that multiple capital structure theory is effective in explaining the financing behavior of airline companies.

Keywords: Global Alliances, Capital Structure, Airlines, Panel Data

JEL Codes : C58, G32, B23

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1. Introduction

From the past to the present, with the changes in technology, economy, social and political fields, the world economy has become globalized and the interaction of companies with the external environment has increased significantly. As a result of these developments, the new world order and intense competition environment forced the companies to make some strategic decisions in order to survive and sustain their lives. Especially in the air transport sector, where the economic developments have been effective significantly and competition is experienced intensively, the airlines have had to develop new competitive strategies and cooperation. The most commonly used of these cooperation strategies is airline alliances.

In strategic alliances, airlines reduce risk and transaction costs, create value, expand network structure, and lower costs (Goetz & Shapiro, 2012). In order to benefit from these advantages, it is seen that many airlines are members of global alliances. Nowadays, there are three global airline alliances. These are SkyTeam, OneWorld and StarAlliance. The current data on the three global airline alliances are given in Table 1.

Table 1: General Profile of the World's Largest Airline Alliances

	StarAlliance	SkyTeam	OneWorld
Number of Members	28	19	13
Date of Establishment	1997	2000	1999
Annual Passenger Number	756 Milyon	630 Milyon	528 Milyon
Fleet	5046	3054	3553
Daily Flight Number	18800	14500	13100
Staff Number	443703	392155	493650
Destinations (Countries)	193	176	158

Source: www.staralliance.com, www.oneworld.com, www.skyteam.com (2018)

In addition to having the capital required for the continuity of their activities and sustaining their lives, companies must also have a capital structure appropriate for their activities (Taner & Akkaya, 2005, p.33). In this respect, capital structure or, more generally, the choice of financing composition that maximizes the value of the firm or how the financial structure should be is very important for the companies (Korkmaz, Başaran, & Gökbulut, 2009, p.30). In particular, it is considered that it is important to examine the capital structure of the airline transportation industry, which its importance has increased in global industries. Because the air transportation industry is one of the industries with the highest growth rate in the world. Besides, it is thought that the global alliances created by airlines may have affected the capital structure. Therefore, the focus of the study was on the airlines that are members of global alliances.

In the air transport industry, airplanes (tangible fixed assets) are expensive. Therefore, airlines incur high investment costs. In other words, airlines have to allocate significant budgets to the aircraft they use to carry out their activities. In this case, it requires the airlines to plan their debt-equity balance correctly. The fact that a significant portion of tangible fixed assets is provided by using liabilities increases the risk of airlines. However, it should be taken into account that large airlines obtain liabilities at lower cost. In particular, taking into account the advantages that airlines have for joining global alliances, it should be kept in mind that the debt-equity balance of airlines may change with global alliances membership. Therefore, empirical investigation of the effects of debt costs, financing behaviors and financial indicators on leverage level of member airlines of global alliances has gained importance.

It is expected that this study, in which empirical analysis of capital structure decisions of airlines joining global alliances, will contribute to the literature in a number of ways. Firstly, studies which empirically analyze capital structure of airlines are rare in the literature. Second, global alliances give competitive advantages to airlines and affect capital structure decisions of airlines. Finally, in the literature there is no study related to the empirical examination of capital structure decisions of airlines that are members of global alliances. Therefore, this study is expected to fill this gap in the literature.

2. Literature

Capital structure is one of the most researched and debated issues in finance literature. Investigation of the relationship between capital structure and business value, determining the factors affecting the capital structure decisions of enterprises and examining the capital structure theories of firms' ability to explain capital structures constitute the subjects of the studies.

When the studies in the literature are examined, it is seen that the decisions of the capital structure of many companies or industries are examined empirically. The focus of the studies is to examine the factors affecting the capital structure in the context of the industry. Among the studies conducted, as well as studies which the factors affecting the capital structure of Small and Medium-Sized Enterprises (SMEs) are analyzed empirically (Bhaird and Lucey; 2010; Palacin-Sanchez and Pietro, 2016; Lopez-Gracia and Sogorb-Mira, 2008), studies that examine the financial factors that determine the capital structure of sector enterprises are also found (Ajanthan, 2013; Serrasqueiro and Nunes, 2014). In the literature, it is also observed that the studies which examined the capital structure decisions of the companies and the factors affecting the capital structure are examined in the context of the country or the region (Bancel, and Mittoo, 2004; Chang, et al., 2014; Crnigoj and Mramor, 2009).

In this study, the factors determining the capital structure of member airlines of global alliances will be examined. When the literature is examined, it is seen that the number of studies on the capital structure of the member airlines in the global airline are a few. Therefore, this study is expected to contribute to the literature in this respect. Table 1 summarizes the factors that determine the capital structure of the companies.

Tablo 2: Studies on the Factors Determining the Capital Structure

	Kiraci and Aydin (2018)a	Kiraci and Aydin (2018)b	Le and Phan (2017)	Vo (2017)	Seo and Choi (2016)
Period	2004-2015	2004-2015	2007-2012	2006-2015	2008-2012
Sample	15 Firms	31 firms	2625 Observations	30 Firms	86 Firms
Dependent variable	Book leverage	Book leverage	Book leverage	Book leverage	Book leverage
Firm size	Total asset (-/+)	Total asset (+/-)		Total asset(+/-)	Sales (-)
Growth opportunities	Sales (+/-)	Sales (+/-)	Sales (+)	Tobin q(+)	Percent change in Sales (-)
Profitability	Operating income/ total asset (+/-)	Operating income/ total asset (-/+)	Ebit/ total sales (-/+)	Roa(+/-/+)	Net profits/asset (-)
Tax	Non-debt tax shields (-/+)	Non-debt tax shields (-/-)			
Firma risk,	Std. dev. of EBIT (-/-)	Std. dev. of EBIT (-/-)	Std. dev. of EBIT(-)		
Asset structure	Fixed asset/ total assets (-/+)	Fixed asset/ total assets (+/-)		Fixed asset/ total assets (+/-)	Tangible asset /total asset(+)
Liquidity ratio	Current total/short term liabilities (-/+)	Current total/short term liabilities(-/+)	Current total/ total asset (+/-)	Current total/short term liabilities(+/-)	
	Keefe and yoghoubi (2016)	**Bandyopadhyay and barua (2016)**	**Arsov and naumoski (2016)**	**Pacheco and tavares (2015)**	**Handoo and sharma(2014)**
Period	1974-2012	1998-2011	2008-2013	2010-2013	2001-2010
Sample	109613 observations	1594 firms	172 firms	70 firms	870 firms
Dependent variable	Book leverage	Book leverage	Book leverage	Book leverage	Book leverage
Firm size	Total asset(+)	Total asset(+)	Total asset(+)	Total asset(+)	Total asset(-)
Growth opportunities		Total sales/ total asset(-)	Sales (+)	Sales(+)	Total sales/ total asset(+)
Profitability	Operating income/ total asset(-)		Operating income/ total asset (-)	Ebit/total assets(-)	Ebit/total assets(-)
Tax			Non-debt tax shields(-)		Non-debt tax shields
Firma risk,	Std. dev. of EBIT(+)		Std. dev. of ROA(-)	Equity/total liabilities(-)	
Asset structure	Fixed asset/ total assets (+)	Tangible asset/ total assets (+)	Tangible asset/ total assets(-)		Fixed asset/ total assets(+)
Liquidity ratio				Current Total/Short Term Liabilities(+)	

3. Theoretical Background

Since the 1950s, many theoretical approaches have been developed based on different assumptions about capital structure. The most well-known of these approaches is the Modigliani and Miller (M & M) approach, which was based on a study by Modigliani and Miller in 1958. According to this approach, it is argued that the capital structure cannot affect the market value of the company in an efficient market and no tax environment. Therefore, the value of the company cannot be increased by using capital structure (Modigliani & Miller, 1963). However, in the study conducted by Modigliani and Miller, ignoring the factors such as representative and bankruptcy cost and tax factor have led to the emergence of new theories of capital structure which better explain the capital structure decisions. These theories include; tax factor theory, financial distress costs theory, asymmetric information theory, representative costs theory, balancing theory and financial hierarchy theory (Korkmaz, Basaran, & Gökbulut, 2009, p.31). These theories will be mentioned briefly.

3.1. Tax Factor Theory

Tax factor theory is created by Modigliani and Miller in 1963 by adding the corporate tax factor to their previous proposal. According to this theory, it is argued that the deduction of the interest paid due to the debt is an advantage, but because the profit share does not provide such an advantage, the companies can reach their maximum market value by full borrowing (Durukan, 1997, p.30). At the same time, the use of debt financing instead of financing with equity maximizes the value of the company by reducing the amount of taxable income (Ehrhardt & Brigham, 2008, p.577).

3.2. Financial Cost Theory

The financial costs theory argues that the tax advantage obtained by the borrowing of companies will increase the debt / equity ratio after a certain period of time and hence, there may be difficulties in interest and principal payments. In other words, as the financing increases through borrowing, the capital cost of the company will increase and after a certain stage, interest payments and other payments may be difficult and this situation will increase the cost of bankruptcy (Van Horne, 2002, p.458). In this respect, it is argued that companies with variable yields may face financial hardship and bankruptcy risk, such as high-paying companies, and thus have to borrow less than those with fixed returns (Brigham & Houston, 1999, p.474).

3.3. Asymmetric Information Theory

Asymmetric information theory aims to maximize the value of the company by sending signals about the operation to the people outside the company, thus making the capital owners profit. In general, managers prefer financing through borrowing rather than financing by issuing shares. This is because the investors perceive the borrowing of the company as positive and issuing shares as the negative signal (Gitman, 2003, p.534). In other words, investors agree that the financial performance of the companies that prefer debt finance is good. However, investors believe that companies issuing shares have difficulties in finding loans and that their financial performance is not good (Stiglitz, 1988, p.123).

3.4. Agency Theory

The agency theory consists of conflicts of interest between company managers, partners and shareholders or between shareholders and creditors (Harris & Arthur, 1991, p.301). In other words, it is a theory that managers do not want to pay dividends to shareholders in order to strengthen their positions. Executives argue that leaving the profit obtained in the company will save the company from the control of the capital market. On the other hand, managers demand the dividends that are the equivalent of their capital. As a result, a conflict of interest arises between managers and shareholders. In order to reduce this conflict of interest, companies prefer financing through borrowing. This time, the problem of agency costs arises as a result of the problems experienced between the shareholders and the creditors of the companies (Gürsoy, 2012, p.551).

3.5. Equilibrium Theory

The most important criticism of Modigliani and Miller's study in 1963 was to take into account the benefits of financing through borrowing and ignore the cost of delegates and financial costs. However, the increase in the level of borrowing leads to an increase in the cost of bankruptcy of the company. In this respect, according to the equilibrium theory taking into account of the cost of bankruptcy, there is an optimal debt level determined by a balance between the benefits and the cost of financing through borrowing (Sayılgan & Uysal, 2011, p.104). In other words, equilibrium theory is the creation of an optimal capital structure by establishing a balance between the tax advantage provided by financing through borrowing and the cost of bankruptcy that the company may face (Ehrhardt & Brigham, 2008, p.579).

3.6. Pecking Order Theory

According to the pecking order theory developed by Myers in 1984, while companies finance their investments, firstly they prefer auto-financing and then prefer financing with debt and finally issue shares. The reason for this is the asymmetric information problem between managers and investors. In this respect, investors perceive the new share issuance negatively and lower prices. For this reason, companies firstly prefer self-financing to reduce the cost of asymmetric information. Then, in cases where self-financing is insufficient, companies prefer liabilities. In cases where the financing is very costly, companies prefer the way of issuance of shares (Wattson & Wilson, 2002, p.562). According to the pecking order theory, the first reason that companies follow a certain sequence in the resource usage is to try to reduce the costs of asymmetric information. In other words, the company refrains from sending negative signals to investors. The second reason is flexibility and control. In other words, it means that outsourcing may destroy the future financing flexibility of the company and that the management's influence on the company may be reduced. In this respect, companies need to use internal resources first for financing (Damodaran, 1999, p.249).

4. Data and Method

In this study, the factors that determine the capital structure of airlines which are members of global alliances are examined. Within the scope of the study, financial data of the member airlines of any of the global alliances of StarAlliance, SkyTeam or OneWorld have been reached. In the study, 26 airlines which financial data were fully obtained were included in the

analysis. In the study which examined the period of 2005-2017, panel data analysis was used as a method.

The panel data model is termed as regression models, which are estimated by panel data. Therefore, the tests to be applied for the regression model are applied to these models (Güriş, 2015, p.4). In the panel data analysis, it is aimed to estimate the economic relations by using the horizontal sections with time dimension. In the panel data analysis, it is generally encountered that the number of horizontal section units (N) is higher than the number of periods (T) (Yerdelen Tatoglu, 2016, p.4).

In the panel data equation, i shows the horizontal section units (i = 1, Y, N), t the time change (t = 1, t, N) and the Y dependent variable, X independent variable or variables. In general, a panel data model is shown as follows.

$Y_{it} = \alpha_{it} + \beta_{it} X_{it} + \varepsilon_{it}$ Here, ε_{it} shows the error terms. In this study where panel data analysis method is used, firstly, descriptive statistics related to variables will be included. Next, the results of the correlation matrix and pre-test results will be given.

5. Research Model

In this study, the factors affecting the capital structure decisions of the airlines that are members of the global alliances are analyzed and three different ratios are used as indicators of the capital structure. The main objective of the study is to investigate empirically the financial factors that affect the total debt behavior, long-term debt behavior and short-term debt behavior of the airlines. The dependent and independent variables used in the study and their measurement indicators are given in the table below.

Table 3: Definitions of variables

	Acronym	**Variables**	**Measurement indicator**
Dependent variables	TDR	Total debt ratio	Total debt / total assets
	LTDR	Long term debt ratio	Long term debt / total assets
	STDR	Short term debt ratio	Short term debt / total assets
Independent variables	ROA	Profitability	Gross income / total assets
	ROE	Profitability	Gross income / total capital
	ROS	Profitability	EBIT / total sales
	SIZE	Firm size	LN(total assets)
	GROW1	Growth opportunity	% change in assets
	GROW2	Growth opportunity	% change in sales
	TANG	Tangibility	Property, plant & equip / total assets
	NDTS	Non-debt tax shield	Depreciation/total assets
	RISK1	Firm Risk	Standard Deviation of EBIT / total assets
	RISK2	Firm Risk	Standard Deviation of Sales / total assets
	LIQ	Liquidity	Current assets/short-term liabilities

In order to measure the profitability of airlines, three different ratios were used. These; return on assets; return on equity; and return on sales. In addition, multiple indicators were used to measure growth opportunities and firm risk. The main reason for using more than one indicator is due to certain characteristics of the air transportation industry. The main aim of the study is to reveal the financing behaviors of airlines by using the best and most sensitive measurement indicators. Both dependent and independent variables used in the study were determined by using the widely used indicators in the literature. Within the scope of the study,

three different models have been created in order to reveal the financing factors that affect the total, long term and short term debt behavior of the airlines. These models are as follows.

Model 1- $TDR_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 ROS_{it} + \beta_4 SIZE_{it} + \beta_5 GROW1_{it} + \beta_6 GROW2_{it} + \beta_7 TANG_{it} + \beta_8 NDTS_{it} + \beta_9 RISK1_{it} + \beta_{10} RISK2_{it} + \beta_{11} LIQ_{it} + \varepsilon_{it}$

Model 2- $LTDR_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 ROS_{it} + \beta_4 SIZE_{it} + \beta_5 GROW1_{it} + \beta_6 GROW2_{it} + \beta_7 TANG_{it} + \beta_8 NDTS_{it} + \beta_9 RISK1_{it} + \beta_{10} RISK2_{it} + \beta_{11} LIQ_{it} + \varepsilon_{it}$

Model 3- $STDR_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 ROS_{it} + \beta_4 SIZE_{it} + \beta_5 GROW1_{it} + \beta_6 GROW2_{it} + \beta_7 TANG_{it} + \beta_8 NDTS_{it} + \beta_9 RISK1_{it} + \beta_{10} RISK2_{it} + \beta_{11} LIQ_{it} + \varepsilon_{it}$

In Model 1, it is aimed to determine the financing factors that determine the total debt behavior of airlines. Therefore, the ratio of total debt to total assets is used as dependent variable. In Model 2, the aim is to identify financing factors that determine the long-term debt behavior of airlines. Therefore, the ratio of long term debt to total assets is used as dependent variable. In Model 3, financing factors that affect the short-term debt behavior of airlines are aimed. Therefore, the ratio of short term debt to total assets is used as the dependent variable.

6. Application and Findings

In this part of the study, descriptive statistics, correlation matrix, cross-section dependence and unit root test results of variables are given. In addition to these, appropriate model determination tests, pre-test results and resistance standard error test results are given.

Table 4: Descriptive statistics

	TDR	LTDR	STDR	ROA	ROE	ROS	SIZE
Mean	0.4033	0.3126	0.0908	0.2546	0.4430	0.0332	6.9998
Maximum	0.7936	0.5577	0.3896	1.7725	54.962	0.9320	7.7190
Minimum	0.0426	0.0319	0.0017	-0.0401	-54.860	-1.7701	5.2110
Std. Dev.	0.1651	0.1182	0.0741	0.2706	4.3689	0.1439	0.5048
Skewness	-0.2564	-0.5490	1.4263	2.9980	-0.3335	-6.3643	-1.1350
Kurtosis	2.4761	2.7626	4.8092	14.566	148.84	89.183	4.0901
J-B	7.5688	17.815	160.71	2390.1	299555	106885	89.407
Prob.	0.0227	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Obs.	338	338	338	338	338	338	338
	GROW1	**GROW2**	**TANG**	**NDTS**	**RISK1**	**RISK2**	**LIQ**
Mean	0.0849	0.0940	0.5968	0.0565	0.0499	0.0610	0.8371
Maximum	1.4751	4.3412	0.8822	0.1057	1.6718	0.7997	2.9354
Minimum	-0.3690	-0.3921	0.1323	0.0121	0.0000	0.0000	0.1719
Std. Dev.	0.2133	0.2996	0.1341	0.0141	0.1496	0.0808	0.3758
Skewness	2.4070	8.6095	-0.4982	-0.0501	8.0795	4.2959	0.9971
Kurtosis	14.291	121.01	3.8026	3.4213	75.715	30.385	5.8818
J-B	2121.8	200311	23.051	2.6406	78144	11601	172.96
Prob.	0.0000	0.0000	0.0000	0.2671	0.0000	0.0000	0.0000
Obs.	338	338	338	338	338	338	338

Table 4 shows the descriptive statistics used in the study. In this study, 3 dependent and 11 independent variables were used. Data related to all variables used in the study are shown in the table.

Table 5: Correlation matrix of independent variables

	ROA	ROE	ROS	SIZE	GROW1	GROW2	TANG	NDTS	RISK1	RISK2	LIQ
ROA	1										
ROE	0.150	1									

ROS	0.207	0.057	1								
SIZE	-0.349	-0.061	-0.054	1							
GROW1	0.041	0.007	0.201	-0.048	1						
GROW2	0.085	0.001	0.106	-0.017	0.450	1					
TANG	-0.569	-0.086	-0.075	0.288	-0.038	0.012	1				
NDTS	-0.433	-0.054	-0.189	-0.025	-0.292	-0.145	0.422	1			
RISK1	0.081	0.016	-0.124	-0.014	-0.029	-0.046	-0.156	0.024	1		
RISK2	0.326	0.035	0.050	-0.338	0.309	0.321	-0.322	-0.236	0.146	1	
LIQ	0.247	0.014	-0.074	-0.237	0.034	-0.022	-0.567	-0.153	0.176	0.108	1

In the regression analysis, high correlation between the independent variables, in other words, the correlation coefficient above 0.80 causes multiple multicollinearity problem. Table 4 shows the correlation matrix between the independent variables. Accordingly, the correlation coefficient between the variables is well below the critical value of 0.80.

Table 6: Cross-Sectional Dependence Test Results

LMadj (PUY, 2008)		
Variables	**Stat**	**Prob.**
TDR	1.008	0.1570
LTDR	-1.484	0.9310
STDR	0.635	0.2630
ROA	-0.776	0.7810
ROE	0.105	0.4580
ROS	0.370	0.3560
SIZE	-1.311	0.9050
GROW1	-1.095	0.8630
GROW2	4.614	0.0000
TANG	4.087	0.0000
NDTS	-1.167	0.8780
RISK	-0.562	0.7130
RISK2	0.875	0.1910
LIQ	0.657	0.2560

Table 6 shows the cross-sectional dependency test results of the variables used in the analysis. It is seen that H_0 hypothesis is not rejected for GROW2 and TANG variables. This situation shows that in the unit root analysis, GROW2 and TANG variables should be determined for the second and second variables for the first variables. This situation shows that GROW2 and TANG variables' stability levels should be determined with second generation unit root analysis, other variables' stability levels should be determined with first generation unit root analysis.

Table 7: Panel Unit Root Test Results

Variables	**Model**	**LLC -t test**		**IPS -W test**		**ADF - Fisher**	
		Stat	**Prob.**	**Stat**	**Prob.**	**Stat**	**Prob.**
TDR	Constant	-4.46511	0.0000	-1.91459	0.0278	70.5537	0.0443
	Constant and Trend	-7.26481	0.0000	-2.94662	0.0016	88.5899	0.0012
LTDR	Constant	-4.78347	0.0000	-3.43371	0.0003	90.3414	0.0008
	Constant and Trend	-6.82412	0.0000	-3.20298	0.0007	92.9102	0.0004
STDR	Constant	-4.88134	0.0000	-3.15293	0.0008	84.0641	0.0032
	Constant and Trend	-3.71437	0.0001	-1.67197	0.0473	68.4614	0.0626
ROA	Constant	-3.34388	0.0004	-1.26107	0.1036	64.5619	0.1134
	Constant and Trend	-4.56557	0.0000	-1.33984	0.0901	65.5359	0.0983
ROE	Constant	-3.98589	0.0000	-2.57572	0.0050	82.0877	0.0049
	Constant and Trend	-7.23474	0.0000	-2.37665	0.0087	77.9034	0.0115

ROS	Constant	-8.20876	0.0000	-5.04891	0.0000	111.427	0.0000
	Constant and Trend	-21.3901	0.0000	-5.32968	0.0000	91.0563	0.0007
SIZE	Constant	-6.55716	0.0000	-2.70493	0.0034	92.4989	0.0005
	Constant and Trend	-13.6191	0.0000	-1.49232	0.0678	72.7238	0.0304
GROW1	Constant	-7.51862	0.0000	-5.29151	0.0000	116.867	0.0000
	Constant and Trend	-9.51773	0.0000	-4.34837	0.0000	105.732	0.0000
NDTS	Constant	-10.1414	0.0000	-5.27601	0.0000	114.91	0.0000
	Constant and Trend	-5.97572	0.0000	-5.30183	0.0000	118.434	0.0000
RISK1	Constant	-20.7072	0.0000	-6.12517	0.0000	99.9425	0.0001
	Constant and Trend	-11.7092	0.0000	-3.11749	0.0009	84.6372	0.0028
RISK2	Constant	-2.79334	0.0026	-3.64317	0.0001	89.9153	0.0009
	Constant and Trend	-2.99925	0.0014	-2.26982	0.0116	74.1074	0.0237
LIQ	Constant	-4.43226	0.0000	-1.91551	0.0277	69.6661	0.0514
	Constant and Trend	-9.27192	0.0000	-2.78515	0.0027	87.6619	0.0014

Note: The maximum delay length is 1 and the optimal delay length is determined according to the SIC (Schwarz Info Criteria) criteria.

Table 7 shows panel unit root test results. When prob. values are examined, it is seen that all the variables included in the analysis are stable at the level. Therefore, all of the variables were used in the analysis with level values.

Table 8: Second Generation Unit Root Test Results

CADF Panel Unit Root Test					
Variables		**Stat**	**1 %**	**5 %**	**10 %**
GROW2	Constant	-2.420	-2.34	-2.17	-2.07
	Constant and Trend	-4.524	-2.89	-2.70	-2.60
TANG	Constant	-2.229	-2.34	-2.17	-2.07
	Constant and Trend	-2.608	-2.89	-2.70	-2.60

Note: Critical values are derived from Pesaran (2007) tables II (a) and II (b).

Table 8 shows the results of second generation analysis applied to GROW2 and TANG variables. Analysis results show that these variables can be used with level values.

Table 9: Tests for identification of appropriate model

F Test		**LM Test**		**Hausman Test**		**Appropriate Model**
Stat.	**Prob.**	**Stat.**	**Prob.**	**Stat.**	**Prob.**	
21.0267	0.0000	578.669	0.0000	8.8700	0.5441	Random Effects
17.0887	0.0000	541.247	0.0000	2627.8	0.0000	Fixed Effects
25.2901	0.0000	606.858	0.0000	15.730	0.1077	Random Effects

In the panel data analysis, it is necessary to carry out tests to determine the appropriate model after the stability analysis. Modeling test results show that the model of random effects for the first model (Model 1) and third model (Model 3) and the model of fixed effects for the second model (Model 2) the model of random effects are appropriate.

Table 10: Heteroscedasticity test results

Levene, Brown ve Forsythe test				
	Test	**W0**	**W50**	**W10**
Model - 1	**Stat.**	7.1737	4.3147	6.5233
	Prob.	0.0000	0.0000	0.0000
Model - 3	**Stat.**	6.9303	3.8526	6.6038
	Prob.	0.0000	0.0000	0.0000
Modified Wald				
Model - 2	**Stat.**	3267.33		

	Prob.	0.0000		

Heteroskedasticity test results for the models (Model 1, Model 2 and Model 3) created in Table 10 are given. Results show that H_0 hypothesis was rejected for all models. This situation shows that the variance is not constant in all models, and that there is heteroskedasticity problem.

Table 11: Autocorrelation test results

	Durbin Watson	**Baltagi–Wu**
	Stat.	**Stat.**
Model - 1	0.76375	1.05083
Model - 2	0.79395	1.07719
Model - 3	1.07822	1.21874

Table 11 shows the results of the DW autocorrelation test of Bhargava, Franzini and Narendranathan and the Baltagi and Wu's LBI autocorrelation test. There is no critical value for DW and LBI autocorrelation tests in the literature. In contrast, the DW and LBI statistical values less than 2 indicate autocorrelation.

For the models used in the study (Model 1, Model 2 and Model 3), after changing variance and autocorrelation test, resistant standard errors must be obtained. In the next part of the study, for Model 1, Model 2 and Model 3 model findings which were calculated by the resistant standard errors in which the problems related to the changing variance and autocorrelation are eliminated will be given.

Table 12: Random-effects GLS regression for Model - 1

	Coef.	**Std. Err.**	**z**	**Prob.**	**[95% Conf. Interval]**	
ROA	-0.06938	0.04760	-1.46	0.1450	-0.16267	0.02391
ROE	0.00006	0.00042	0.14	0.8870	-0.00077	0.00089
ROS	-0.00385	0.06394	-0.06	0.9520	-0.12916	0.12147
SIZE	0.01063	0.03613	0.29	0.7690	-0.06019	0.08144
GROW1	-0.01351	0.02831	-0.48	0.6330	-0.06900	0.04198
GROW2	**-0.04217**	**0.01232**	**-3.42**	**0.0010**	**-0.06632**	**-0.01802**
TANG	0.09632	0.14054	0.69	0.4930	-0.17914	0.37178
NDTS	-0.29507	0.66660	-0.44	0.6580	-1.60159	1.01145
RISK1	**0.05792**	**0.03406**	**1.70**	**0.0890**	**-0.00884**	**0.12468**
RISK2	**0.20868**	**0.06101**	**3.42**	**0.0010**	**0.08910**	**0.32825**
LIQ	**-0.16988**	**0.05578**	**-3.05**	**0.0020**	**-0.27921**	**-0.06055**
_cons	0.43759	0.24409	1.79	0.0730	-0.04082	0.91601
Number of obs. = 338				Wald chi2(11) = 142.06		
Number of groups = 26				Prob > chi2 = 0.0000		

Table 12 presents the first model (Model 1) findings of TDR (total debt / total assets) as dependent variables. Analysis findings indicate that the growth opportunities of the member airlines of the global alliances, the firm risk and the liquidity ratio are effective on the total debt level. Accordingly, it is observed that the growth opportunities of airlines have a negative effect on total debt level. On the other hand, the results indicate that firm risk has a positive effect on total leverage level. The findings also show that the liquidity level of airlines has a negative impact on the total debt level. This indicates that airlines with high liquidity tend to use their existing liquidity instead of using liability.

Table 13: Regression with Driscoll-Kraay standard errors for Model - 2

	Coef.	**Std. Err.**	**t**	**Prob.**	**[95% Conf. Interval]**

ROA	-0.01108	0.02691	-0.41	0.6840	-0.06650	0.04433
ROE	0.00000	0.00020	0.00	0.9970	-0.00042	0.00042
ROS	0.02502	0.05165	0.48	0.6320	-0.08135	0.13139
SIZE	**0.07197**	**0.03005**	**2.39**	**0.0240**	**0.01007**	**0.13386**
GROW1	-0.02209	0.02205	-1.00	0.3260	-0.06751	0.02334
GROW2	**-0.03232**	**0.00874**	**-3.70**	**0.0010**	**-0.05031**	**-0.01432**
TANG	**0.20805**	**0.07631**	**2.73**	**0.0120**	**0.05089**	**0.36520**
NDTS	**-0.82421**	**0.47546**	**-1.73**	**0.0950**	**-1.80345**	**0.15502**
RISK1	0.03787	0.03655	1.04	0.3100	-0.03742	0.11315
RISK2	**0.14078**	**0.04355**	**3.23**	**0.0030**	**0.05109**	**0.23048**
LIQ	**-0.05664**	**0.01597**	**-3.55**	**0.0020**	**-0.08954**	**-0.02374**
_cons	-0.22495	0.27041	-0.83	0.4130	-0.78188	0.33197
Number of obs. = 338				F(11, 25) = 1135.49		
Number of groups = 26				Prob > F = 0.0000		

Table 13 shows the results of the second model (Model 2) in which long term total debt / total assets are used as dependent variables. Analysis findings show that the size, growth opportunities, asset structure, non-debt tax shield, firm risk and liquidity ratio variables in the member airlines of the global alliances have a significant effect on the long-term debt level. Accordingly, it is seen that the airline size, asset structure and firm risk variables have a positive effect on long-term debt level in airlines. The results also indicate that the growth opportunities of the airlines, the non-debt tax shield and the liquidity ratio variables negatively affect the long-term debt level. Therefore, it is possible to say that large airlines (in terms of total assets), airlines with more tangible assets and airlines with higher risk have more long-term debt. On the other hand, it is observed that the airlines, which have high growth opportunities, non-debt tax shielding and liquidity ratio, have relatively lower liability ratio.

Table 14: Random-effects GLS regression for Model - 1

	Coef.	**Std. Err.**	**z**	**Prob.**	**[95% Conf. Interval]**	
ROA	**-0.05741**	**0.02052**	**-2.80**	**0.0050**	**-0.09762**	**-0.01720**
ROE	**0.00007**	**0.00004**	**1.80**	**0.0710**	**-0.00001**	**0.00015**
ROS	-0.02743	0.02056	-1.33	0.1820	-0.06772	0.01286
SIZE	**-0.04655**	**0.02238**	**-2.08**	**0.0380**	**-0.09042**	**-0.00268**
GROW1	0.00721	0.00997	0.72	0.4690	-0.01232	0.02674
GROW2	**-0.00973**	**0.00465**	**-2.09**	**0.0360**	**-0.01885**	**-0.00061**
TANG	**-0.12736**	**0.06707**	**-1.90**	**0.0580**	**-0.25881**	**0.00409**
NDTS	**0.60570**	**0.30281**	**2.00**	**0.0450**	**0.01220**	**1.19920**
RISK1	**0.02187**	**0.00835**	**2.62**	**0.0090**	**0.00550**	**0.03823**
RISK2	**0.07125**	**0.02189**	**3.25**	**0.0010**	**0.02834**	**0.11415**
LIQ	**-0.10938**	**0.02025**	**-5.40**	**0.0000**	**-0.14907**	**-0.06970**
_cons	0.56031	0.18405	3.04	0.0020	0.19958	0.92105
Number of obs. = 338				Wald chi2(11) = 224.56		
Number of groups = 26				Prob > chi2 = 0.0000		

In Table 14, the third model (Model 3), in which STDR (short term debt / total assets) is used as dependent variable, is included. The analysis results show that return on assets, return on equity, firm opportunity, tangibility, non-debt tax shield, firm risk and liquidity variables of airlines which are members of global alliances have significant effect on short-term debt level. Accordingly, it is seen that return on assets, firm opportunity, growth opportunity, tangibility and liquidity variables of airlines have a negative effect on short-term debt level. However, the

results indicate that return on equity, non-debt tax shield and firm risk variables have a positive effect on the short-term leverage level.

Table 15: Comparison of theoretical expectations with findings

Measurement Indicator	Trade-Off	Pecking Order	Agency Cost	Model 1	Model 2	Model 3
Profitability	+	-	na	na	+	-/+
Firm size	+	-	+	na	+	-
Growth opportunity	-	+	-	-	-	-
Tangibility	+	-	+	na	+	-
Non-debt tax shield	-	na	na	na	-	+
Firm Risk	-	-	-	+	+	+
Liquidity	+	-	na	-	-	-

Table 15 shows the comparison of the findings of the models created with the expectation of the signs of capital structure theories. Accordingly, the Model 1 findings produced results that are consistent with the expectation of trade-off theory and agency cost theory for the growth opportunity variable. In Model 1, the liquidity variable corresponds to the pecking order theory. In addition, when Model 2 findings are evaluated in general, it is seen that airlines behave in accordance with trade-off theory and agency cost theory for long-term liabilities use. The results of Model 3 were developed to reveal the short-term debt behavior of airlines. Accordingly, short-term financing behavior of airlines is generally consistent with the pecking order theory.

7. Conclusions

Airlines become members of a number of collaborations to expand their network structures and reduce costs. In this study, the factors that determine the capital structure of airlines that are members of strategic cooperation are examined. Within the scope of the study, the capital structure decisions of the member airlines of any of the major strategic alliances (StarAlliance, SkyTeam or OneWorld) in the world are analyzed empirically. In the study, a total of 26 airlines which financial data were obtained for the period 2005-2017 were analyzed. In the study, panel data analysis was used as the method by considering the structure of the data.

In this study which examines the financial factors affecting the capital structure of the member airlines of the global alliances, three different models have been formed in order to determine the capital structure decisions. In these models created by taking into consideration the studies in the literature, indicators measuring the level of leverage of firms were used. In this context, the ratio of total liabilities to total assets was used as a dependent variable in the first model. In the second model, the ratio of long-term liabilities to total assets is preferred as dependent variable. In the third model, the ratio of short-term liabilities to total assets was used as dependent variable. In this way, it was aimed to reveal the financial factors affecting the long-term and short-term financing behavior of airlines. The independent variables used in the study are profitability, firm size, growth opportunity, tangibility, non-debt tax shield, firm risk and liquidity.

The findings of the study show that total, long and short term financing behaviors of member airlines of global alliances are different from each other. Accordingly, the first model findings, in which the ratio of total liabilities to total assets are used as dependent variables (TDR), show that the growth opportunities in the airlines, firm risk and liquidity ratio are

significantly effective on the total debt level. Accordingly, it is seen that having high growth opportunities for airlines has a negative impact on total debt level. In addition, having a high liquidity ratio affects the total debt level negatively. This indicates that firms with high liquidity tend to use their existing liquidity instead of using liability. In contrast, the results show that, in contrast to the theoretical expectations, the firm risk in airlines has a positive effect on the total leverage level.

The second model results which long-term liabilities to total assets is used as a dependent variable (LTDR) show that firm size, growth opportunities, asset structure, non-debt tax shield, firm risk and liquidity ratio variables have a significant effect on long-term debt level in member airlines of global alliances. Accordingly, it is seen that the airline size, asset structure and firm risk variables have a positive effect on long-term debt level in airlines. This suggests that airlines with relatively large and more tangible assets prefer equity instead of using long-term liabilities. From a theoretical point of view, there are many studies that emphasize that firms having large and more tangible assets will tend to use more liabilities because their debt costs will be lower. The results also indicate that the growth opportunities, the non-debt tax shield and the liquidity variables of the airlines negatively affect the long-term debt level. Therefore, it can be claimed that the airlines which have high growth opportunities, non-debt tax shield and liquidity ratio, have relatively more liability rate.

The third model findings which short-term liabilities to total assets is used as a dependent variable (STDR) show that return on assets, return on equity, growth opportunity, tangibility, non-debt tax shield, firm risk and liquidity variables have significant effect on short-term debt level. Accordingly, firms with high return on equity have a higher level of short-term debt. In addition, the findings show that airlines use more short-term liabilities to take advantage of the non-debt tax shield. On the other hand, the results indicate that firms with higher return on assets, higher tangible fixed assets, higher growth opportunities and higher liquidity ratios use less short-term liabilities. From a theoretical standpoint, the findings were in accordance with the Pecking Order theory. Accordingly, companies with high return on assets prefer to use their equity instead of borrowing. This situation provides a relatively low short-term debt ratio. In addition, it is supported theoretically by the fact that firms with high tangibility prefer to use equity instead of using liabilities. As a result, it can be said that total, long-term and short-term financing behaviors in member airlines of global alliances are different.

ID	AIRLINE	ID	AIRLINE
1	AMERICAN AIRLINES	**14**	CHINA SOUTHERN AIR
2	QANTAS AIRWAYS	**15**	ASIANA AIRLINES
3	AIR CANADA	**16**	KOREAN AIR LINES
4	LATAM AIRLINES	**17**	FINNAIR
5	AIR CHINA LIMITED	**18**	THAI AIRWAYS
6	CHINA EASTERN	**19**	AEROFLOT-ROSSIY
7	LUFTHANSA	**20**	SINGAPORE AIRLINES
8	AIR FRANCE - KLM	**21**	TURK HAVA YOLLARI
9	AEGEAN AIRLINES	**22**	CHINA AIRLINES
10	ANA HOLDINGS	**23**	EVA AIRWAYS
11	JAPAN AIRLINES	**24**	DELTA AIR LINES
12	ALIA - THE ROYAL	**25**	UNITED CONTINENTA
13	CATHAY PACIFIC AIR	**26**	AIR NEW ZEALAND

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